Solomon Islands
MATHEMATICS
Year 7 Teacher's Guide

ALWAYS LEARNING

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Solomon Islands
Mathematics
Year 7 Teacher's Guide

Solomon Islands Curriculum Development Division

This book was written by the members of the Mathematics Subject Working Group (SWG) working with the Principal Curriculum Development Officer (PCDO) for Secondary Mathematics with the assistance of the Technical Advisor (TA) for Mathematics under the Curriculum Development Division (CDD) in the Ministry of Education and Human Resource Development (MEHRD).

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Contents

Introduction

This *Teacher's Guide* is written as an additional resource for mathematics teachers to use in secondary schools in the Solomon Islands. The book is designed to assist teachers to cover all the strands and sub-strands with their General and Specific Learning Outcomes in the Secondary Mathematics Years 7 to 9 Syllabus.

Mathematics is a practical part of everyday life for Solomon Islanders. We use mathematical skills and knowledge in many situations, inside and outside the classroom. Mathematical knowledge and skills are essential for all learners, to fully participate in life at school and in their communities, now and in the future as adults.

The *Teacher's Guide* is designed to be user-friendly for teachers, and to assist them to teach mathematics in a realistic and meaningful way.

There are fourteen chapters in this *Teacher's Guide*. Each chapter includes an overview, a list of skills that show the scope and sequences to be covered, and a teaching plan to assist in teaching the Specific Learning Outcomes needed to achieve the General Learning Outcomes for that chapter. Each chapter in the *Teacher's Guide* corresponds to a chapter in the *Learner's Book*.

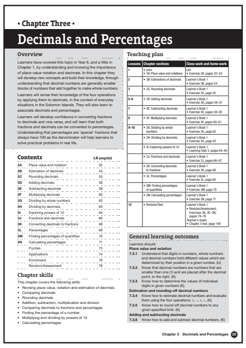
The *Teacher's Guide* provides the following comprehensive features:

- **Specific learning outcomes** – achievable variables. These should be used as indicators for the lessons to show whether the General Learning Outcomes have been achieved.
- **Teaching points** – these elaborate on the Specific Learning Outcomes.
- **Suggested teaching approach** – suggested steps for teachers to follow, at their own discretion.
- **Starter activities** – suggested activities for learners before beginning the chapter or section.
- **Assessment activities** – suggested assessment questions that can be done during or after the completion of the chapter.
- **Additional activities** – provided for teachers to use at their own discretion.

We hope you find this resource useful and user-friendly, and that it assists you in imparting knowledge and skills to learners that they can use not only in class but also in their everyday lives.

How to use this *Teacher's Guide*

The *Teacher's Guide* is designed to assist teachers in covering all the strands and sub-strands that are given in the Secondary Mathematics Syllabus for all secondary schools in the Solomon Islands.



Each chapter opening page includes the following sections:

- **Overview** – a brief summary of what is covered in the chapter.
- **Contents** – a list of sub-sections in the chapter with their corresponding pages in the *Learner's Book*. *Teacher*: Use this section to navigate between the *Teacher's Guide* and the relevant pages of the *Learner's Book*.
- **Chapter skills** – a list of the anticipated skills that should be acquired by learners by the end of each sub-section and the chapter as a whole. *Teacher*: This will assist you to plan how best to teach the content within the allocated lesson(s).
- **Teaching plan** – a guide to help you plan how to teach the content of the chapter. It indicates the allocated number of lessons for each section of the chapter, as well as class work and home work. *Teacher*: Use this planner as a guide to how best to teach the contents, with the given number of lessons and periods per sub-section and chapter.
- **General learning outcomes** – a list of the anticipated outcomes for learners after completing the chapter. *Teacher*: Use this list to derive the aims and objectives for each lesson.

General learning outcomes

Learners should:

Place value and notation

7.3.1 Understand that digits in numbers, whole numbers and decimal numbers hold different values which are determined by their position in a given number. (U)

7.3.2 Know that decimal numbers are numbers that are smaller than one (1) and are placed after the decimal point, to the right. (K)

7.3.3 Know how to determine the values of individual digits in given numbers (K).

Estimation and rounding-off decimal numbers

7.3.4 Know how to estimate decimal numbers and evaluate them using the four operations: +, −, ×, ÷. (K)

7.3.5 Know how to round-off decimal numbers to any given specified limit. (K)

Adding and subtracting decimals

7.3.6 Know how to add and subtract decimal numbers. (K)

Each sub-section of the chapter includes the following features:

- **Specific learning outcomes (SLOs)** – can be used to indicate whether the General Learning Outcomes have been achieved, and whether the learners have acquired the skills required for each lesson and the chapter as a whole. *Teacher*: Use the SLOs as objectives and aims for your lesson plans. They are measurable and should indicate whether the General Learning Outcomes have been achieved.

6A • Writing expressions

LB Pages 150–151

Specific learning outcomes

Learners should be able to:

7.6.1.1 Define 'algebra'.

7.6.1.2 Define 'terms' and 'expressions'.

7.6.2.1 Translate maths problem statements into algebraic expressions by using symbols and objects.

7.6.3.1 Use symbols, pronumerals and other objects to create mathematical expressions by grouping same symbols, pronumerals and objects together.

- **Teaching points** – elaborate on the Specific Learning Outcomes.
- **Additional notes** – provide additional useful information or explanations.

Additional notes

In some situations it helps to calculate an approximate answer first. This helps with checking calculations and making sure that the exact answer is a sensible one.

Example

A car dealer has six cars on special, all at $8995. Estimate how much money the dealer would make if they sold all the cars.

$8995 is close to $9000

$9000 × 6 = $54 000

- **Suggested teaching approach** – ideas and suggestions on how to teach the contents. *Teacher*: Use these suggestions at your discretion.

Suggested teaching approach

- Start the chapter section by doing the **Starter activities** provided.
- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercise 4A** on page 82 in the LB, and **Activity 4A** in the TG below.

- **Starter activities** – given at the beginning of each chapter, these are provided to give teachers and learners a taste of what is in the chapter. *Teacher*: These activities can be seen as a 'warm-up' before going into the chapter or sub-section in depth.

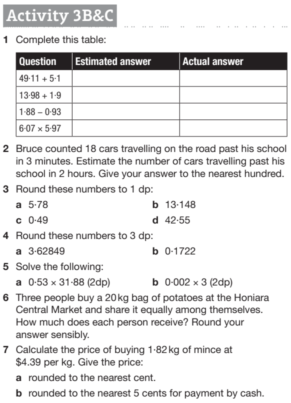
Starter activities

Activity 1: Using your body to measure

Learners work in pairs to do the following tasks:

1. Each learner uses their feet (steps) to measure the length and width of the classroom.
2. Each learner uses their fingers to measure the length and width of their desk.
3. Each learner compares their measurements with their partner's. Are they the same?
4. Each pair compares their results with other pairs. Are they the same?
5. Learners should discuss their findings with the class, including:
   - what could be done to solve the irregularities in the measurements
   - which item was easiest to measure and which measuring 'device' was easiest to use.

- **Activity** – extra activities that can be used to assess learners. *Teacher*: Use this section to assess your learners, either during the teaching of the chapter as formative assessment, or at the end of the chapter as summative assessment.



Activity 3B&C

1 Complete this table:

Question	Estimated answer	Actual answer
49·11 + 5·1		
13·98 + 1·9		
1·88 – 0·93		
6·07 × 5·97		

2 Bruce counted 18 cars travelling on the road past his school in 3 minutes. Estimate the number of cars travelling past his school in 2 hours. Give your answer to the nearest hundred.

3 Round these numbers to 1 dp:

a 5·78 **b** 13·148

c 0·49 **d** 42·55

4 Round these numbers to 3 dp:

a 3·62849 **b** 0·1722

5 Solve the following:

a 0·53 × 31·88 (2dp) **b** 0·002 × 3 (2dp)

6 Three people buy a 20 kg bag of potatoes at the Honiara Central Market and share it equally among themselves. How much does each person receive? Round your answer sensibly.

7 Calculate the price of buying 1·82 kg of mince at $4.39 per kg. Give the price:

a rounded to the nearest cent.

b rounded to the nearest 5 cents for payment by cash.

The outcomes-based approach

This *Teacher's Guide* is written for a *Learner's Book* and a syllabus that follow the outcomes-based approach to learning. This has been adopted by the Ministry of Education and Human Resource Development through the Curriculum Development Division as part of the new curriculum for Basic Education from Years 1 to 9.

The curriculum is learner-centred rather than subject-centred – it is based on the needs of the learners, rather than the needs of the subject. The emphasis is not on the traditional content of the subject, but on choosing those elements of the subject that will be useful and valuable to learners. The basis of this approach is that learners should acquire knowledge, understanding, skills, values and attitudes that will be useful to them later in life.

This learner-centred approach contrasts with the teacher-centred approach of the past. The emphasis is on learners learning for themselves with the guidance of the teacher, rather than being taught by the teacher. This means active learning in which learners do things that help them to find out for themselves, think about and draw on their own knowledge and experience, make observations, do experiments and carry out practical tasks. This can be called 'learning by doing'. Because of this approach, the syllabuses, Learner's Books and Teacher's Guides refer to *learners*, which suggests active participation in the process, rather than *students*, which suggests passive reception of knowledge.

One way to understand this approach is to think of the more traditional approach of our schools as banking education. In banking education, the teacher regards the learners as empty vessels to be filled with knowledge. The learners are tested by being asked to reproduce the knowledge that the teacher has given them. This method relies heavily on the learner listening to the teacher, copying notes from the board, learning these notes and reproducing them later. This can be done successfully without the learner understanding fully what they are writing and reading.

The present approach can be called 'problem-posing education'. This presumes that learners already have their own ideas, knowledge and skills based on previous experience in school or elsewhere. The job of the teacher is to build on these by posing problems to the learners that make them think about their own ideas and experiences, as well as adding new knowledge and skills. Learners are also exposed to experiences by being asked to observe reality outside the classroom, look at pictures or diagrams, examine statistics and read passages and thus find out knowledge and ideas for themselves. They are then expected to express these in their own words, not those of the teacher, to prove that they have understood what they have learnt. Learners are encouraged to be responsible for their own learning, to think for themselves and form their own ideas and opinions. They are encouraged to become critical thinkers and to be able to face new challenges and situations for themselves. Learning becomes a cooperative effort between the learner and the teacher.

In addition, education is seen not just as a way of passing on knowledge and skills but a way of forming the kinds of values and attitudes that will make people good and responsible citizens in the future.

The approach of the *Learner's Book*

The *Learner's Book* follows all these principles. It is not just a summary of the factual knowledge and concepts of the subject. There are activities for learners to do, and these activities form an essential part of the learning process. It is no longer enough just to read the book. Learners must also do the activities in the book.

In the past, activities were often included only at the end of a chapter, and learners and teachers often ignored these and moved on to the next chapter. With this book, the activities are part of the text and must be completed in order to fully learn. Some units start with an activity that helps learners to find out information, think about their own experiences and knowledge, or practise skills for themselves.

Some of the activities are to be done in groups. This is to encourage interaction among the learners, because learners can often learn as much from each other as they can from the textbook or the teacher.

The *Learner's Book* and the syllabus

The *Learner's Book* is based on the strands and sub-strands of the syllabus. The chapters of the *Learner's Book* are based on one or more sub-strands of the syllabus, and the order of the chapters follows the order of the sub-strands of the syllabus.

Individual chapters, however, do not always follow the order of the outcomes in the sub-strand of the syllabus. Each sub-strand of the syllabus outlines the knowledge, understanding, skills and attitudes – that is, the outcomes – we want learners to achieve. The *Learner's Book* gives guidance about how the learners might best achieve those outcomes. The best way to do this is not always to follow the exact order of the outcomes in the syllabus. In teaching, therefore, you should usually follow the order of presentation in the *Learner's Book* rather than following the order of outcomes in the syllabus. As long as the outcomes are achieved, we have reached our goal. The *Learner's Book* is full of illustrations, photos, maps and diagrams. These are not just included for decoration. They should be used as an important part of your teaching. They are often just as important as the words of the book.

The syllabus and the yearly program planner

The yearly program planner below shows you the total amount of time that should be spent on teaching each of the topics covered by the Year 7 *Learner's Book*.

Try to spend the indicated number of weeks teaching each strand of the syllabus. Schools vary a great deal in the ability of their learners. This is partly due to the selective nature of our education system at present. It is impossible, therefore, to suggest that all schools should teach the strands and sub-strands in the same way or at the same speed. If you find you are unable to teach all the topics in a strand or sub-strand in the time suggested, try to choose the most important topics and leave some of the rest. Do not spend so long on one topic that you miss other topics altogether. Try to teach at least some of every chapter in the *Learner's Book*.

Yearly program planner

Semesters 1 & 2: 40 weeks			
Semester	**Week**	**Strand/sub-strand**	**Allocated time**
Semester 1		NUMBERS	
	1	Whole numbers	2 weeks
	2		
	3	Number patterns	2 weeks
	4		
	5	Decimals and percentages	3 weeks
	6		
	7		
		MEASUREMENTS	
	8	Length and perimeter	3 weeks
	9		
	10		
	Mid-semester break		
		PROBABILITY & STATISTICS	
	11	Statistics	3 weeks
	12		
	13		
		ALGEBRA	
	14	Algebra symbols	3 weeks
	15		
	16		
		GEOMETRY	
	17	Angles	3 weeks
	18		
	19		
	20	*Mid-year examinations*	1 week
	Mid-year holidays		

Semester	Week	Strand/sub-strand	Allocated time
Semester 2		NUMBERS	
	21	Directed numbers	3 weeks
	22		
	23		
		GEOMETRY	
	24	Coordinate graphs & location	2 weeks
	25		
		NUMBERS	
	26	Fractions	3 weeks
	27		
	28		
		MEASUREMENTS	
	29	Time and mass	2 weeks
	30		
	Mid-semester break		
		PROBABILITY & STATISTICS	
	31	Probability	3 weeks
	32		
	33		
		GEOMETRY	
	34	Polygons	3 weeks
	35		
	36		
		MEASUREMENTS	
	37	Area and volume	3 weeks
	38		
	39		
	40	*Final examinations*	1 week
End of year holidays			

Teaching methods

It is important to plan and prepare before classes. The following are some teaching methods or approaches you can use to facilitate effective learning in your classrooms. To ensure effective applications of these methods, teacher planning and good preparation are important.

Fieldwork and excursions

Fieldwork means any work outside the classroom. Fieldwork helps learners to link classroom learning to real-world experience outside the classroom. Learners are instructed to apply skills such as observation, investigation and interviewing as a means of collecting information about the topic for themselves, thus achieving the outcomes of the syllabus in practical and realistic ways.

Fieldwork is particularly important in the outcomes approach, which aims to link learning to the real needs of learners. It should not be treated as an 'optional extra'. To ensure an effective and successful outcome, you must consider important aspects of fieldwork, such as good classroom preparation and planning, the best way to carry out work in the field, and follow-up work in the classroom. This means you must go and look at the area you plan to do fieldwork in before you do it, and decide exactly what you want learners to observe and do when they go there.

The best way is often to provide a questionnaire to the learners before they go. A lot of the work can then be done by learners working in groups to answer the questions, without too much help from you. The activities in the *Learner's Book* will often give the basis for a questionnaire. Fieldwork takes time and may have to be fitted in after the normal teaching time – on an afternoon or a weekend. Some fieldwork can be done by giving questionnaires for learners to fill in during their own time by looking at their own area – either after school or, in boarding schools, during the holidays.

Fieldwork is difficult in town schools but should not be ignored by those schools. You may have to rely on questionnaires to help learners to do the fieldwork in their own time, as described above. For instance, learners can be encouraged to go out and look at a river or a stream, or the sea and coastline, or a farming area, on weekends. Assignments can also be given for learners to do in their home areas during holidays; this helps them to realise that what they are learning applies to their home area.

Group work

Learners take a more active role and talk naturally when they are allowed to work in small groups. In this way they can express their ideas rather than listening passively to the teacher, as is often the case in the whole class. Group work encourages learners to talk or do things for themselves as part of the learning process. Learners discuss, share views and interact in their learning in small groups, and present their collective work to the class. To ensure that group work achieves effective learning, preparation and class management are important for teachers.

Group work must be properly organised and supervised. You must not use it as an excuse to sit back and let learners get on with it. On the other hand, learners will often not talk freely if they know the teacher is listening, so you must leave groups to talk on their own. Sometimes it is even effective to walk out of the classroom for a while, to give groups a chance to get going without you listening.

The role of the teacher in group work should be to:

- **choose the topic.** Groups can only discuss topics that they know something about and for which it is possible to have different points of view or opinions. You cannot discuss a topic such as 'How many sides does a triangle have?', because there is only one answer to the question and answers are right or wrong. However, you *can* discuss a topic such as 'How is the study of triangles used in the arts and crafts of the Solomon Islands people?' There are many different answers to this and each learner can suggest different ideas.
- **set the objective.** Make sure each group knows exactly what to discuss and has a set of clear questions to answer. It is not enough to just say 'Discuss this topic'.
- **organise the groups.** Groups should be small enough for everyone to be able to talk. They should usually be mixed – different island groups (e.g. not all wantoks). It is good to mix girls and boys, but do not do this if it leads to girls being too shy to talk. All-girl groups may sometimes be better.
- **organise the seating.** Good discussion will only take place if learners face each other. Learners should not talk to someone else's back! If possible, arrange the classroom by grouping desks in circles facing each other, so group work is easy and no movement is necessary. In crowded classrooms you may allow some groups to go outside and work.
- **circulate and listen to progress.** It is best to do this only after allowing time for discussion to start. Try to make sure all learners are being given a chance to speak. If you see certain people dominating groups, intervene and ask others their ideas. If groups are having difficulty, give guidance by explaining the topic, giving some extra questions or asking individuals their ideas. If groups are doing well on their own, do not interfere.
- **decide on the language to be used.** In Year 7, most learners will want to use Pijin. It is best to let them do so, or they may say nothing. There is nothing wrong with a local language if everyone in the group speaks it. But try to get each group to report back their ideas at the end in English, either verbally or in writing. If groups are confident in using English throughout, allow them to do so.
- **decide how reporting back will be done.** It is often a good idea to appoint a chairperson who will report back to the whole class at the end, but this is not always necessary. Each member may write their own ideas, or groups may just learn from the process of discussion.

Debate and discussions

Group work involves learners in debates and discussions, and these are active ways of engaging learners. Learners can collect information through research to use in debates about a particular topic or to share ideas with others in the classroom. They will learn a lot in this process.

Debates are a good way to encourage learners to form their own opinions about a topic. Even in Year 7 we should encourage this. At this level, debates should be informal, without trying to follow the strict parliamentary rules of debating.

Graphs and statistics

Representing information through graphs and statistics is an important and effective way of teaching and learning about some topics. Instead of providing a lot of information in words, representing it in a graphical or statistical way may make it easier for learners to understand the importance of the information. You should not expect learners to remember statistical data. They are there to illustrate a point, not to be learnt.

Research interviews and questions

There are different ways of using research interviews with people to collect information about a topic. This could include: informal chats; questions for particular people prepared in advance; or standardised questionnaires by which learners work in small groups, asking the same questions of a large number of people and later converting the answers into statistical form. Prepared questions are also useful for fieldwork, and they can be used alone or with any of the stated techniques to collect information.

Assessment

Assessment is a process in which teachers gather, analyse and interpret assessment information and data. You should use such information and data to develop and implement enrichment support and intervention strategies to improve the teaching and learning processes in the classroom. It is important to assess the learners to know where they are and the progress they are making in the classroom. It is an important ongoing process in teaching and learning and it should be used continuously, meaning it should not be done only at the end, after completing a particular topic.

Assessment should include:

- **formative assessment.** This takes place throughout every teaching topic and every chapter of the *Learner's Book*. Formative assessment emphasises continuous assessment as part of the teaching and learning process. 'Assessment for learning' focuses on using the assessment information to improve teaching and learning on an ongoing process. This helps you to monitor learners' progress continuously. You should constantly observe and evaluate learners' achievements, collecting data on areas of improvement and new skills that they acquire. In doing this, you should focus on the general and specific learning outcomes stated in the syllabus. Learners should also be aware of what is being assessed, and the assessment techniques and criteria being used. Learners can then judge for themselves whether they are achieving the general and specific learning outcomes.
- **summative assessment.** An example is a unit or chapter test. This tells you what learners have learnt or can do after a topic of work. This type of assessment focuses on 'assessment of learning' and is directed towards ranking learners from their performance on the learning outcomes. This will also help you to devise ways of improving the learners' performance in the classroom. These tests are important, but assessment should not be done only by test. Assessment must cover skills as well as knowledge. You should test whether learners can, for example, interpret a photograph or a graph, as well as testing the factual knowledge they have learnt.
- **diagnostic assessment.** This is the type of assessment you are encouraged to do in order to identify a learner's ability or achievement level in a specific learning outcome. If necessary, you can then devise remedial tasks as an intervention strategy. Learners who have achieved the specific learning outcome should be given enrichment support, to encourage them to maintain their achievement level.

Assessment techniques

Verbal assessment:

- answering questions
- making a verbal report
- interviewing.

Written assessment:

- doing an activity (from textbooks or self-prepared)
- completing an assignment
- writing a report
- sitting a test or an examination.

Practical assessment:

- participating in a field trip/excursion and collecting information
- demonstrating a particular task
- drawing, interpreting and using a map
- analysing a photograph
- basic library research and collecting information.

Group-work assessment:

- participating in a group task and discussion
- participating in a role-play and drama.

Other assessment techniques include:

- observation of what individual learners do
- consultation with individual learners by asking them questions
- focused analyses of learners' work such as portfolios, or a collection of work they have done, to determine how each individual learner is performing in their learning process.

Assessment of individual specific learning outcomes using achievement levels

Learners' achievements in Mathematics will be reported in levels instead of marks. These levels of achievement are derived from curriculum outcomes in the Year 7 Mathematics syllabus. Six levels are used to describe learners' achievement of the learning outcomes, ranging from L5, the highest, through L4, L3, L2, L1, to L0, the lowest.

Learners achieving at L0, L1 and L2 are considered to be at a critical level (Lc) and need urgent assistance. Learners in this category must be given remedial work in order to reach the curriculum standard or benchmark. Learners achieving at L3+, which is a combination of L3 and L4, require assistance and must be given remedial work in order to acquire the curriculum standards or benchmark. Learners achieving at L5 are considered to have reached the curriculum benchmark and should be given enrichment support in order to maintain high excellence.

Note the following:

- Learners achieving at L5 are considered to have achieved the curriculum benchmark and have full mastery of the learning outcome.
- Learners achieving at L1 to L4 are considered to have partially achieved the curriculum benchmark and either have substantial, moderate, minor or minimal mastery of the learning outcome.
- Learners achieving at L0 are considered not to have achieved the curriculum benchmark and to have no mastery of the learning outcome.

Level	Assessment criteria	Judgement criteria	Achievement award
L5	Statement to identify the fifth and highest level of achievement	Criteria for judging learner's achievement	**Achieved (A)** Full mastery of learning outcome
L4	Statement to identify the fourth level of achievement	Criteria for judging learner's achievement	**Partially Achieved (PA4)** Substantial mastery of learning outcome
L3	Statement to identify the third level of achievement	Criteria for judging learner's achievement	**Partially Achieved (PA3)** Moderate mastery of learning outcome
L2	Statement to identify the second level of achievement	Criteria for judging learner's achievement	**Partially Achieved (PA2)** Minor mastery of learning outcome
L1	Statement to identify the first level of achievement	Criteria for judging learner's achievement	**Partially Achieved (PA1)** Minimal mastery of learning outcome
L0	Statement to identify the lowest level of achievement	Criteria for judging learner's achievement	**Not Achieved (NA)** No mastery of learning outcome

Assessment criteria as achievement levels

Following is an example of an assessment criteria framework for a specific learning outcome (SLO) in Year 7 Mathematics. The SLO is the curriculum benchmark. The statements in the table are assessment criteria for SLO 7.10.5.1 Change mixed numbers to improper fractions. Each of the six levels describes the achievement of the learner.

Level	Assessment Criteria	Judgement criteria	Achievement Award
L5	7.10.5.1 Change mixed numbers to improper fractions	Steps: 1 Identify and name different parts of a mixed number 2 Multiply the denominator and the whole number. 3 Add the result to the numerator. 4 The result is the correct answer.	**Achieved (A)** Full mastery of learning outcome
L4	Change mixed numbers to improper fractions	One mistake	**Partially Achieved (PA4)** Substantial mastery of learning outcome
L3	Change mixed numbers to improper fractions	Two mistakes	**Partially Achieved (PA3)** Moderate mastery of learning outcome
L2	Change mixed numbers to improper fractions	Three mistakes	**Partially Achieved (PA2)** Minor mastery of learning outcome
L1	Change mixed numbers to improper fractions	Three mistakes	**Partially Achieved (PA1)** Minimal mastery of learning outcome
L0	Change mixed numbers to improper fractions	None correct	**Not Achieved (NA)** No mastery of learning outcome

Recording learners' achievements

You are encouraged to keep accurate records of both individual learners and the whole class. At the end of each assessment event, individual records of achievements must be recorded, using the approved recording template (see Appendix 3, page 193). Indicate whether learners have: achieved an outcome (A), partially achieved an outcome (PA 1–4) or not achieved an outcome (NA).

Keeping up-to-date and accurate records is very important for monitoring and reporting the performance, progress and achievements of learners. It is also useful to show the records during meetings with parents, the learner and other key stakeholders.

Monitoring individual learner and class achievements

With accurate records, teachers are able to monitor the learning performance, progress and achievement of individual learners and the whole class. You should monitor individual learners' performance, progress and achievements at the end of each assessment event. As you continue to assess more outcomes, the learning pathway of each learner can be mapped and tracked during a term or semester in any one year. This information is useful for providing advice to the parents, the learner and other key stakeholders.

In order to identify strengths and weaknesses of individual learners, you need to keep accurate records of the performance of all learners in the class against the performance of an assessed outcome at the end of an assessment event. In this way you can identify whether individual learners have achieved, partially achieved or not achieved the outcome for a particular assessment event.

Using this simple monitoring technique, you can identify learners who need enrichment support and those who need remedial work to help them achieve the standards required by the national curriculum. The recommended monitoring template is provided in Appendix 4 (page 194).

Reporting individual learners' achievements

With accurate records and effective monitoring systems, you can compile and make a balanced, accurate and fair report on each learner's performance, progress and achievements in a given assessment period. The type of reporting system recommended by the Ministry of Education requires more description of the learner's performance. This means that the report must also give a descriptive account of the learner's achievements.

The reporting system will no longer use marks or grades; instead you need to specify whether a learner has achieved, partially achieved or not achieved the assessed outcome. You should indicate this with A, PA (1–4) or NA on the approved reporting form. At the end of each assessment period, you need to give an overall achievement level for the learner. This is essential for the calculation of the overall award. The overall achievement level is calculated as a gross point average, whereby the total values of each of the outcomes assessed are added and divided by the number of outcomes assessed. The value of each overall achievement level is equivalent to an award of attainment for the learner. The recommended reporting template is provided in Appendix 7 (page 197).

Calculating progressive achievement levels for formative and summative assessment

To calculate the progressive achievement level for formative assessment, add the values of achievement levels for all outcomes assessed during the formative component of the assessment and divide by the number of outcomes assessed. The number you get is the progressive achievement level for the learner for formative assessment.

Similarly, to calculate the progressive level for summative assessment, add the values of achievement levels for all outcomes assessed in the summative component of the assessment and divide by the number of outcomes assessed. The number you get is the progressive achievement level for the learner for summative assessment.

Calculating overall achievement levels using formative and summative assessments

To calculate the overall achievement for each individual learner, add progressive achievement levels for formative and summative assessment and divide by 2. The number you get is the overall achievement level for the learner for that specific assessment period. The overall achievement level attained corresponds to an overall award for the learner (you should round off the calculated values to the nearest whole number). The award will be issued to the learner in the form of a coloured certificate in recognition of the learner's achievement.

Reporting learners' overall performance and achievements

Teachers will prepare two types of reports. The first is a detailed report using the internal reporting template for learners and teachers. The second is the overall reporting template using the letter grades for parents, guardians and other key stakeholders. Teachers must issue certificates in recognition of the achievements made by the learner for each subject learnt at school, with appropriate school reports at the end of each assessment period. The letter-grading reporting framework is used, to give parents a clear understanding of the report. Such a reporting system is similar to the current and traditional reporting framework (see Appendix 6, page 196).

However, detailed reports will be used for parent–teacher meetings at the school level (see Appendix 5, page 195). This report should be kept in the learner's folio as a record of his or her learning record to show the learner's performance, progress and achievements.

The table below shows achievement levels, awards and certifications.

Overall achievement level	Performance descriptors	Achievement award	Certificate position	Colour code	Objective grading system
Level 5 Mastery level	Learner is competent with 95–100% of the outcomes.	Achieved with excellence	Gold	Yellow	A
Level 4 Progressive level	Learner is competent with 80–94% of the outcomes.	Achieved with merit	Silver	Green	B
Level 3 Progressive level	Learner is competent with 50–79% of the outcomes.	Achieved with minimum standards	Bronze	Blue	C
Level 2 Critical level	Learner is competent with 20–49% of the outcomes.	Achieved below minimum standards	Critical level	No award	D
Level 1 Critical level	Learner is competent with less than 20% of the outcomes.	Achieved far below minimum standards	Critical level	No award	E
Level 0 Critical level	Learner is not competent. Did not achieve outcomes.	Not achieved	Critical level	No award	F

Meetings with parents, learners and other stakeholders

Teachers and the school administration are encouraged to consult parents, learners and other stakeholders to discuss the performance, progress and achievements of learners and suggest ways in which learners can improve. This is a very important process because it involves giving proper feedback to both the learner and the parents. The school can organise consultative meetings between teacher and parents, as well as teacher, parent and learner. If you have kept accurate records of each learner's performance, progress and achievements, you will be able to identify the learning progress and pathway of the learner and therefore determine appropriate remedial work for that learner. You will also then need to provide results after remedial work has been carried out with the learner. Conducting such very important meetings will give parents and key stakeholders the confidence for their children to be educated in our schools. These meetings will make important links with the parents and other key stakeholders.

Links between mathematics and other subjects

Many other topics or skills that are similar to or related to the topics and skills that are taught in Mathematics are also taught in other subjects. It is important that you are aware of these when you teach a topic or use a skill. Remind learners that they have also learnt about this, or will learn about it in another subject.

Below is a list of some of the topics or skills in other subjects that you should be aware of.

Other subjects: level and sub-strand	Mathematics
Social Studies **Year 7** • Reading maps, interpreting scales • Identifying directions using a compass, maps and bearings • Demonstrating the behaviour of populations using statistics, charts and graphs • Expressing pollution distribution in charts, data and graphs as a percentage	Strands: • Percentages • Trigonometry • Statistics
Business Studies • General calculations of money • Calculations of cost price, selling price, profit or loss and mark-up • Using graphs to demonstrate business behaviour • Expressing mark-up as a percentage	Strands: • Numbers • Money • Statistics • Percentages
Home Economics • Essential for recipe measurements, design and patterns • Cost and selling price • Using graphs and charts • Ratios and quantities • Design patterns using transformations	Strands: • Ratios and proportions • Money • Statistics • Percentages • Geometry
Technology • Constructing objects and furniture requires measurements • Measurements for buildings • Calculating distances	Strands: • Measurements • Geometry • Trigonometry
Agriculture • Mixing animal feed and insecticide spray • Relativity of costs and selling products • Quantities expressed as percentages • Crop yield per area or hectare • Spacing of crops when planting	Strands: • Ratios and proportions • Money • Percentages • Measurements
Science • A number of basic physics experiments involve measurement (distance, speed, acceleration, mass and time). • Balancing equations in chemistry • Reading charts, and collecting, analysing and presenting data • Expressing results as percentages	Strands: • Measurements • Algebra • Statistics • Percentages

• Chapter One •

Whole Numbers

Overview

Learners begin Year 7 by consolidating and building on their understanding of whole numbers from earlier years. They will appreciate that different cultures, including that of the Solomon Islands, have developed a range of number systems from the earliest times. By comparing examples of different number systems, they will understand the importance of place value and realise why a decimal Hindu–Arabic system is now universally accepted.

Learners will revise their knowledge of the four operations and apply them to everyday applications and problems. They will develop their number sense by using a variety of approximation methods to estimate answers, and appreciate the need for an agreed order of operations to ensure consistent answers.

Learners need to develop their confidence in using number skills as the foundation for their studies of all the other strands in Year 7. While basic facts such as knowledge of multiplication tables are important, they need to appreciate that there are many possible ways to calculate answers and that there is value in exploring different methods. Learners should be encouraged to use mental, written and calculator methods for computations. Materials and patterns can be used to understand different number systems, such as binary numbers. Real-life problems provide contexts for using multiple operations, and rounding and estimation are used to provide answers to practical situations.

Contents

Chapter skills

This chapter covers the following skills:

- Understanding place value
- Adding, subtracting, multiplying and dividing whole numbers
- Doubling and halving mentally
- Estimating values
- Converting numbers from different counting systems
- Simplifying using order of operations:

B Work out the calculations inside the **brackets** first. If there is more than one operation inside the brackets, then they must also follow the rules of BODMAS.

O If the question contains fractions **of** or powers **of**, then these are calculated next.

D Work out the **division** and

M **multiplication** calculations, working across the page from left to right.

A Work out the **addition** and

S **subtraction** calculations, working across the page from left to right.

Teaching plan

Lessons	Chapter sections	Class work and home work
1–2	• Intro • 1A: Number systems of the past	Learner's Book 1 • Exercise 1A, page 5
3–4	• 1B: Place value	Learner's Book 1 • Exercise 1B, pages 6–7
5–7	• 1C: Addition • 1D: Subtraction • 1E: Multiplication • 1F: Division	Learner's Book 1 • Exercise 1C, pages 8–9 • Exercise 1D, pages 10–11 • Exercise 1E, pages 12–13 • Exercise 1F, pages 14–15 • Exercise 1H, pages 18–19
8–9	• 1G: Calculation short-cuts and estimation	Learner's Book 1 • Exercise 1G, page 17 • Exercise 1I, pages 20–21
10	• Revision/test	Learner's Book 1 • Test, Exercises 1A–1I, pages 28–29 Teacher's Guide • Chapter 1 test, page 159

General learning outcomes

Learners should:

Number systems of the past

7.1.1 Know that there are different number systems that have been developed by different civilisations in the past. Currently, we use the Hindu–Arabic system. (K)

7.1.2 Know how to write numbers using different number systems of the past. (K)

7.1.3 Convert numbers between past and present number systems. (S)

Place value

7.1.4 Understand that our number system is ‘base 10’ and is made up of the digits: 0, 1, 2, 3, 4, 5, 6, 7, 8 and 9. (U)

7.1.5 Understand that the position of individual digits in a number holds different values and names. (U)

Addition, subtraction, multiplication and division

7.1.6 Know how to compute with numbers using addition, subtraction, multiplication and division. (K)

Double and halving

7.1.7 Know how to evaluate numbers using the ‘doubling and halving’ method. (K)

Order of operations

7.1.8 Know how to use rule of BODMAS to solve and evaluate problems that have a mixture of operations. (K)

Estimation

7.1.9 Know how to estimate numbers to the nearest whole numbers (ones, tens, hundreds etc.). (K)

1A • Number systems of the past

LB Pages 4–5

Specific learning outcomes

Learners should be able to:

7.1.1.1 Identify the different counting systems that were used in the olden days in Solomon Islands.

7.1.1.2 Identify and distinguish between the different number systems that were used in the past, including: Hindu–Arabic that we use now, Egyptian, Roman, Greek and Chinese–Japanese.

7.1.2.1 Write numbers using different number systems of the past: Roman, Greek etc.

7.1.3.1 Convert numbers from one counting system to another using the past and present number systems.

Teaching points

1. Learners need to become aware that number systems have developed and evolved over the years. These systems include Hindu–Arabic, Roman, Japanese and Chinese number systems.
2. Solomon Islands also has a different counting system that was used in the past and is still used today.
3. Learners should appreciate the development of number systems around the world, including Solomon Islands, which are also used as the basis for communication and exchange of ideas.

Suggested teaching approach

- Start the chapter section by doing the **Starter activities** provided.
- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercise 1A** on page 5 in the LB.

Starter activities

Activity 1: Fizz-Buzz

Play a counting game such as Fizz-Buzz.

1. Learners count around in a circle.
2. Any number that contains a 3 or is divisible by 3 must be spoken as ‘fizz’. Any number that contains a 5 or is divisible by 5 is spoken as ‘buzz’.
3. For example, the counting starts as: ‘One, two fizz, four, buzz, fizz, seven, eight, fizz, buzz …’ and so on.
4. Fifteen becomes ‘fizz-buzz’, as do 30, 35, 53 etc.
5. Start by practising with ‘fizz’, and introduce ‘buzz later’.
6. Once the learners understand, you can introduce a competition so that those who make a mistake drop out of the circle.

Activity 2: Solomon Islands number systems

1. Find people who speak different Solomon Islands languages.
2. Ask each of them to count to 20 in their own language.
3. Compare the names of the numbers, and any differences and similarities in pronunciation.

Additional notes

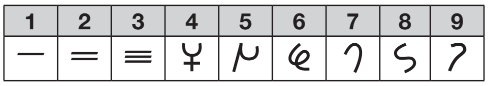
Numbers Around the World

Throughout history, different civilisations and cultures have developed various systems and symbols for numbers. Some of these systems travelled to other parts of the world as people migrated and traded, while others were (and still are) only used by small groups with a certain language or culture.

The Hindu–Arabic system

0 1 2 3 4 5 6 7 8 9

You are very familiar with the above 10 symbols that we use to represent numbers. Have you ever thought about where these symbols come from? They have their origins in Brahmi numerals, which were used in India from about 300 BCE. They were adopted and modified by the Arabic people, who brought them to Europe during the Middle Ages. The Arabs also developed a symbol for zero, calling it ‘sifr’. Because of its history, we refer to our number system as the ‘Hindu–Arabic system’. The Brahmi numerals are shown in the second row of the table below. They have evolved over time to become the more familiar symbols in the top row.



1	2	3	4	5	6	7	8	9
𑁒	𑁓	𑁔	𑁕	𑁖	𑁗	𑁘	𑁙	𑁚

The Roman system

The ancient Romans used letters as their symbols for numbers. Roman numerals are still used today on some clocks, watches and monuments, or to show the date when something (such as a movie) was made.

The Roman number system was based on the following symbols with corresponding numerals:

I	II	III	IV	V	VI	VII
1	**2**	**3**	**4**	**5**	**6**	**7**
VIII	IX	X	L	C	D	M
8	**9**	**10**	**50**	**100**	**500**	**1000**

In **Roman numerals**, the letter I or the letter C before a higher-value letter means we *take it away* from the *higher value*. The rule is that you can only subtract these from the next two higher Roman numerals.

For example:

4 is IV and 9 is IX.

So:

- I can be subtracted from V and X
- X can be subtracted from L and C, and
- C can be subtracted from D and M.

39 is XXXIX

(10 + 10 + 10 + 9)

2644 is MMDCXLIV

(1000 + 1000 + 500 + 100 + (50 – 10) + (5 – 1))

Chinese counting number system

The Chinese character system uses two symbols to show each of the place values represented. The first symbol indicates how many, and the second symbol indicates the place value. However, when there is only one of a particular place value, only one symbol is used. If a place value is zero, then no symbols are needed. Chinese numbers are written vertically.

0	1	2	3	4	5	6
〇	一	二	三	四	五	六

7	8	9	10	100	1000	10000
七	八	九	十	百	千	万

Examples

270		19		8005	
二 百 七 十	two (lots of) one hundred and seven (lots of) ten	十 九	ten and nine	八 千 五	eight (lots of) one thousand and five

Activity 1A

1 The table at the top of the next column shows numerals in some of the different languages that are spoken in the Solomon Islands. Use the table to answer the questions that follow.

Numeral	Fauro (Shortlands)	Marau (Guadalcanal)	Lau North (Malaita)	Tikopia (Polynesian outlier)
1	kala	eta	eta	tasi
2	elua	rua	rua	rua
3	episa	oru	olu	toru
4	ehati	hai	fai	fa
5	lima	nima	lima	rima
6	onomo	ono	ono	ono
7	hitu	hiu	fiu	fitu
8	alu	waru	kwalu	varu
9	ulia	siwa	sikwa	siva
10	lahulu	tanahuru	tangafulu	fuanafura
100	ea latuu	tanarau	talange	fuaterau
1000	ea kokolei	kesa toya	toni	teafe

a Work with a partner and pronounce the words in the table. Which numbers sound most similar in each of the dialects and which ones are different?

b Check the locations of the places on a map. Do the districts that are closer to each other have numbers that sound similar? Explain why this might be.

2 Change these numbers from Roman numerals to their modern equivalents:

a XIII

b LI

c XX

d CLVI

e MCCCLIII

f MD

3 Write these numbers as Roman numerals:

a 6

b 14

c 21

d 61

e 29

f 2000

4 Perform the following calculations. Write your answers using Roman numerals.

a XXIX + CLII

b MDCCLX – MCDXCIX

5 What is the largest Roman numeral you can make that uses one of each of these symbols: C, L, M, X, D, V, I?

Write your answer in Roman and Hindu–Arabic numerals.

6 **a** Write these numbers using the Chinese character system:

i 37

ii 823

iii 6400

b Change these Chinese numbers into modern numerical numbers, then perform the calculations.

i 五百六十 + 八百九

ii 千 – 三百二十七

c Was it easy to perform calculations with the Roman and Chinese systems? What are the advantages of using the Hindu–Arabic system for calculations?

Answers 1A

1 Answers will vary.

2 **a** 13 **b** 51
c 20 **d** 156
e 1353 **f** 1500

3 **a** VI **b** XIV
c XXI **d** LXI
e XXIX **f** MM

4 **a** CLXXXI **b** CCLXI

5 MDCLXVI = 1666

6 **a** **i** 三十七 **ii** 八百二十三
iii 六千四百
b **i** 1369 **ii** 673
c Answers will vary.

1B • Place value

LB Pages 6–7

Specific learning outcomes

Learners should be able to:

7.1.4.1 Write and express numbers in figures, using digits: 0, 1, 2, 3, 4, 5, 6, 7, 8 and 9, and also in words.
7.1.5.1 Identify the names and values of numbers in respect to the positions of the digits in the Place Value Table.
7.1.5.2 Arrange numbers in ascending and descending order according to their values.

Teaching points

1. Stress that the **position** of each **digit** in a number determines the **value** and **name** of the digit (**place value**).
2. Learners should be able to write numbers in both words and numerals.
3. Learners should be able to identify the values of numbers and arrange them according to their values in ascending and descending order.

Suggested teaching approach

- Start the chapter section by doing the **Starter activities** provided.
- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB or TG.
- Learners complete **Exercise 1B** on pages 6–7 in the LB, or **Activity 1B** in the TG below.

Starter activities

Activity 1: Place-value alignment

1. Make sets of cards with the names of the columns of the place-value table (ones/units, tens, hundreds, thousands, ten thousands).
2. Give each learner a card.
3. Ask learners to group themselves according to the names they have. Ones go together, tens go together, thousands go together etc.
4. Ask learners to line up according to their groups, from smallest to largest.

Activity 2: Think, pair, share

1. Ask each learner to write down three different single-digit numbers (e.g. 5, 8, 2).
2. Challenge them to write down all the numbers that can be written with their three digits (e.g. 582, 825, 852, 528, 258, 285), and then to order their numbers from smallest to largest (e.g. 258, 285, 528, 582, 825, 852).
3. Pairs of learners check each other's work and discuss whether they are correct.
4. Invite three pairs to show and explain their answers to the rest of the class.
5. Check learners' understanding of the terms 'hundreds', 'tens' and 'ones' (or 'units').
6. Repeat the 'Think, pair, share' challenge for four-digit numbers with one repeated digit (e.g. 3, 7, 7, 4).

Additional notes

Our whole-number system uses 10 digits:
0, 1, 2, 3, 4, 5, 6, 7, 8 and 9.

The position of a digit in a number represents its 'place value'. It tells you how many units (U), tens (T), hundreds (H) etc. there are. For instance, 20 649 means:

Thousands			BASE		
H	T	U	H	T	U
	2	0	6	4	9

- 2 lots of ten thousand
- no thousands
- 6 hundreds
- 4 tens
- 9 units.

The above number is twenty thousand six hundred forty-nine.

Note

See how the three columns Hundred (H) Tens (T) and Units (U) are repeated throughout the place value system of numbers.

Examples

1 Write the number fourteen million, six hundred and thirteen thousand, five hundred and twenty four using numerals.

Solution:

MILLION			THOUSAND			BASE		
H	T	U	H	T	U	H	T	U
	1	4	6	1	3	5	2	4

2 Write 4 403 128 in words.

Solution:

We need to display the number inside the place value table first.

MILLION			THOUSAND			BASE		
H	T	U	H	T	U	H	T	U
		4	4	0	3	1	2	8

The number in words is 4 million, 403 thousand, 128 or Four million four hundred and three thousand one hundred twenty eight.

3 What is the place value of 5 in 75 362?

Solution:

Write the number in the place value table.

Thousands			BASE		
H	T	U	H	T	U
	7	5	3	6	2

The value of five in seventy five thousand, three hundred sixty two is five thousands.

Activity 1B

1 Write these numbers in numerals:
- **a** thirty-one
- **b** seven hundred and three
- **c** two thousand
- **d** four hundred thousand, nine hundred

2 Write these numbers in words:
- **a** 12
- **b** 4010
- **c** 7 000 000
- **d** 45 313

3 What is the value of the 7 in the number 45 788?

4 Write this sum as a single number:
300 000 + 6000 + 800 + 4

5 **a** Use the five digits 6, 8, 2, 1 and 7 to write a number in which each digit is used only once.
- **b** What is the largest number that can be written using these digits?
- **c** What is the smallest number?

Answers 1B

1 **a** 31
- **b** 703
- **c** 2000
- **d** 400 900

2 **a** twelve
- **b** four thousand and ten
- **c** seven million
- **d** forty-five thousand, three hundred and thirteen

3 seven hundred

4 306 804

5 **a** Answers will vary.
- **b** 87 621
- **c** 12 678

1C • Addition

LB Pages 8–9

Specific learning outcomes

Learners should be able to:

7.1.6.1 Use *Addition* to compute and solve whole number problems with and without trading.

Teaching points

1 Learners should be able to align whole numbers in their correct place-value positions.

2 Learners should confidently add whole numbers up to five digits, aligning numbers in their correct place-value positions.

Suggested teaching approach

- Start the chapter section by doing the **Starter activities** provided.
- Read through the **Additional notes** provided, for additional help.
- Model the **Examples** provided in the LB or TG.
- Learners complete **Exercise 1C** on pages 8–9 in the LB, or **Activity 1C** in the TG below.

Questioning strategies

Here are four helpful questions teachers can ask learners who are unsure of how to proceed with a written question.

1 "Read the question out loud." (Any unfamiliar words will be identified quickly.)

2 "Tell me the question in your own words." (The learner's answers will reveal whether they understand the question.)

3 "What do you think you need to do to find the answer to the question?" (This identifies whether the learner has a strategy to solve the problem.)

4 "What type of answer are you expecting to the question?" (This allows the learner to estimate a sensible answer and units.)

Encouraging learners to talk about the question can often help them identify the next step in the solution for themselves.

Starter activities

Activity 1: Find the sum

Use the strategies from the 'Think, pair, share' activity (Section 1B, Starter Activity 2) to have the learners explore the following challenges.

1 Find two single-digit whole numbers that sum to 10 (e.g. 3 + 7, 4 + 6, etc.).

2 Find a single-digit whole number and a double-digit whole number that sum to 100 (e.g. 7 + 93, etc.). How many solutions are possible?

3 Find a single-digit number, a double-digit number and a triple-digit number that sum to 1000.

Have learners demonstrate their answers on the board. When columns are used, prompt students for reasons for lining up according to place value.

Additional notes

When adding, we set out numbers so that the place values line up.

$$\begin{array}{r} 479 \\ +\ \ 38 \\ \hline 517 \end{array}$$

Activity 1C

1 Work out the following sums.

a $\begin{array}{r} 641 \\ +\ \ 28 \\ \hline \end{array}$

b $\begin{array}{r} 4573 \\ +\ 617 \\ \hline \end{array}$

2 What is the result when you add the following numbers?

a 8831 and 692

b 1947, 6551 and 803

3 George Abana prepared a budget for the amount he will spend on family birthday presents next year:

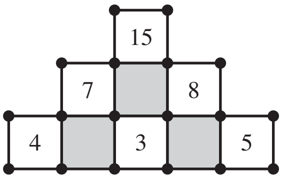
Mum $40, Dad $40, Sally $25, Steve $25, Grandma $18.

How much does he plan to spend altogether?

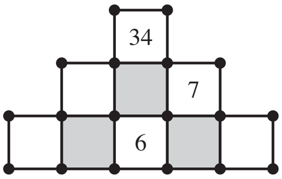
4 Sam went to the Central Market in Honiara to buy some food for the weekend. He bought two pineapples for $15 each, three mangoes for $9 each and a melon for $24. How much did Sam spend altogether?

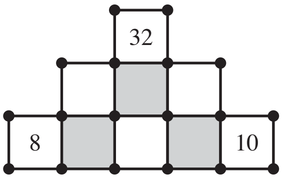
5 Each number in a number pyramid is the sum of the two numbers below it.

Example



a Copy the pyramids below and fill in the missing numbers.





b Make up some similar problems, and swap with a partner.

6 The Our Telekom Company wished to analyse its sales of mobile phones at three centres over four years. The number of mobile phones sold in each centre is shown in the table below.

Centre	2009	2010	2011	2012
Auki	32	47	123	226
Buala	5	26	56	104
Gizo	0	17	35	84

Use the table to answer the following questions:

a What were the total sales of mobile phones for each centre over the four years?

b What were the total sales for each year?

c How many mobile phones were sold in each of the centres in the past two years?

d How many mobile phones were sold in Buala and Gizo since the beginning of 2009?

Answers 1C

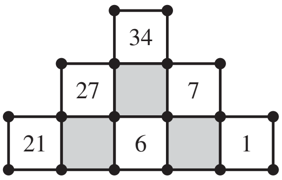
1 **a** 669 **b** 5190

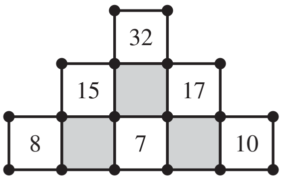
2 **a** 9523 **b** 9301

3 $148

4 $81

5 **a**





b Answers will vary

6 **a** Auki, 428; Buala, 191; Gizo, 136

b 2009, 37; 2010, 90; 2011, 214; 2012, 414

c Auki, 349; Buala, 160; Gizo, 119

d 327

1D • Subtraction

LB Pages 10–11

Specific learning outcomes

Learners should be able to:

7.1.6.1 Use *Subtraction* to compute and solve whole number problems with and without trading.

Teaching points

1 Learners should be able to align whole numbers in their correct place-value positions.

2 Learners should confidently subtract whole numbers up to five digits, aligning numbers in their correct place-value positions.

3 Learners should be able to apply **subtraction** in real-life situations.

Suggested teaching approach

- Start the chapter section by doing the **Starter activities** provided.
- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB or TG.
- Learners complete **Exercise 1D** on pages 10–11 in the LB, or **Activity 1D** in the TG below.

Starter activities

Activity 1: Class subtraction competition

1. Choose a starting number, e.g. 100.
2. Choose a single-digit number to subtract, e.g. 7.
3. With the learners standing up, choose one learner to start. Show how turns will progress around the room (e.g. up and down the rows) until everyone has had a turn.
4. The first person says the starting number (e.g. 100). Each person then subtracts the chosen number (e.g. 7) and says the result (93, 86, and so on).
5. If a learner makes a mistake, that person sits down and the pattern continues. The aim is to see who is the last person standing.
6. If the counting gets down to the lowest number before someone wins, choose a new starting number (e.g. 152) and start again, still subtracting 7 each time.

This activity can be repeated over several lessons, to strengthen learners' mental skills. It can also apply to addition.

Additional notes

When we subtract two numbers, we take one away from the other. This gives the *difference* between the two numbers.

The example shows how to set out the working for 564 – 93. Notice how the numbers are arranged so that the place values line up in columns.

$$\begin{array}{r} \overset{4}{\cancel{5}}\,\overset{16}{\cancel{6}}\,4 \\ -\quad 9\,3 \\ \hline 4\,7\,1 \\ \hline \end{array}$$

Examples

Find the answers to each of the following subtraction questions:

Example 1

$$\begin{array}{r} 458 \\ -\ 117 \end{array}$$

Solution

$$\begin{array}{r} 458 \\ -\ 117 \\ \hline 341 \\ \hline \end{array}$$

Example 2

$$\begin{array}{r} 4278 \\ -\ 1565 \end{array}$$

Solution

$$\begin{array}{r} \overset{3}{\cancel{4}}\,\overset{12}{\cancel{2}}\,7\,8 \\ -\ 1\,5\,6\,5 \\ \hline 2\,7\,1\,3 \\ \hline \end{array}$$

Example 3

Place the following subtraction in columns and then work out the answer.

Take 129 away from 752.

Solution

$$\begin{array}{r} 7\,\overset{4}{\cancel{5}}\,\overset{12}{\cancel{2}} \\ -\ 1\,2\,9 \\ \hline 6\,2\,3 \\ \hline \end{array}$$

Activity 1D

1 Work out the answers to these subtraction questions.

a
$$\begin{array}{r} 868 \\ -\ 152 \\ \hline \\ \hline \end{array}$$

b
$$\begin{array}{r} 9760 \\ -\ \ 481 \\ \hline \\ \hline \end{array}$$

2 Work out the answers to these subtraction questions. Carefully show how the working is set out.

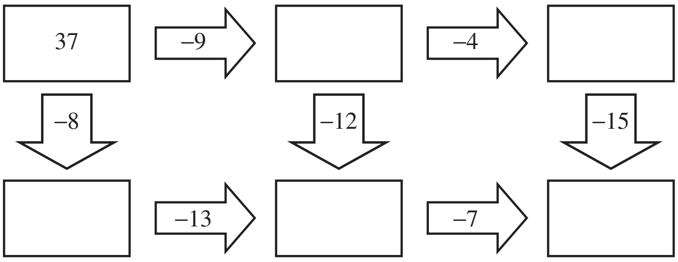
a 107 – 19

b 6307 – 5413

Additional activity

3 Learners can create worksheets using the pattern below for further subtraction practice and to challenge their classmates. They will learn as much from designing the challenges as from solving them.

The number in the top left-hand box can be as big as they choose. (The number 37 is shown in the example.) The numbers in the subtraction arrows need to sum to the same values for all three routes.



This puzzle can be adapted to any types of numbers (whole numbers, fractions, decimals) and any of the four operations (+, –, ×, ÷) or any combination.

Instructions for learners

Do the subtraction problems along the paths according to the arrows until you get to the end. You should get to the same final answer in three different ways.

Answers 1D

1 **a**
$$\begin{array}{r} 868 \\ -\ 152 \\ \hline 716 \\ \hline \end{array}$$

b
$$\begin{array}{r} 9\,\overset{6}{\cancel{7}}\,\overset{15}{\cancel{6}}\,\overset{10}{\cancel{0}} \\ -\quad 4\,8\,1 \\ \hline 9\,2\,7\,9 \\ \hline \end{array}$$

2 **a**
$$\begin{array}{r} \cancel{1}\,\overset{9}{\cancel{0}}\,\overset{17}{\cancel{7}} \\ -\quad 1\,9 \\ \hline 8\,8 \\ \hline \end{array}$$

b
$$\begin{array}{r} \overset{5}{\cancel{6}}\,\overset{12}{\cancel{3}}\,\overset{10}{\cancel{0}}\,7 \\ -\ 5\,4\,1\,3 \\ \hline 8\,9\,4 \\ \hline \end{array}$$

3 Learner activity

1E • Multiplication

LB Pages 12–13

Specific learning outcomes

Learners should be able to:

7.1.6.1 Use *Multiplication* to compute and solve whole number problems with and without trading.

Teaching points

1. Aim to ensure that learners can confidently multiply whole numbers up to four digits, aligning the place values correctly in columns.
2. Learners should be able to solve real-life whole-number multiplication problems.
3. Learners should be confident with their times tables and multiplication facts. If this is not the case, some remedial work and time for practice are essential at this stage.
4. Learners should become familiar with the term **product**.

Suggested teaching approach

- Start the chapter section by doing the **Starter activities** provided.
- Read through the **Additional notes** provided below for additional information.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercise 1E** on pages 12–13 in the LB, or **Activity 1E** in the TG below.

Starter activities

Activity 1: Times-table races

Times-table races are also a good warm-up activity.

1. Call different learners from the class and ask them to recite any times tables from 2 to 12.
2. Ask brighter learners to continue to times tables for 15.
3. Call different learners in the class and ask them to recite times tables at the same time. The one who finishes first is the winner.
4. Call out different numbers to be multiplied together and see who gets the answer first.

Additional notes

Multiplication is the repeated addition of the same number.

260 + 260 + 260 + 260 + 260 + 260 + 260
= 7 × 260
= 1820

Examples

1 18 × 6

$$\begin{array}{r} {}^{4} \\ 18 \\ \times\quad 6 \\ \hline 108 \\ \hline \end{array}$$

2 375 × 29

$$\begin{array}{r} {}^{1\,1} \\ {}^{6\,4} \\ 375 \\ \times\quad 29 \\ \hline 3\,375 \\ 7\,500 \\ \hline 10\,875 \\ \hline \end{array}$$

Another approach: using rectangles

Learners can improve their understanding of multiplication by using number properties, and by visualising the process as if they were calculating the area of a rectangle.

Examples

Find the answers to each of these multiplications:

Example 1
238 × 9

Solution

$$\begin{array}{r} {}^{3\,7} \\ 238 \\ \times\quad 9 \\ \hline 2142 \\ \hline \end{array}$$

Example 2
378 × 75

Solution

$$\begin{array}{r} {}^{5\,5} \\ {}^{3\,4} \\ 378 \\ \times\quad 75 \\ \hline 1\,890 \\ 26\,460 \\ \hline 28\,350 \\ \hline \end{array}$$

Example 3
69 × 234

Solution

$$\begin{array}{r} {}^{2\,2} \\ {}^{3\,3} \\ 234 \\ \times\quad 69 \\ \hline 2\,106 \\ 14\,040 \\ \hline 16\,146 \\ \hline \end{array}$$

Activity 1E

1. Work out the answers to these multiplications:

   a $\begin{array}{r} 519 \\ \times\quad 6 \\ \hline \\ \hline \end{array}$ **b** $\begin{array}{r} 796 \\ \times\quad 38 \\ \hline \\ \hline \end{array}$

2. Work out the answers to these multiplications. Carefully show how the equation is set out.

   a 107 × 19 **b** 35 × 546

3. Tracy bought five CDs at $29 each and three cassettes at $8 each. What was the total cost?
4. John makes three trips to Savo Island each week, and each Monday and Wednesday he makes two trips to Honiara. How many trips does John make each week?

Additional activities

5. Learners work in pairs to draw up a 100s chart (a 10 × 10 grid numbered from 1 to 100).

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	40
51	52	53	54	55	56	57	58	59	50
61	62	63	64	65	66	67	68	69	60
71	72	73	74	75	76	77	78	79	70
81	82	83	84	85	86	87	88	89	80
91	92	93	94	95	96	97	98	99	100

a Give pairs of learners one or more numbers and ask them to colour in all the multiples of that number. For example, learners with the number 2 will colour in all the even-numbered squares.

b Each pair displays their multiples to the class and describes the pattern of colours they see.

c Challenge learners to find patterns for multiples of 2, 3, 4, 5 and so on up to 20.

6 a Create a table like the one below with the multipliers (factors) missing.

b Learners work in pairs to fill in the missing numbers in the boxes so that the multiplication table is correct. They can choose numbers from 2 to 12 for each row and column.

×	□	□	□	□
□	20	44	28	16
□	50	110	70	40
□	55	121	77	44
□	45	99	63	36

Variations

1 Learners make up similar puzzles to challenge their classmates.

2 Cover each number in the main part of the table with a piece of paper. Partners take it in turns to reveal the numbers until one person thinks they have successfully guessed the multipliers.

Answers 1E

1 a

$$\begin{array}{r} {\scriptstyle 1\,5} \\ 519 \\ \times\quad 6 \\ \hline 3114 \\ \hline \end{array}$$

b

$$\begin{array}{r} {\scriptstyle 2\,1} \\ {\scriptstyle 7\,4} \\ 796 \\ \times\quad 38 \\ \hline 6\,368 \\ 23\,880 \\ \hline 30\,248 \\ \hline \end{array}$$

2 a

$$\begin{array}{r} {\scriptstyle 6} \\ 107 \\ \times\quad 19 \\ \hline 963 \\ 1070 \\ \hline 2033 \\ \hline \end{array}$$

b

$$\begin{array}{r} {\scriptstyle 1\,1} \\ {\scriptstyle 2\,3} \\ 546 \\ \times\quad 35 \\ \hline 2\,730 \\ 16\,380 \\ \hline 19\,110 \\ \hline \end{array}$$

3 (5 × 29) + (3 × 8) = 145 + 24 = $169

4 3 + (2 × 2) = 3 + 4 = 7

5 Answers will vary.

6 Answers will vary.

1F • Division

LB Pages 14–15

Specific learning outcomes

Learners should be able to:

7.1.6.1 Use *Division* to compute and solve whole number problems with and without trading.

Teaching points

1 Learners should become familiar with the terms **divisor**, **dividend**, **quotient** and **remainder**.

2 Learners should link the concept of **division** by whole numbers to 'sharing'.

3 Learners should be able to divide whole numbers up to five digits with divisors up to 12 using a long-division algorithm without remainders.

4 By Year 7, learners should be confident in knowing their tables and division facts. If this is not the case, then some remedial work and time for practice are essential at this stage.

5 Learners should be able to solve real-life whole-number division problems in any context.

6 Give learners a range of long-division questions that have remainders. Ask some learners to explain the methods they use to get their answers.

Suggested teaching approach

- Start the chapter section by doing the **Starter activities** provided.
- Read through the **Additional notes** provided below for additional information.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercise 1F** on pages 14–15 in the LB, or **Activity 1F** in the TG below.

Starter activities

Activity 1: Division memory match game

1 Make up sets of 10 division cards (e.g. 28 ÷ 4) and matching quotient cards (e.g. 7).

2 In groups of four, learners mix the cards and place them face down on the desk.

3 Player 1 turns over any two cards and shows them to all the players.

4 If the cards match, Player 1 keeps the cards. If they don't match, the cards are returned to their original places, face down on the desk.

5 Players take it in turns until all the cards are matched and removed from the desk. The player with the most pairs wins.

This game can be played for any of the operations and types of numbers. Sets of cards can vary in difficulty, to enable learners to practise basic skills. Learners can make up their own sets for others to play. Store each set in a separate plastic bag for future use.

Additional notes

When we divide one number by another, we are working out how many times the second number goes into the first number.

Example

63 ÷ 9 = 7 (because 9 goes into 63 exactly 7 times)

Example

This example shows how to set out 3952 ÷ 8.

$$\begin{array}{r} 0494 \\ 8\overline{)\,39{}^{7}5{}^{3}2} \end{array}$$

Activity 1F

1 Work out the answers to these divisions:
   - **a** $6\overline{)2478}$
   - **b** $7\overline{)623}$

2 Work out the answers to these division questions. Carefully show how the working is set out.
   - **a** 3741 ÷ 3
   - **b** 40 205 ÷ 5

3 The ferry to Auki used 876 litres of diesel fuel for three return trips. How much diesel fuel was used on each return trip?

4 Tickets for students at a cinema cost $8. At one showing of a movie to students, the ticket office collected $1032.
   - **a** Calculate 1032 ÷ 8.
   - **b** Explain what the answer represents in this situation.

Additional question

5 Learners work in pairs, and present their solutions to the class for further discussion.

A farmer has 36 metres of fencing wire. He uses it to make a rectangular pen for his pigs.
   - **a** Draw as many plans for the pen as possible, marking the length and width dimensions clearly.
   - **b** Which do you think would be the best dimensions for the pen? Give a reason for your choice.

This question can be investigated for other lengths of fencing wire and for different shapes of pig pen (e.g. a triangle). Learners' explanations should include how they solved the problem as well as a justification of their solution.

Answers 1F

1 **a** 413 **b** 89

2 **a** 1247 **b** 8041

3 292 litres

4 **a** 129
   - **b** 129 student tickets were sold, so 129 students went to the movie.

5 **a** Possible pen sizes (assuming whole metre fence lengths): 1 × 17, 2 × 16, 3 × 15, etc.
   - **b** Answers will vary.

1G • Calculation short-cuts

LB Pages 16–17

Specific learning outcomes

Learners should be able to:

7.1.6.1 Use multiplication to compute and solve whole number problems with and without trading.

Teaching points

Learners should be able to use a variety of calculation short-cuts, such as **rearranging of numbers** and **doubling and halving** to solve number problems effectively and efficiently.

Suggested teaching approach

- Start the chapter section by doing the **Starter activities** provided.
- Read through the **Additional notes** provided below for additional information.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercise 1G** on page 17 in the LB, or **Activity 1G** in the TG below.

Starter activities

Activity 1: Think, pair, share

1 Ask the learners to mentally evaluate 28 + 39.

2 Encourage them to share with a partner how they did it, using their own words.

3 Invite one learner to the board, to demonstrate their thinking in finding the solution. The emphasis is on methods, not answers.

4 Invite other learners who have alternative methods to demonstrate their thinking. Check that everyone can follow the methods, by asking the learner to repeat their explanation if necessary. Encourage learners to ask questions if necessary.

The value of the activity is for learners to understand each other's thinking, so they can look at calculations in new ways, depending on particular number properties.

Two possible solution methods for 28 + 39 are:

- 28 + 39 = (30 − 2) + (40 − 1) = 30 − 2 + 40 − 1
  = 30 + 40 − 2 − 1 = 70 − 3 = 67
- 28 + 39 = (20 + 8) + (30 + 9) = 20 + 8 + 30 + 9
  = 20 + 30 + 8 + 9 = 50 + 17 = 67

The learners with the best number sense will instinctively choose a method of regrouping the numbers in their heads to find a quick solution.

More questions to explore with learners are examples such as:

- 137 − 59
- 4 × 17 × 25
- 5500 ÷ 11 ÷ 5

Additional notes

If the same number is used twice in a calculation, the calculation can sometimes be simplified.

Examples

1 24 × 7 + 56 × 7 = 24 lots of 7 plus 56 lots of 7
= (24 + 56) × 7
= 80 × 7
= 560

2 It is also possible to change the order in multiplication problems:

5 × 39 × 2 = 5 × 2 × 39
= 10 × 39
= 390

3 A 'doubling and halving' method can make some problems easier to calculate:

362 × 50 = 362 × 100 ÷ 2
= 36 200 ÷ 2
= 18 100

Number sense

Learners should understand *number sense*. Number sense is a term used to describe how well learners can use number properties to solve calculations.

For example, when asked to mentally evaluate 2 × 33 × 50, different learners may suggest different methods, such as:

- 2 × 33 × 50 = 66 × 50 = 66 × 5 × 10 = 66 × 10 × 5 = 660 × 5 = 3300
- 2 × 33 × 50 = 2 × 50 × 33 = 100 × 33 = 3300
- 2 × 33 × 50 = 2 × 50 × (30 + 3) = (100 × 30) + (100 × 3) = 3000 + 300 = 3300

All these methods lead to the correct answer, but some are easier because they use different number facts and strategies.

Learners should be encouraged to explore alternative strategies and share them with others.

Examples

Example 1

Simplify the following to find the answer:

35 × 6 + 18 × 6

Solution

35 × 6 + 18 × 6
= (35 + 18) × 6
= 53 × 6
= 318

Example 2

Simplify the following to find the answer:

50 × 17 × 6

Solution

50 × 17 × 6
= 50 × 6 × 17
= 300 × 17
= 5100

Example 3

Use the doubling and halving technique to find the answer:

48 × 50

Solution

48 × 50
= 48 × 100 ÷ 2
= 4800 ÷ 2
= 2400

1G • Assessment activity

1 Solve the following problems. In each case, show how the problem can be worked out by first rearranging the numbers.

a 5 × 69 × 2 =
b 36 × 4 × 25 =
c 18 × 5 × 20 =
d 50 × 97 × 2 =
e 250 × 19 × 4 =

2 Evaluate the following:

a 7 × 56 + 3 × 56 =
b 41 × 8 + 59 × 8 =
c 29 × 33 − 19 × 33 =
d 5 × 392 − 4 × 392 =
e 6 × 88 + 12 × 6 =

3 Use the 'doubling and halving' method to solve these problems:

a 28 × 50
b 334 × 5
c 500 × 684

4 Bob and Fiona from Tenaru National Secondary School were selling $5 raffle tickets to raise funds for a school trip. Bob sold 53 tickets and Fiona sold 47 tickets. How much did they raise altogether?

Answers 1G

1 a 690
b 3600
c 1800
d 9700
e 19 000

2 a 560
b 800
c 330
d 392
e 600

3 a 28 × 50
= 28 × 100 ÷ 2
= 2800 ÷ 2
= 1400

b 334 × 5
= 334 × 10 ÷ 2
= 3340 ÷ 2
= 1670

c 500 × 684
= 1000 × 684 ÷ 2
= 684 000 ÷ 2
= 342 000

4 $500

1H • Order of operations

LB Pages 18–19

Specific learning outcomes

Learners should be able to:

7.1.8.1 Apply the Order of Operations Rule (BODMAS) when performing number calculations.

Teaching points

1 Learners should be able to use the rule of **BODMAS** to compute and solve number problems.

2 Learners should also be able to apply the rule of BODMAS to real-life situations.

Suggested teaching approach

- Start the chapter section by doing the **Starter activities** provided.
- Read through the **Additional notes** provided below for additional information.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercise 1H** on pages 18–19 in the LB, or **Activity 1H** in the TG below.

Starter activities

Activity 1: What's the rule?

Rather than beginning by explaining the rule, first establish that there is a need for a rule.

1 Ask the learners to evaluate:

  a $2 + 3 \times 5$

  b $2 \times 3 + 5$

  c $2 \times (3 + 5)$

  d $20 - 4 \div 2$

  e $\frac{1}{2}$ of $12 + 8$

2 Write the different answers on the board. For some answers, all learners will agree with the answer. Others may have two possibilities (e.g. the answer to question (e) above could be 14 or 10).

3 Explain that, to avoid mistakes, mathematicians needed to agree on an order of operations. This is why the BODMAS rule was created.

4 Explain the rule, especially for examples such as the following, where the calculations are completed from left to right:

- $16 - 9 + 5 = 12$ and $16 + 9 - 5 = 20$
- $12 \times 3 \div 4 = 9$ and $12 \div 3 \times 4 = 16$

When an addition needs to be done *before* a multiplication, brackets can be used:

- $4 \times (5 + 7)$ or $(6 - 3) \times 7$

Additional notes

Brackets show that the part inside the brackets is worked out first. For example:

$$(42 - 22) \div 4 = 20 \div 4$$
$$= 5$$

When there are no brackets in an expression, multiplication and division are done before addition and subtraction.

Work from left to right, doing × and ÷ first.

Then work from left to right again, this time doing + and –.

The letters of BODMAS summarise the rules for the order of operations:

B Deal with **brackets** first

O Then calculate fractions and powers **of**, e.g. $7^2 = 49$

D
M Do **divisions** and **multiplications**

A
S before **additions** and **subtractions**

Examples

1 $6 + 2 \times 10 = 6 + 20$
$= 26$

× is done before +

2 $10 - 5 + 1 = 5 + 1 = 6$

This only has + and –, so work it out from left to right.

3 Evaluate $400 - 2 \times 5^2$

Do the index first, then ×, then –

$$400 - 2 \times 5^2 = 400 - 2 \times 25$$
$$= 400 - 50$$
$$= 350$$

Common problems or misconceptions about the order of operations

1 Understanding the use of the letter 'O' in the name BODMAS. The 'O' represents the word 'of', as in three-quarters of 12, which is the same as three-quarters multiplied by 12 ($\frac{3}{4} \times 12 =$).

2 Division and multiplication are on the same step of the operations ladder. They are calculated in the order of left to right, unless there are brackets. The brackets are always done first.

Example

In this example, working from left to right, the division is done first:

$15 \div 3 \times 4 = 5 \times 4 = 20$

If 3×4 was done first, it would give a different answer: $15 \div 12 = 1{\cdot}25$. This is incorrect.

However, if brackets are present, the brackets are calculated first. So:

$15 \div (3 \times 4) = 15 \div 12 = 1{\cdot}25$

3 Similarly, addition and subtraction are on the same step of the operations ladder, and so they are calculated from left to right **if** there are no brackets.

Example

$18 - 6 + 4 = 12 + 4 = 16$

(Without brackets, the answer 8 would be incorrect.)

Examples

Use BODMAS to calculate the following.

Example 1

$2 + (4 \times 7) - 3$

Solution

$2 + (4 \times 7) - 3$
$= 2 + 28 - 3$
$= 30 - 3$
$= 27$

Example 2

5 × 7 + (18 ÷ 6) × 5

Solution

5 × 7 + (18 ÷ 6) × 5
= 35 + 3 × 5
= 35 + 15
= 50

Example 3

$\frac{1}{3}$ of 27 × (5 + 2)

Solution

$\frac{1}{3}$ of 27 × (5 + 2)
= 9 × (5 + 2)
= 9 × 7
= 63

Activity 1H

1 Work out these expressions.

- **a** 10 + (3 × 2) =
- **b** (16 – 3) + 5 =
- **c** (5 + 7) ÷ 3 =
- **d** 16 – (4 + 1) =
- **e** (72 ÷ 6) ÷ 3 =
- **f** 72 ÷ (6 ÷ 3) =

2 Insert brackets in the correct places, so that the answer to each of these expressions is 18.

- **a** 6 × 5 – 2 =
- **b** 20 – 8 – 6 =
- **c** 36 ÷ 6 ÷ 3 =

3 Write these statements with brackets and using the symbols +, –, × and ÷ as needed.

- **a** Multiply the result of 3 plus 8 by 2.
- **b** Subtract 10 lots of 5 from 62.

4 Evaluate these expressions.

- **a** 13 – 8 + 2 =
- **b** 48 ÷ 12 × 2 =
- **c** 11 – 1 + 6 – 10 =

5 Use the rules for order of operations to evaluate these equations.

- **a** 6 × 2 ÷ 3
- **b** 14 – 10 ÷ 2
- **c** 10 + 8 × 3
- **d** 8 – 3 + 5
- **e** 12 + 8 ÷ 2
- **f** 4 – 1 × 2 + 3

Answers 1H

1
- **a** 16
- **b** 18
- **c** 4
- **d** 11
- **e** 4
- **f** 36

2
- **a** 6 × (5 – 2)
- **b** 20 – (8 – 6)
- **c** 36 ÷ (6 ÷ 3)

3
- **a** (3 + 8) × 2
- **b** 62 – (10 × 5)

4
- **a** 7
- **b** 8
- **c** 6

5
- **a** 6 × 2 = 12; 12 ÷ 3 = 4
- **b** 10 ÷ 2 = 5; 14 – 5 = 9
- **c** 8 × 3 = 24; 10 + 24 = 34
- **d** 8 – 3 = 5; 5 + 5 = 10
- **e** 8 ÷ 2 = 4; 12 + 4 = 16
- **f** 1 × 2 = 2; 4 – 2 + 3 = 5

1I • Estimation

LB Pages 20–21

Specific learning outcomes

Learners should be able to:

7.1.9.1 Round-off numbers to the nearest ones, tens, hundreds, thousands, etc.

Teaching points

1. Estimation can be done by **rounding numbers** to the closest place value: ones, tens, hundreds, thousands etc.
2. Rounding-off or estimating numbers is determined by the digit to the right of the rounding place value. For example, if you are rounding a number to the nearest hundred, refer to the digit in the tens place.
3. Learners should be encouraged to guess an approximate answer for a question before calculating the correct answer. This habit ensures that their answer is sensible in the context of the question, and encourages them to recalculate when it is not sensible.
4. The purpose of **estimation** is best understood by using real-life examples. Using the example and questions 2 and 3 (LB1, page 20) as a guide, teachers should encourage learners to think of other situations where estimating numbers would be useful.
5. Question 4 (LB1, page 21) could result in a useful whole-class discussion about different strategies to estimate the number of objects in a picture. One method might be to count the actual numbers in a 1 cm vertical strip of the picture, and then multiply by the width of the picture. For the betel nut photo, you might use a grid, counting the number in one square and multiplying by the number of squares.

Suggested teaching approach

- Start the chapter section by doing the **Starter activities** provided.
- Read through the **Additional notes** provided below, for additional information.
- Model the **Examples** provided in the LB and/or TG.
- Learners complete **Exercise 1I** on pages 20–21 in the LB, or **Activity 1I** in the TG below.

Starter activities

Activity 1: Number line

1. Draw a number line on the board from 10 to 20.
2. Ask a learner to mark the position of 16.
   Ask: "Is 16 nearer 10 or 20?"
   It is nearer 20. So when we round 16 to the nearest 10, we make it 20.
3. Check the number line for other values that should also round to 20.
4. Which numbers round to 10?
5. What should we do to round 15 to the nearest 10?
   Numbers that end in 5 are rounded up, so 15 should be rounded up to 20.
6. Repeat the activity with a number line from 40 to 60. Identify examples of numbers that will round to 40, 50 and 60. Discuss the special cases of 45 and 55.
7. Draw a number line from 300 to 400. Repeat the questions for different numbers, this time rounding to the nearest hundred. Note that 351 will round to 400, and 349 will round to 300. What about 350?
8. Ask the learners to write down what they think the rules for rounding are, in their own words. Have some learners read out their rules, and clarify them as necessary.

Additional notes

In some situations it helps to calculate an approximate answer first. This helps with checking calculations and making sure that the exact answer is a sensible one.

Example

A car dealer has six cars on special, all at $8995. Estimate how much money the dealer would make if they sold all the cars.

$8995 is close to $9000

$9000 × 6 = $54 000

Examples

Example 1

On one Sunday at the Kokonut Café down at Point Cruz, many people came for a picnic and decided to buy an ice-cream cone. On that day, 43 people bought an ice-cream cone at $5.00 each. Estimate how much money was raised by selling ice-cream cones.

Solution

43 is approximately equal to 40.

$43 \approx 40$

so $40 \times 5 = 200$

about $200 was raised.

Example 2

Round each number to the nearest multiple of 10 or 100 and then estimate the answer:

25×477

Solution

$\approx 30 \times 500$
$\approx 15\,000$

Activity 1I

1. Round-off the numbers in these problems to the nearest multiple of 10 or 100 and then estimate the result. The first one has been done for you. The symbol ≈ means 'approximately equal to'.
   - **a** $53 + 696 \approx 50 + 700 = 750$
   - **b** $41 + 503$
   - **c** $793 - 58$
   - **d** 49×11
   - **e** $798 \div 10$
   - **f** 102×39
2. Bruce has a budget of $160 to spend on Christmas gifts for his friends and family. He decides to buy each person a $19 DVD. Write down, and then work out, an approximate calculation that shows how many gifts he can buy.

Answers 1I

1 **b** $\approx 40 + 500 = 540$

c $\approx 790 - 60 = 730$

d $\approx 50 \times 10 = 500$

e $\approx 800 \div 10 = 80$

f $\approx 100 \times 40 = 4000$

2 $160 \div 19 \approx 160 \div 20 = 8$; Bruce can buy approximately 8 DVDs

• Chapter Two •

Number Patterns

Overview

Patterns are created when events or objects recur in a predictable manner. Tessellation is a common type of pattern, occurring in both natural and artificial environments. In the Solomon Islands, patterns are all around us, in natural settings and in environments constructed by humans. Patterns can also be seen in our dances, arts and painting, and in many other aspects of our diverse cultures.

Patterns can also exist in numbers. Among the many types of patterns that can be created from numbers are arithmetic sequences, geometric sequences, triangular numbers, square numbers, cube numbers, Fibonacci numbers and others.

In this chapter, learners will explore and investigate different types of number patterns, including arithmetic sequences, multiples, factors, squares and square roots, prime numbers, and odds and evens.

Contents

Chapter skills

This chapter covers the following skills:

- Exploring and comparing number patterns
- Finding factors, common factors and highest common factors of given numbers
- Finding multiples, common multiples and lowest common multiples of given numbers
- Expressing a number as a product of its prime factors
- Revising divisibility tests
- Exploring prime and composite numbers
- Expressing products of factors in index form
- Finding squares and square roots
- Investigating odd and even numbers.

Teaching plan

Lessons	Chapter sections	Class work and home work
1	• Intro • 2A: Exploring number patterns	Learner's Book 1 • Exercise 2A, pages 32–33
2	• 2B: Multiples	Learner's Book 1 • Exercise 2B, page 34
3	• 2C: Factors	Learner's Book 1 • Exercise 2C, page 35
4	• 2D: Divisibility tests	Learner's Book 1 • Exercise 2D, page 36
5	• 2E: Exploring primes and composites	Learner's Book 1 • Learning task 2E, page 37
6	• 2F: Index notation	Learner's Book 1 • Exercise 2F, page 38
7	• 2G: Squares and square roots	Learner's Book 1 • Exercise 2G, page 39
8	• 2H: Prime factors	Learner's Book 1 • Exercise 2H, page 40
9	• 2I: Odds and evens	Learner's Book 1 • Exercise 2I, page 41
10	• Revision/test	Learner's Book 1 • Revision/Assessment, Exercises 2A–2I, pages 48–49 Teacher's Guide • Chapter 2 test, page 161

General learning outcomes

Learners should:

Exploring number patterns

7.2.1 Understand that patterns can be found everywhere: in nature and other objects. Some patterns occur in natural settings. (U)

7.2.2 Know how to use objects and numbers to create patterns. (K)

Multiples and factors

7.2.3 Know how to find multiples, common multiples, lowest and highest common multiples of numbers. (K)

7.2.4 Know how to find factors, common factors, lowest and highest common factors of numbers. (K)

Divisibility test

7.2.5 Know how to apply 'divisibility tests' to numbers to find factors. (K)

Exploring primes and composites

7.2.6 Recognise 'prime numbers' and 'composite numbers' and how to distinguish between them. (S)

Index notation

7.2.7 Understand the make-up of an index notation number, which has a base and a power. (U)

7.2.8 Know that the 'index number' (power) indicates how many times a number is to be multiplied by itself. (K)

7.2.9 Know how to express and evaluate numbers in the index notation. (K)

Squares and square roots

7.2.10 Recognise squares and square roots and how to distinguish between them. (S)

Prime factors

7.2.11 Understand that a composite number can be expressed and written as a product of its prime factors. (U)

Odds and evens

7.2.12 Understand how to determine and identify ‘odd numbers’ and ‘even numbers’. (U)

2A • Exploring number patterns

LB Pages 32–33

Specific learning outcomes:

Learners should be able to:

7.2.1.1 Identify patterns that can be found in natural settings around our environment.

7.2.2.1 Create patterns using sticks, stones and numbers: *rectangles*, *square* and *rectangle* numbers.

7.2.2.2 Identify and complete patterns with numbers and dots, etc.

Teaching points

1 Learners should be able to identify natural patterns that occur in their surroundings and in nature.

2 Learners should appreciate that patterns can be created using stones, sticks and other objects.

3 Patterns can also be created using numbers, such as positive and negative numbers, whole numbers etc.

4 Learners should be able to create their own patterns using numbers.

Suggested teaching approaches

- Start the chapter section by doing the **Starter activities** provided.
- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB or TG.
- Learners complete **Learning tast 2A** on pages 32–33 in the LB, or **Activity 2A** in the TG below.

Starter activities

Activity 1: Patterns in nature

1 Ask learners to form into groups of 3 or 4.

2 Go with the groups around the school compound and surroundings, to find examples of naturally occurring patterns.

3 Each group should bring examples (or a description of the examples) back to the class and get a representative to present the group’s examples in class.

Activity 2: Patterns in our culture

1 Ask learners to identify some of the patterns that are produced by Solomon Islanders through dancing, arts and painting.

2 Learners should present their examples in class.

Additional notes

Numbers can have interesting patterns. Some common **number patterns** are listed here.

An *arithmetic sequence* is made by adding the same value each time.

Example

1, 4, 7, 10, 13, 16, 19, 22, 25, …

In this sequence, the difference between each pair of terms is 3. This means the rule can be written as: ‘We start with 1, and add 3 each time.’

A *geometric sequence* is made by performing the same operation each time.

Examples

1, 2, 4, 8, 16, 32, 64, 128, 256, ...

In this sequence, the number is multiplied by 2 to get the next number.

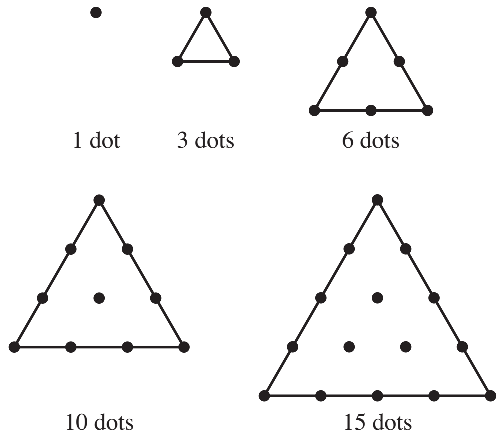
8, 27, 64, 125, 216, 343, 512, 729, ...

In this sequence, the numbers 1, 2, 3 etc. are cubed to get the next number.

0, 1, 1, 2, 3, 5, 8, 13, 21, 34, ...

This is known as a **Fibonacci sequence** – the number is added to the previous number to get the next number.

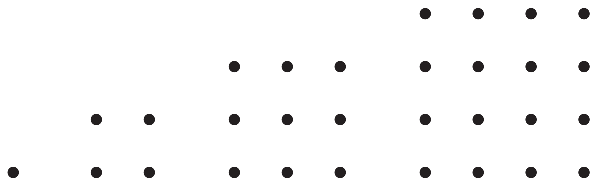
Triangular numbers can be represented as dots in a triangle, as shown below.



Example

1, 3, 6, 10, 15, 21, 28, 36, 45 ….

Square numbers can be represented as dots in square patterns.



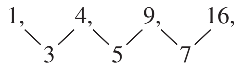
Example

1, 4, 9, 16, 25, 36, 49, 64, 81, ...

Other number patterns include:

- odd and even numbers
- factors of numbers
- multiples of numbers
- primes and products of prime factors.

In this pattern, look at the differences between the numbers:



Examples

Example 1
1, 5, 9, 13, 17, 21, 25, ...

In this sequence, the difference between each number is 4. The pattern is continued by adding 4 to the previous number.

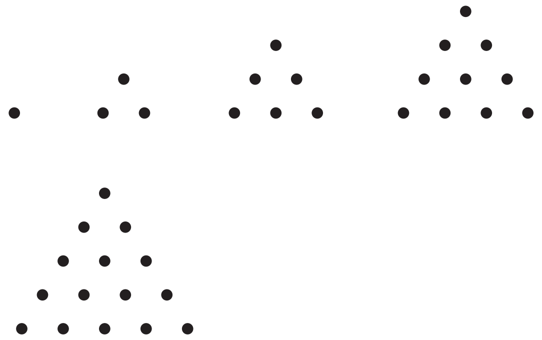
Example 2
3, 8, 13, 18, 23, 28, 33, 38, ...

In this sequence, the difference between each number is 5. The pattern is continued by adding 5 to the previous number.

Activity 2A

1 Write down the next 4 numbers in these number patterns:
  - **a** 1, 6, 11, 16 …
  - **b** 3, 4, 6, 9 …
  - **c** 100, 91, 82, 73 …
  - **d** 2, 5, 10, 17 …

2 **a** Draw the next shape in this pattern of triangles.



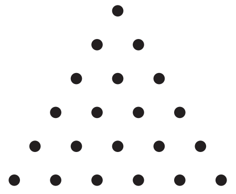
  b Write down the first six terms in the pattern by counting the number of dots in each shape.

3 Find the common difference for the following number patterns:
  - **a** 19, 27, 35, 43, ...
  - **b** 25, 23, 21, 19, 17, 15, ...

Answers 2A

1 **a** 21, 26, 31, 36 **b** 13, 18, 24, 31
  c 64, 55, 46, 37 **d** 26, 37, 50, 65

2 **a**



  b 1, 3, 6, 10, 15, 21

3 **a** The difference between each number is 8.
  b The difference between each number is 2. The pattern is continued by subtracting 2 from the previous number.

2B • Multiples

LB Pages 34–35

Specific learning outcomes

Learners should be able to:

7.2.3.1 Find multiples of numbers and factors by identifying the patterns they created.

7.2.4.1 Find the common multiples, lowest and highest common multiples of given numbers.

Teaching points

1 Patterns can be created by using **multiples** of numbers.

2 Learners should be able to identify common multiples, and the highest and **lowest common multiples** of numbers.

Suggested teaching approach

- Start the chapter section by doing the **Starter activities** provided.
- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB or TG.
- Learners complete **Exercise 2B** on page 34 in the LB, or **Activity 2B** in the TG below.

Starter activities

Activity 1: Revising multiples

Ask the learners to recite the multiplication tables from 2 to 12.

Additional notes

When we multiply a number by 1, 2, 3, 4, 5 etc. we get multiples of that number.

Example Multiples of 6 are 6, 12, 18, 24, 30 …

To find the common multiples of two numbers, write down the multiples of each and look for numbers that are in both lists.

Example

Multiples of 18 = {18, 36, 54, 72, 90 … }

Multiples of 12 = {12, 24, 36, 48, 60, 72, 84 … }

Common multiples of 18 and 12 = {36, 72 …}

The lowest common multiple is 36.

Examples

Example 1
List the multiples of 7 less than 65.

Solution 7, 14, 21, 28, 35, 42, 49, 56, 63

Example 2
Find all the common multiples of 3 and 4 that are less than 35.

Solution

Multiples of 3 less than 35 are:

3, 6, 9, 12, 15, 18, 21, 24, 27, 30, 33

Multiples of 4 less than 35 are:

4, 8, 12, 16, 20, 24, 28, 32

The common multiples of 3 and 4 are 12 and 24.

Example 3

Find the lowest common multiple of 3 and 4.

Solution

Multiples of 3 are:

3, 6, 9, ⑫ 15, 18, 21, 24, 27, 30, 33

Multiples of 4 are:

4, 8, ⑫ 16, 20, 24, 28, 32 …

The lowest common multiple of 3 and 4 is 12.

Activity 2B

1 List the first five multiples of:
  - **a** 8
  - **b** 20

2 Write a sentence to describe the following set of numbers:
4, 8, 12, 16, 20 …

3 List all multiples of 7 between 50 and 100.

4 Write down the first three numbers that are:
  - **a** common multiples of 4 and 6
  - **b** common multiples of 9 and 12.

5 Find the lowest common multiple of:
  - **a** 8 and 10
  - **b** 12 and 15.

6 Denise, Erik and Fred are each checking their mail boxes today. Denise checks her box every 4 days, Erik checks his every 6 days, and Fred checks his every 14 days.
  - **a** In how many days will Denise and Erik both check their boxes on the same day?
  - **b** In how many days will all three check their boxes on the same day?

Answers 2B

1 **a** 8, 16, 24, 32, 40 **b** 20, 40, 60, 80, 100

2 Multiples of 4

3 56, 63, 70, 77, 84, 91, 98

4 **a** 12, 24, 36 **b** 36, 72, 108

5 **a** 40 **b** 60

6 **a** In 12 days **b** In 84 days

2C • Factors

LB Page 35

Specific learning outcomes

Learners should be able to:

7.2.4.1 Find factors of numbers, identifying the patterns they created

7.2.4.2 Find common factors, lowest and highest common factors of given numbers.

Teaching points

1 Learners should be able to identify the factors of a given number – these are numbers that will divide exactly into that number.

2 Learners should be able to find the highest and the lowest factors of any given numbers.

Suggested teaching approach

- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB or TG.
- Learners complete **Exercise 2C** on page 35 in the LB, or **Activity 2C** in the TG below.

Additional notes

The **factors** of a number are all the counting numbers that divide into that number exactly.

Example

The factors of 18 are {1, 2, 3, 6, 9 and 18}.

To find the *common factors* of two numbers, write down the factors of each, then look for numbers that are in both lists.

Example

Factors of 24 = {**1**, **2**, 3, **4**, 6, **8**, 12, 24}

Factors of 16 = {**1**, **2**, **4**, **8**, 16}

Common factors of 24 and 16 = {1, 2, 4, 8}

The highest common factor is 8.

Activity 2C

1 List all the factors for each of these numbers:
  - **a** 8
  - **b** 15
  - **c** 24
  - **d** 11

2 Which number is a factor of every counting number?

3 Explain why 99 gold coins cannot be shared equally between 7 people.

4 One way of writing 72 as a product is 1 × 72.
  - **a** Write down five other ways.
  - **b** How many factors does 72 have?

5 Find all the common factors of 18 and 45.

6 Find the highest common factor of:
  - **a** 4 and 6
  - **b** 64 and 27

Answers 2C

1 **a** {1, 2, 4, 8} **b** {1, 3, 5, 15}
c {1, 2, 3, 4, 6, 8, 12, 24} **d** {1, 11}

2 1

3 99 is not a multiple of 7

4 **a** 2 × 36, 3 × 24, 4 × 18, 6 × 12, 8 × 9
b 12

5 1, 3, 9

6 **a** 2 **b** 1

2D • Divisibility tests

LB Page 36

Specific learning outcomes

Learners should be able to:

7.2.5.1 Identify and find other factors with no remainders, using the 'Divisibility Test'.

Teaching points

The **divisibility rules** can be used to test for the factors of given numbers. Learners should be able to identify these rules (listed on page 36 of the LB).

Suggested teaching approach

- Read through the **Additional notes** provided below for additional information.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercise 2D** on page 36 in the LB, or **Activity 2D** in the TG below.

Additional notes

The rules for checking whether certain numbers can be divided by small numbers (such as 2, 3, 4, 5) are known as the **divisibility rules**.

Example

A number can be divided by 4 if the last two digits can be divided by 4.

1732 is divisible by 4 because the last two digits are 32, which can be divided by 4 exactly.

35 561 is not divisible by 4.

Activity 2D

1 Are these numbers divisible by 4? Write 'yes' or 'no':

a 339 **b** 561 128

c 8034 **d** 19 996

2 Complete this rule for testing divisibility by 2:

'A number is divisible by 2 if it ends in __, __, __, __ or __.'

3 Write down in your own words a rule for checking divisibility by 5.

4 The rule for divisibility of a number by 9 is: 'The sum of all the digits must be divisible by 9'. Show your working and explain briefly why 7155 is divisible by 9.

5 Write down the smallest number over 8000 that is divisible by:

a 4 **b** 9

Additional activity

6 Ask learners to find examples of the various divisibility tests and where they are useful. They could prepare a slide show of their findings to present to the class.

Answers 2D

1 **a** no **b** yes

c no **d** yes

2 0, 2, 4, 6 or 8

3 A number is divisible by 5 if it ends in 0 or 5.

4 7 + 1 + 5 + 5 = 18; 18 ÷ 9 = 2 no remainder

5 **a** 8004 **b** 8001

6 Learner activity

2E • Exploring primes and composites

LB Page 37

Specific learning outcomes

Learners should be able to:

7.2.6.1 Define prime and composite numbers.

7.2.6.2 Identify prime and composite numbers.

7.2.6.3 Solve prime and composite number problems.

Teaching points

1 A **prime number** is a positive whole number that has exactly two factors: itself and one.

Example 37 = 1 × 37.

The number 1 is **not** prime, as it has only one factor.

2 A **composite number** is a positive whole number that has more than two factors – that is, it is not a prime number.

Example 36 = 1 × 36, 2 × 18, 3 × 12, 4 × 9, 6 × 6.

Suggested teaching approach

- Read through the **Additional notes** provided below for additional information.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Learning task 2E** on page 37 in the LB, or **Activity 2E** in the TG below.

Additional notes

A prime number is a number that has exactly two factors. It can only be divided by 1 and itself.

Example

7 is prime (only two factors: 1 and 7)

A composite number has more than two factors.

Example

15 is composite (15 is divisible by 1, 3, 5 and 15).

Activity 2E

1 The table below shows all the numbers from 1 to 50.

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50

  a Cross out 1. (1 is not a prime number.)
  b Cross out all numbers divisible by 2 (except 2).
  c Cross out all numbers divisible by 3 (except 3).
  d Cross out all numbers divisible by 5 (except 5).
  e Cross out all numbers divisible by 7 (except 7).
  f Explain why you did not have to cross out numbers divisible by 4 and 6.

2 Write down the first prime number larger than 50.

3 Explain why 1 is not a prime number.

4 There is one composite number in this list: 37, 5, 67, 91.
  a Write down the composite number.
  b Explain why it is a composite number.

Answers 2E

1

~~1~~	2	3	~~4~~	5	~~6~~	7	~~8~~	~~9~~	~~10~~
11	~~12~~	13	~~14~~	~~15~~	~~16~~	17	~~18~~	19	~~20~~
~~21~~	~~22~~	23	~~24~~	~~25~~	~~26~~	~~27~~	~~28~~	29	~~30~~
31	~~32~~	~~33~~	~~34~~	~~35~~	~~36~~	37	~~38~~	~~39~~	~~40~~
41	~~42~~	43	~~44~~	~~45~~	~~46~~	47	~~48~~	~~49~~	~~50~~

2 53

3 1 only has one factor. A prime number has two factors.

4 **a** 91
  b 91 has four factors: 1 × 91 and 7 × 13

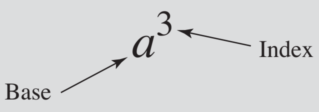
2F • Index notation

LB Page 38

Specific learning outcomes

Learners should be able to:

7.2.7.1 Identify parts of an index number:



7.2.8.1 Identify the 'index number or power', and its purpose or function. *'Index number or power' indicates how many times a number is multiplied by itself.*

7.2.9.1 Express numbers in 'index notation'.

7.2.9.2 Evaluate index number problems using the BODMAS rule.

Teaching points

1 **Index notation** is used when a number is multiplied by itself two or more times.

2 The **index** or **power** tells us how many times the number must be multiplied by itself.

3 Learners should be able to identify the parts of a number written in index notation: base and index.

4 Learners should be able to write numbers using index notation.

5 Learners should be able to evaluate index numbers using the BODMAS rule.

Suggested teaching approach

- Go through the **Learner difficulties** with **corresponding remedies** before starting the chapter sections.
- Read through the **Additional notes** provided below for additional information.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercise 2F** on page 38 in the LB, or **Activity 2F** in the TG below.

Additional notes

The power or index shows the repeated multiplication of the same number.

Example

7 × 7 × 7 can be written as 7^3.

7 is the base, and 3 is the index.

In this example, its value is 343.

We can extend our shorthand for square numbers and cube numbers to write other large numbers produced by repeated multiplication, by continuing a pattern.

Example

If: $3^2 = 3 \times 3$ (= 9)
and: $3^3 = 3 \times 3 \times 3$ (= 27)
then: $3^4 = 3 \times 3 \times 3 \times 3$ (= 81)
$3^5 = 3 \times 3 \times 3 \times 3 \times 3$ (= 243)

This shorthand notation is called index form. The number being multiplied repeatedly is called the **base**. The number written up high to the right of the base is called the **power**, or **index**. (The plural of index is *indices*.) The index shows how many times the base will appear when written in expanded form (that is, written as a series of multiplications).

Example

Index form: 5^4

This is pronounced '5 to the power of four', or '5 to the fourth' or 'base 5, index 4'.

Expanded form: 5 × 5 × 5 × 5

The value of 5^4 is 625.

Any number to the power of 1 is itself. For example, $5^1 = 5$.

Examples

Example 1

Write 4^3 in expanded form, then find its value.

Solution

1. Identify the base and the index.
   base is 4, index is 3
2. Multiply the base by itself according to what the index is.
   $4 \times 4 \times 4$
3. Perform the multiplication.
   $= 64$

Example 2

Write 8^5 in expanded form, then find its value.

Solution

1. Identify the base and the index.
   base is 8, index is 5
2. Multiply the base by itself according to what the index is.
   $8 \times 8 \times 8 \times 8 \times 8$
3. Perform the multiplication
   $= 32768$

Activity 2F

1 Write these expressions in index form:

a $5 \times 5 \times 5 \times 5$ **b** $67 \times 67 \times 67$

2 Write these expressions in full, using multiplication signs:

a 8^2 **b** 9^6

3 Work out the value:

a 2^5 **b** 6^3

4 State whether the following are true or false:

a $3^2 = 2^3$ **b** $5^2 = 4^2 + 3^2$

Answers 2F

1 **a** 5^4 **b** 67^3

2 **a** 8×8 **b** $9 \times 9 \times 9 \times 9 \times 9 \times 9$

3 **a** 32 **b** 216

4 **a** false **b** true

2G • Squares and square roots

LB Page 39

Specific learning outcomes

Learners should be able to:

7.2.10.1 Define 'square' and 'square root'.
7.2.10.2 Evaluate numbers by squaring them.
7.2.10.3 Evaluate numbers by taking their square roots.

Teaching points

1. When a number is multiplied by itself or raised to the power of 2, the number is said to be **squared**.
2. Finding the **square root** of a number is the opposite of squaring – you are finding the number that is being squared or multiplied by itself. This gives the number under the 'square root' sign.
3. Learners should be able to square numbers.
4. Learners should be able to find the square root of numbers.

Suggested teaching approach

- Read through the **Additional notes** provided below for additional information.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercise 2G** on page 39 in the LB, or **Activity 2G** in the TG below.

Additional notes

Squaring a number

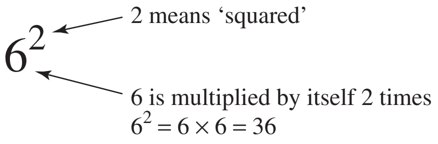
To square a number, multiply the number by itself.

Example

To square 4, you have to multiply 4 by itself:

$4^2 = 4 \times 4$
$= 16$

The little 2 means 'squared'.



Squaring a number is also known as **raising a number to the power of 2**.

Example

$11^2 = 11 \times 11 = 121$

11 to the power of 2 equals 121.

Finding the square root of a number

To find the square root of a number, go the opposite way compared to squaring the number.

Example

$3^2 = 9$, or 3 squared is 9.

The square root of 9 is 3.

$$\begin{tikzcd} 3 \arrow[r, shift left, "\text{square}"] & 9 \arrow[l, shift left, "\text{square root}"] \end{tikzcd}$$

Remember: 'square root' is the opposite of 'square'.

When you find the square root of a number, you are finding the number that was multiplied by itself to give the first number.

The square root of 9 is 3, which means that 3 is the number that was squared, or multiplied by itself, to equal 9.

The square root symbol is:

$\sqrt{\ }$

As you can see, this symbol looks similar to a tick. It is used like this:

$\sqrt{9} = 3$

When reading this, you would say: 'The square root of 9 equals 3.'

Example

$\sqrt{36} = 6$ (because $6^2 = 36$)

Most calculators have a square root key.

$\boxed{\sqrt{\ }}$

Use this for finding the square root of more difficult numbers.

Example

$\sqrt{571{\cdot}21} = 23{\cdot}9$

Activity 2G

1 Work out these squares:
  - **a** 6^2
  - **b** 12^2
  - **c** 8^2

2 Which two numbers when squared are equal to themselves?

3 Work out these square roots without using a calculator:
  - **a** $\sqrt{25}$
  - **b** $\sqrt{100}$
  - **c** $\sqrt{81}$

4 Use a calculator to evaluate these squares:
  - **a** 25^2
  - **b** 45^2
  - **c** 112^2
  - **d** 373^2

5 Which number other than zero has a square root equal to itself?

Answers 2G

1 **a** 36
  - **b** 144
  - **c** 64

2 0 and 1

3 **a** 5
  - **b** 10
  - **c** 9

4 **a** 625
  - **b** 2025
  - **c** 12 544
  - **d** 139 129

5 1

2H • Prime factors

LB Page 40

Specific learning outcomes

Learners should be able to:

7.2.11.1	Define 'prime factors'.
7.2.11.2	Write composite numbers as products of their prime factors.
7.2.11.3	Construct a factor tree to express a composite number as a product of its prime factors.

Teaching points

1 A **prime factor** is a factor of a positive whole number that is a prime number. For example, 2 × 3 = 6. Both 2 and 3 are prime factors of 6.

2 Learners should be able to write numbers as the product of their prime factors.

3 Learners should be able to use a factor tree to write a composite number as a product of its prime factors.

Suggested teaching approach

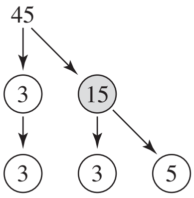
- Read through the **Additional notes** provided below for additional information.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercise 2H** on page 40 in the LB, or **Activity 2H** in the TG below.

Additional notes

Every composite number can be written as a product of prime numbers. A *factor tree* shows how.

Example

Write 45 as a product of prime factors.



$45 = 3 \times 3 \times 5$

Examples

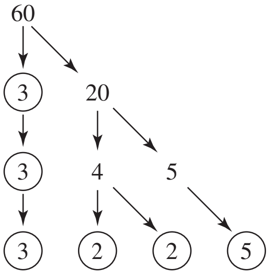
Example

Write 60 as a product of its prime factors.

Solution

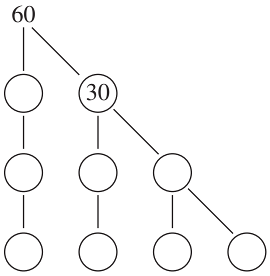
$60 = 2 \times 2 \times 3 \times 5$

$= 2^2 \times 3 \times 5$



Activity 2H

1 Complete this factor tree and write the result underneath it.

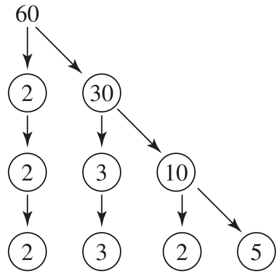


60 = ____ × ____ × ____ × ____

2 Write each of these numbers as a product of prime factors:
  - **a** 24
  - **b** 400
  - **c** 50
  - **d** 98
  - **e** 120
  - **f** 57

Answers 2H

1 There is more than one solution.
Example:



60 = 2 × 2 × 3 × 5

2 **a** $2^3 \times 3$
b $2^4 \times 5^2$
c 2×5^2
d 2×7^2
e $2^3 \times 3 \times 5$
f 3×19

2I • Odds and evens

LB Page 41

Specific learning outcomes

Learners should be able to:

7.2.12.1 Define ‘odd’ and ‘even’ numbers.
7.2.12.2 Identify and list odd and even numbers, and solve odd and even number problems.

Teaching points

1 An **odd number** is a number that cannot be divided exactly by 2 (1, 3, 5, 7 etc.).

2 An **even number** is a number that can be divided exactly by 2 (2, 4, 6, 8 etc.).

Suggested teaching approach

- Read through the **Additional notes** provided below for additional information.
- Model the **Examples** provided in the LB.
- Learners complete **Exercise 2I** on page 41 in the LB, or **Activity 2I** in the TG below.

Additional notes

Even numbers are divisible by 2: 2, 4, 6, 8, 10 …

Odd numbers cannot be divided exactly by 2: 1, 3, 5, 7, 8, 11 …

Activity 2I

1 How many odd numbers are there between 64 and 72?

2 List three consecutive even numbers that add to 18.

3 Complete the tables below to show what happens when pairs of odd and/or even numbers are added, subtracted or multiplied.

+	Odd	Even
Odd	Even	
Even		

–	Odd	Even
Odd		
Even		

×	Odd	Even
Odd	Odd	
Even		

Answers 2I

1 4

2 4 + 6 + 8 = 18

3

+	Odd	Even
Odd	Even	Odd
Even	Odd	Even

–	Odd	Even
Odd	Even	Odd
Even	Odd	Even

×	Odd	Even
Odd	Odd	Even
Even	Even	Even

• Chapter Three •

Decimals and Percentages

Overview

Learners were introduced to this topic in Year 6, and a little in Chapter 1, by understanding and knowing the importance of place-value notation and decimals. In this chapter they will develop new concepts and build their knowledge, through understanding that decimal numbers are generally smaller blocks of numbers that add together to make whole numbers.

Learners will revise their knowledge of the four operations by applying them to decimals, in the context of everyday situations in the Solomon Islands. They will also learn to associate decimals and percentages.

Learners will develop confidence in converting fractions to decimals and vice versa, and will learn that both fractions and decimals can be converted to percentages. Understanding that percentages are 'special' fractions that always have 100 as the denominator will help learners to solve practical problems in real life.

Contents

Chapter skills

This chapter covers the following skills:

- Revising place value, notation and estimation of decimals
- Comparing decimals
- Rounding decimals
- Addition, subtraction, multiplication and division
- Comparing decimals to fractions and percentages
- Finding the percentage of a number
- Multiplying and dividing by powers of 10
- Calculating percentages

Teaching plan

Lessons	Chapter sections	Class work and home work
1	• Intro • 3A: Place value and notations	Learner's Book 1 • Exercise 3A, pages 52–53
2	• 3B: Estimations of decimals	Learner's Book 1 • Exercise 3B, pages 54
3	• 3C: Rounding decimals	Learner's Book 1 • Exercise 3C, page 55
5–6	• 3D: Adding decimals	Learner's Book 1 • Exercise 3D, pages 56–57
7	• 3E: Subtracting decimals	Learner's Book 1 • Exercise 3E, pages 58–59
8	• 3F: Multiplying decimals	Learner's Book 1 • Exercise 3F, pages 60–61
9–10	• 3G: Dividing by whole numbers	Learner's Book 1 • Exercise 3G, page 62
11	• 3H: Dividing by decimals	Learner's Book 1 • Exercise 3H, page 63
12	• 3I: Exploring powers of 10	Learner's Book 1 • Learning Task 3I, pages 64–65
13	• 3J: Fractions and decimals	Learner's Book 1 • Exercise 3J, pages 66–67
13	• 3K: Converting decimals to fractions	Learner's Book 1 • Exercise 3K, page 68
14	• 3L: Percentages	Learner's Book 1 • Exercise 3L, page 69
14	• 3M: Finding percentages of quantities	Learner's Book 1 • Exercise 3M, page 70
14	• 3N: Calculating percentages	Learner's Book 1 • Exercise 3N, page 71
15	• Revision/Test	Learner's Book 1 • Revision/Assessment, Exercises 3A, 3C–3N, pages 78–79 Teacher's Guide • Chapter 3 test, page 163

General learning outcomes

Learners should:

Place value and notation

7.3.1 Understand that digits in numbers, whole numbers and decimal numbers hold different values which are determined by their position in a given number. (U)

7.3.2 Know that decimal numbers are numbers that are smaller than one (1) and are placed after the decimal point, to the right. (K)

7.3.3 Know how to determine the values of individual digits in given numbers (K).

Estimation and rounding-off decimal numbers

7.3.4 Know how to estimate decimal numbers and evaluate them using the four operations: +, −, ×, ÷. (K)

7.3.5 Know how to round-off decimal numbers to any given specified limit. (K)

Adding and subtracting decimals

7.3.6 Know how to add and subtract decimal numbers. (K)

Multiplication and division of decimal numbers

7.3.7 Know how to multiply and divide decimal numbers. (K)

Exploring powers of 10

7.3.8 Understand how decimal numbers are multiplied and divided by 10 and powers of 10. (U)

Fractions and decimals

7.3.9 Know how to change fractions to decimals. (K)

Converting decimals to fractions

7.3.10 Know how to convert decimals to fractions. (K)

Percentages

7.3.11 Understand that ‘percentage’ is a term given to describe a special fraction, where the denominator is and must always be 100. (U)

7.3.12 Know how to convert percentages to fractions and vice versa. (K)

Finding percentages of quantities

7.3.13 Know how to find percentages of quantities. (K)

Calculating percentages

7.3.14 Know how to use percentages to solve and evaluate problems involving percentages. (K)

3A • Place value and notations

LB Pages 52–53

Specific learning outcomes

Learners should be able to:

7.3.1.1 Identify the different names given to different columns of the place-value table with their corresponding values.

7.3.2.1 Identify decimal numbers and place them accordingly into the place-value table.

7.3.3.1 Determine values of individual digits in numbers and compare their values.

Teaching points

1 By now, learners should be confident in identifying the names of different values in the place-value table.

2 Learners should be aware that values differ depending on where a digit is placed.

3 Learners should understand that decimals are used for numbers that are smaller than one, and for numbers that are in between whole numbers.

4 A decimal point separates a whole number from parts of a whole number.

Suggested teaching approach

- Start the chapter section by doing the **Starter activities** provided.
- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercise 3A** on pages 52–53 in the LB, or **Activity 3A** in the TG below.

Starter activities

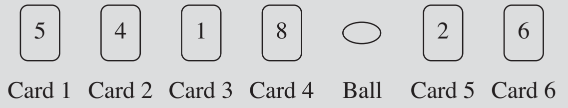
Activity 1: Number cards

Learners stand in front of the class, representing various numbers.

1 Paste number cards on the shirts of learners.

2 Line up the learners according to the place-value table.

For example:



3 The decimal point is represented by any round object, such as a ball, a coconut or a lemon. To begin with, place it between Card 4 and Card 5, depending on where you wish to start.

4 Ask learners to identify which place value each number on the card represents. The answer in the example above is: 5 – thousands, 4 – hundreds, 1 – tens, 8 – ones/units, decimal point, 2 – tenths, 6 – hundredths.

5 Move the ball randomly between any two numbers.

6 Ask learners to identify which place value each number on the card now represents.

7 Repeat steps 5 and 6.

Additional notes

Place value can also be used for numbers smaller than 1. A decimal point is used to separate the whole number part from the fraction part.

Example

607·85 = 6 hundreds *plus* no tens plus 7 units *plus* 8 tenths *plus* 5 hundredths

The place value of the 8 in this number is 8 tenths.

This can be shown in a place-value table:

Hundreds	Tens	Units	·	Tenths	Hundredths	Thousandths
6	0	7	·	8	5	

Examples

Numbers can be placed in the place-value table, with the following place values:

Thousands	Hundreds	Tens	Ones/units	·	Tenths	Hundredths	Thousandths

Example 1

The number 78·95 can be placed in the place-value table with each digit in its correct place-value column, where 7 represents tens, 8 represents ones/units, 9 represents tenths and 5 represents hundredths.

Hundreds	Tens	Units	·	Tenths	Hundredths
	7	8	·	9	5

Activity 3A

1 What is the place value of the digit 9 in each of these numbers?

a 90·41

b 0·97

c 69·003

d 5·091

e 0·009

2 Place the digits of these numbers into the correct place-value columns:

	Thousands	Hundreds	Tens	Units	·	Tenths	Hundredths
63·1							
510·91							
4000·2							
0·07							
31·59							

3 Write these numbers as decimals:
- **a** five tens, no units and four tenths
- **b** 9 units, 3 tenths and 9 hundredths
- **c** 6 thousands, no hundreds, 3 tens, 4 units and 1 tenth
- **d** three hundreds and two tenths
- **e** five thousandths

4 Circle the larger number of each of these pairs:
- **a** 0·8, 0·78
- **b** 12·8, 11·13
- **c** 0·987, 1·2
- **d** 16, 17·001

Challenge questions

5 Learners should work in pairs to do this challenge.

A teacher handed out 5 envelopes to 5 students at random:

Envelope 1 contained $828.20
Envelope 2 contained $8.28
Envelope 3 contained $82.28
Envelope 4 contained $0.82
Envelope 5 contained $0.08

Arrange the envelopes in order from the smallest value to the largest. Do this by filling in the table below.

Thousands	Hundreds	Tens	Ones/Units	·	Tenths	Hundredths
Smallest						
Largest						

6 The Social Science teacher at a college collected data for every rainfall in the first six months of the year. These are the totals:

Month	Reading
January	432·19 ml
February	489·34 ml
March	619·54 ml
April	139·20 ml
May	89·69 ml
June	217·38 ml

- **a** In which month was the highest rainfall measured?
- **b** In which month was the lowest rainfall measured?
- **c** Arrange the readings in descending order (from highest to lowest).
- **d** Write in words the reading for the month of March.

Answers 3A

1
- **a** tens
- **b** tenths
- **c** ones
- **d** hundredths
- **e** thousandths

2

	Thousands	Hundreds	Tens	Units	·	Tenths	Hundredths
63·1			6	3	·	1	
510·91		5	1	0	·	9	1
4000·2	4	0	0	0	·	2	
0·07				0	·	0	7
31·59			3	1	·	5	9

3
- **a** 50·4
- **b** 9·39
- **c** 6034·1
- **d** 300·2
- **e** 0·005

4
- **a** 0·8
- **b** 12·8
- **c** 1·2
- **d** 17·001

5

Thousands	Hundreds	Tens	Ones/Units	·	Tenths	Hundredths
Smallest						
			0	·	0	8
			0	·	8	2
			8	·	2	8
		8	2	·	2	8
	8	2	8	·	2	0
Largest						

6
- **a** March
- **b** May
- **c** 619·54 ml, 489·34 ml, 432·19 ml, 217·38 ml, 139·20 ml, 89·68 ml
- **d** six hundred and nineteen point five four

3B&C • Estimating and rounding decimals

LB Pages 54–55

Specific learning outcomes

Learners should be able to:

7.3.4.1 Estimate decimal numbers by rounding them off to given decimal places.

7.3.5.1 Round off decimal numbers to the nearest specified decimal place(s).

Teaching points

1 Learners should be able to estimate figures and know that estimated figures are not actual figures.

2 To estimate an appropriate answer, we need to round off numerals.

3 Learners should understand that the symbol (≈) represents 'approximately equal to'.

4 Learners need to understand that estimation of decimals is linked with rounding off.

Suggested teaching approach

- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercises 3B and 3C** on pages 54–55 in the LB, or **Activity 3B&C** in the TG below.

Additional notes

The numbers in a question can sometimes be rounded, so an approximate answer can be found.

Examples

48·7 × 2·056 ≈ 50 × 2 = 100
(exact answer using a calculator: 100·1272)

7·88 – 0·931 ≈ 8 – 1 = 7
(exact answer using a calculator: 6·949)

Decide how many decimal places (dp) you are rounding to.

- If the next digit is 5, 6, 7, 8, 9 – round up.
- If the next digit is 0, 1, 2, 3, 4 – round down.

Examples

Round 41·183 to 1 dp:

41·183 = 41·2

Round 56·4347 to 2 dp:

56·4347 = 56·43

Examples

Example 1
Round the following decimal to the number of places indicated in the brackets.

23·45637 (2 dp)

Solution

23·45637 (2 dp) = 23·46

Example 2
Round the following decimal to the number of places indicated in the brackets.

123·5467 (2 dp)

Solution

123·5467 (2 dp) = 123·55

Activity 3B&C

1 Complete this table:

Question	Estimated answer	Actual answer
49·11 + 5·1		
13·98 + 1·9		
1·88 – 0·93		
6·07 × 5·97		

2 Bruce counted 18 cars travelling on the road past his school in 3 minutes. Estimate the number of cars travelling past his school in 2 hours. Give your answer to the nearest hundred.

3 Round these numbers to 1 dp:

a 5·78 **b** 13·148

c 0·49 **d** 42·55

4 Round these numbers to 3 dp:

a 3·62849 **b** 0·1722

5 Solve the following:

a 0·53 × 31·88 (2dp) **b** 0·002 × 3 (2dp)

6 Three people buy a 20 kg bag of potatoes at the Honiara Central Market and share it equally among themselves. How much does each person receive? Round your answer sensibly.

Answers 3B&C

1

Question	Estimated answer	Actual answer
49·11 + 5·1	50 + 5 = 55	54·21
13·98 + 1·9	14 + 2 = 16	15·88
1·88 – 0·93	2 – 1 = 1	0·95
6·07 × 5·97	6 × 6 = 36	36·2379

2 2 hours = 120 mins; 120 ÷ 3 = 40; 40 × 18 ≈ 40 × 20 = 800

3 **a** 5·8 **b** 13·1

c 0·5 **d** 42·6

4 **a** 3·628 **b** 0·172

5 **a** 16·90 **b** 0·01

6 20 ÷ 3 = 6·6666… ≈ 6·7 kg each

3D&E • Adding and subtracting decimals

LB Pages 56–59

Specific learning outcomes

Learners should be able to:

7.3.6.1 Add and subtract decimal numbers by placing digits in their right places.

7.3.6.2 Solve practical decimal problems.

Teaching points

1 Learners should remember, from Grade 6, the concepts of adding and subtracting decimals.

2 Help learners to revise the steps they should follow when adding or subtracting decimals:

Step 1: Line up the decimal points under each other.

Step 2: Place the numbers according to their place values. For whole numbers, put the decimal point at the end.

Step 3: If there is a space, fill it with a zero.

Step 4: Add or subtract the numbers (see the examples and solutions on pages 56 and 58 of the LB).

3 Learners need to understand that in order to easily calculate decimals, their work needs to be neat and orderly.

4 Learners need to know how to place numbers according to their place value.

5 Addition and subtraction of decimals is useful in practical applications. Many application questions are included in the exercises. It is advisable for teachers to use and apply these in math decimal classes.

Suggested teaching approach

- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercises 3D and 3E** on pages 56 and 58 of the LB, or **Activity 3D&E** in the TG below.

Additional notes

Addition of decimals

Addition problems are set out so that the decimal points in the question and the answer line up vertically.

Example 1

4·78 + 6·51:

$$\begin{array}{r} 4{\cdot}78 \\ +\ \ 6{\cdot}51 \\ \hline 11{\cdot}29 \\ \hline \end{array}$$

Example 2

1·9 + 0·27:

$$\begin{array}{r} 1{\cdot}9\ \ \\ +\ 0{\cdot}27 \\ \hline 2{\cdot}17 \\ \hline \end{array}$$

Subtraction of decimals

As for addition, the decimal points should line up, and all digits should be in their correct place-value column. Empty decimal places can be filled with zeroes.

Example

Work out 5 – 3·71:

$$\begin{array}{r} 5{\cdot}00 \\ -\ 3{\cdot}71 \\ \hline 1{\cdot}29 \\ \hline \end{array}$$

Examples

Example 1
Add these decimals:

624·13 + 3·75

Solution

$$\begin{array}{r} 624{\cdot}13 \\ +\ \ \ \ 3{\cdot}75 \\ \hline 627{\cdot}88 \\ \hline \end{array}$$

Example 2
Add these decimals:

16·394 + 1·56 + 27·8

Solution

$$\begin{array}{r} 16{\cdot}394 \\ 1{\cdot}560 \\ +\ 27{\cdot}800 \\ \hline 45{\cdot}754 \\ \hline \end{array}$$

Example 3
Subtract these decimals:

59·86 – 3·61

Solution

$$\begin{array}{r} 59{\cdot}86 \\ -\ \ \ 3{\cdot}61 \\ \hline 56{\cdot}25 \\ \hline \end{array}$$

Example 4
Subtract these decimals:

34·37 – 7·825

Solution

$$\begin{array}{r} 34{\cdot}370 \\ -\ \ \ 7{\cdot}825 \\ \hline 26{\cdot}545 \\ \hline \end{array}$$

Activity 3D&E

1 Add these decimals. In each case, set out the sum so that the decimal points are in line:

a 1·2 + 4·4 **b** 0·8 + 0·9

c 4·71 + 10·3 **d** 5·83 + 0·014

2 The price of a movie ticket has increased by $2.50. It used to cost $9.75. What does it cost now?

3 Subtract these decimals. In each case, set out the sum so that the decimal points are in line:

a 0·78 – 0·53 b 15·31 – 1·96

c 1·8 – 0·05 d 0·4 – 0·12

4 The normal human body temperature is 36·4°C. If a person has a fever, their temperature can increase by up to 2·3°C. What would be their temperature then?

5 The record for the 100 m sprint in the Solomon Islands Secondary School Athletic Competition used to be 11·92 seconds. It was recently reduced by 0·55 seconds. What is it now?

6 A bottle containing 1·25 litres leaks and loses 0·4 litre. How much is left in the bottle?

7 Kata is 6·7 cm shorter than Matangi, whose height is 161·5 cm. How tall is Kata?

Answers 3D&E

1 a

$$\begin{array}{r} 1{\cdot}2 \\ +\ 4{\cdot}4 \\ \hline 5{\cdot}6 \\ \hline \end{array}$$

b

$$\begin{array}{r} \overset{1}{0}{\cdot}8 \\ +\ 0{\cdot}9 \\ \hline 1{\cdot}7 \\ \hline \end{array}$$

c

$$\begin{array}{r} \overset{1}{4}{\cdot}71 \\ +\ 10{\cdot}30 \\ \hline 15{\cdot}01 \\ \hline \end{array}$$

d

$$\begin{array}{r} 5{\cdot}830 \\ +\ 0{\cdot}014 \\ \hline 5{\cdot}844 \\ \hline \end{array}$$

2 The price of a movie ticket is now $12·25

3 a

$$\begin{array}{r} 0{\cdot}78 \\ -\ 0{\cdot}53 \\ \hline 0{\cdot}25 \\ \hline \end{array}$$

b

$$\begin{array}{r} 1\overset{4}{\cancel{5}}{\cdot}\overset{12}{\cancel{3}}\overset{11}{\cancel{1}} \\ -\ \ 1{\cdot}96 \\ \hline 13{\cdot}35 \\ \hline \end{array}$$

c

$$\begin{array}{r} 1{\cdot}\overset{7}{\cancel{8}}\overset{10}{\cancel{0}} \\ -\ 0{\cdot}05 \\ \hline 1{\cdot}75 \\ \hline \end{array}$$

d

$$\begin{array}{r} 0{\cdot}\overset{3}{\cancel{4}}\overset{10}{\cancel{0}} \\ -\ 0{\cdot}12 \\ \hline 0{\cdot}28 \\ \hline \end{array}$$

4 38·7°C

5 11·37 seconds

6 0·85 litres

7 154·8 cm

3F,G&H • Multiplying and dividing decimals

LB Pages 60–63

Specific learning outcomes

Learners should be able to:

7.3.7.1 Evaluate decimal numbers by multiplying and dividing decimal numbers by:

- whole numbers
- decimal numbers.

Teaching points

Multiplying decimals

1. Do a quick revision of multiplication of whole numbers.
2. Learners can use the skills learned in Chapter 1 to multiply **decimal** numbers.
3. Learners need to confidently multiply decimal numbers without being confused about where the decimal should be placed in the set of numbers. Focus the learners on the decimal point, which is included in whole numbers to make them decimal numbers.
4. Stress to learners that, when multiplying decimal numbers, the placing of the decimal point will depend on the number of decimal places given in the question.

Dividing decimals by whole numbers

1. Before starting this section, learners should be confident in dividing whole numbers.
2. Divide using the long division method. Revise quickly on division of whole numbers using the long division method.
3. Learners can use the skills learned in Chapter 1 to divide decimal numbers.
4. When dividing, decimal points are placed directly in line with the decimal of the number in the question.
5. Learners need to identify whether the question is asking them to divide a decimal by a decimal or by a whole number. If dividing by a decimal, then they should convert the divisor (the number being divided by) to a whole number before attempting the question.

Dividing by decimals

Stress to learners that, when dividing by decimals, they should always make the divisor a whole number.

Suggested teaching approach

- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB and the TG.
- Learners complete **Exercises 3F, G and H** on pages 60–63 in the LB, or **Activity 3F,G&H** in the TG below.

Additional notes

Multiplying a decimal number by a decimal number

The number of digits after the decimal point in the answer should be the same as the sum of the number of digits after the decimal point in the numbers being multiplied.

Examples

(These do not need working.)

$0{\cdot}5 \times 0{\cdot}7 = 0{\cdot}35$

$0{\cdot}4 \times 0{\cdot}15 = 0{\cdot}060 = 0{\cdot}06$

An example that needs to be set out as a multiplication problem is:

$73{\cdot}52 \times 4$

$$\begin{array}{r} 73{\cdot}52 \\ \times \quad 4 \\ \hline 294{\cdot}08 \end{array}$$

Note that 7352 × 4 = 29 408, but there are two digits after the decimal point in the numbers being multiplied, so there have to be two digits after the decimal point in the answer.

Dividing by a whole number

Set out the question in the usual way and do the division, ignoring the decimal point. Then place the decimal point in the answer directly in line with the decimal point in the question.

Example

Show how to divide 6·48 by 2.

$$\begin{array}{r} 3.24 \\ 2\overline{)6.48} \end{array}$$

Dividing by a decimal number

Change the problem so that we divide by a whole number instead. Move the decimal point in both numbers by the same number of places.

Example

Show how to divide 4·17 by 0·3.

$4{\cdot}17 \div 0{\cdot}3$ has the same answer as $41{\cdot}7 \div 3$

$$\begin{array}{r} 13{\cdot}9 \\ 3\overline{)41{\cdot}7} \end{array}$$

Therefore, $4{\cdot}17 \div 0{\cdot}3 = 13{\cdot}9$

Examples

Example 1

Multiply these numbers: $2{\cdot}459 \times 15$

Solution

$$\begin{array}{r} 2{\cdot}459 \\ \times \quad 15 \\ \hline 12\,295 \\ +\ 24\,590 \\ \hline 36{\cdot}885 \end{array}$$

There are three decimal places in the question, so the total number of decimal places is three. The answer needs three decimal places.

Example 2

Multiply these numbers: $4{\cdot}76 \times 0{\cdot}8$

Solution

$$\begin{array}{r} 4{\cdot}76 \\ \times\ 0{\cdot}8 \\ \hline 3{\cdot}808 \end{array}$$

The question has three decimal places, so the answer needs three decimal places.

Example 3

Divide these numbers: $36{\cdot}789\,54 \div 3$

Solution

$36{\cdot}789\,54 \div 3$

$$= \begin{array}{r} 12{\cdot}263\,18 \\ 3\overline{)36{\cdot}789\,54} \end{array}$$

$= 12{\cdot}263\,18$

Example 4

Divide these numbers: $512{\cdot}2456 \div 5$

Solution

$512{\cdot}2456 \div 5$

$$= \begin{array}{r} 102{\cdot}449\,12 \\ 5\overline{)512{\cdot}245\,60} \end{array}$$

$= 102{\cdot}449\,12$

Example 5

Divide these numbers: $36{\cdot}789\,54 \div 0{\cdot}003$

Solution

$36{\cdot}789\,54 \div 0{\cdot}003$

Move the decimal point 3 places.

$= 36\,789{\cdot}54 \div 3$
$= 12\,263{\cdot}18$

Activity 3F,G&H

1 Work out these multiplication problems:
   - **a** 0·2 × 0·6 **b** 0·5 × 0·8
   - **c** 1·2 × 0·1 **d** 4·8 × 2
   - **e** 5 × 0·12

2 The numbers in the table below have been multiplied on a broken calculator. The decimal point and the zeroes at the front are not showing up. In the 'Correct answer' column, write the number in the 'Display column' as it *should* appear.

	First number		Second number		Display	Correct answer
a	0·4	×	0·3	=	12	
b	0·01	×	14·3	=	143	
c	8	×	1·68	=	1344	
d	0·04	×	0·05	=	2	

3 Work out these division problems:
   - **a** $4\overline{)27{\cdot}64}$ **b** 31·65 ÷ 5
   - **c** $8\overline{)0{\cdot}904}$ **d** 0·174 ÷ 8

4 John buys 4 litres of paint for $35.16. What does 1 litre cost?

5 Evaluate the following:
   - **a** 0·148 ÷ 0·5 **b** 1·32 ÷ 0·3
   - **c** 0·4198 ÷ 0·2 **d** 12·318 ÷ 0·02

6 How many 0·6-litre cans of pineapple juice are needed to fill a 30-litre plastic container?

7 A roll of fishing line is 100 m long. How many pieces of fishing line that are exactly 0·4 m long can be cut from the roll?

Answers 3F,G&H

1 **a** 0·12 **b** 0·4
c 0·12 **d** 9·6
e 0·6

2 **a** 0·12 **b** 0·143
c 13·44 **d** 0·002

3 **a** 6·91 **b** 6·33
c 0·113 **d** 0·02175

4 $8.79

5 **a** 0·296 **b** 4·4
c 2·099 **d** 615·9

6 50 cans

7 250 pieces of fishing line

3I • Exploring powers of 10

LB Pages 64–65

Specific learning outcomes

Learners should be able to:

7.3.8.1 Multiply and divide decimal numbers by 10, 100, etc … moving the decimal point to the RIGHT.

7.3.8.2 Evaluate by multiplying and dividing whole numbers and decimal numbers by 10 and powers of 10.

Teaching points

1 Stress to learners that with multiplication and division of powers of 10 and 100 etc, the focus must be on the decimal point.

2 When multiplying, move the decimal point to the RIGHT.

3 When dividing, move the decimal point to the LEFT.

Suggested teaching approach

- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Learning Task 3I** on pages 64–65 of the LB, or **Activity 3I** in the TG below.

Additional notes

When multiplying by 10, 100, 1000 etc., the number of places the decimal point moves to the right is the same as the number of zeroes in 10, 100, 1000 etc.

Examples

1·8 × 10 = 18

3·5 × 100 = 350

0·800 377 × 10 000 = 8003·77

When dividing by 10, 100, 1000 etc., move the decimal point in the number being divided to the left by the same number of places as the number of zeroes in 10, 100, 1000 etc.

Examples

9·832 ÷ 10 = 0·9832

0·0011 ÷ 10 = 0·000 11

1889 ÷ 100 = 18·89

Examples

Example 1

Find the answer to the following:

1·56 × 10 000

Solution

1·56 × 10 000
= 1·56 × 10^4
= 15 600

Move the decimal point 4 places to the right. If you don't have enough digits, just add zeroes.

Activity 3I

1 Work out the following:
   - **a** 2·9 × 10 **b** 5·381 × 100
   - **c** 0·49 × 10 **d** 0·156 ÷ 100
   - **e** 60 034 ÷ 1000 **f** 7 ÷ 1000

2 Evaluate the following:
   - **a** 6·3 × 1000 **b** 5·791 × 10
   - **c** 0·004 38 × 100 **d** 23·45 ÷ 10
   - **e** 0·036 ÷ 10 **f** 73·2 ÷ 100

Answers 3I

1 **a** 29 **b** 538·1
c 4·9 **d** 0·00156
e 60·034 **f** 0·007
2 **a** 6300 **b** 57·91
c 0·438 **d** 2·345
e 0·0036 **f** 0·732

3J&K • Fractions and decimals

LB Pages 66–68

Specific learning outcomes

Learners should be able to:

7.3.9.1 Change fractions to decimals by dividing the numerator by the denominator.
7.3.10.1 Change decimal numbers to fractions. Count the decimal numbers and replace them with zero to indicate the total parts of the denominator.

Teaching points

1. Learners need to be comfortable with factors, multiples, equivalent fractions and the four operations before beginning this topic.
2. Explain to learners that, to change a fraction to a decimal, you need to divide the numerator by the denominator.
3. Explain to learners that, to change a decimal to a fraction, you need to count the number of decimal places, to determine the denominator. For example, 1 decimal place will have a denominator of 10, 2 decimal places will have a denominator of 100, etc. The decimal numbers themselves will be the numerator.

Suggested teaching approach

- Start the chapter section by doing the **Starter activities** provided.
- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercises 3J and 3K** on pages 66–68 in the LB and **Activity 3J&K** in the TG below.

Additional notes

Changing a fraction to a decimal

To change a fraction to a decimal, divide the numerator (top) by the denominator (bottom).

Example 1

Express $\frac{5}{8}$ as a decimal.

$$\begin{array}{r} 0{\cdot}625 \\ 8\overline{)5{\cdot}000} \end{array}$$

$\frac{5}{8} = 0{\cdot}625$

Additional method: Another way of explaining how to change a fraction to a decimal is given in the following examples.

Example 2

Express $\frac{3}{4}$ as a decimal.

Step 1: Multiply 4 by 25 to become 100.

Step 2: Multiply 3 by 25.

$$\begin{tikzcd} \frac{3}{4} \arrow[rr, bend left, "\times 25"] \arrow[rr, bend right, "\times 25"'] & = & \frac{75}{100} \end{tikzcd}$$

Step 3: Write down 75 with the decimal point 2 spaces from the right (because 100 has 2 zeroes).

Answer = 0·75

Example 3

Express $\frac{3}{16}$ as a decimal.

Step 1: Multiply 16 by 625 to become 10 000.

Step 2: Multiply 3 by 625.

$$\begin{tikzcd} \frac{3}{16} \arrow[rr, bend left, "\times 625"] \arrow[rr, bend right, "\times 625"'] & = & \frac{1875}{10\,000} \end{tikzcd}$$

Step 3: Write down 1875 with the decimal point 4 spaces from the right (because 10 000 has 4 zeroes).

Answer = 0·1875

Example 4

Express $\frac{1}{3}$ as a decimal.

Step 1: There is no way to multiply 3 to become 10 or 100 or any ‘1 followed by 0s’, but we can calculate an *approximate* decimal by choosing to multiply by, say, 333.

Step 2: Multiply top and bottom by 333.

$$\begin{tikzcd} \frac{1}{3} \arrow[rr, bend left, "\times 333"] \arrow[rr, bend right, "\times 333"'] & = & \frac{333}{999} \end{tikzcd}$$

Step 3: 999 is *nearly* 1000, so write 333 with the decimal point 3 spaces from the right (because 1000 has 3 zeroes).

Answer = 0·333 (accurate to 3 decimal places)

Decimals with repeating patterns

Sometimes the decimal has a repeating pattern.

$2 \div 3 = 0{\cdot}666\,666\,666\,666\ldots$

This is written in short form as $0{\cdot}\dot{6}$

If two or more digits repeat, then we place a line above the group of digits that repeat.

$0{\cdot}4\overline{78} = 0{\cdot}478\,787\,878\ldots$

Example

Convert $0{\cdot}\overline{45}$ to a fraction.

Solution

$0{\cdot}\overline{45} = 0{\cdot}45454545\ldots$

Let N represent the decimal number.

$N = 0{\cdot}454545454545\ldots$ *Equation 1*

$100N = 45{\cdot}45454545\ldots$ *Equation 2*

The recurring decimal part is subtracted.

Equation 2 – Equation 1:

$100N - N = 45{\cdot}454545\ldots - 0{\cdot}4545454545\ldots$

$99N = 45$

$N = \frac{45}{99} = \frac{5}{11}$

Examples

Example 1

Change $\frac{3}{8}$ to a decimal.

Solution

$$\frac{3}{8} = 3 \div 8 \qquad \begin{array}{r} 0{\cdot}375 \\ 8\overline{)3{\cdot}000} \end{array}$$

$$= 0{\cdot}375$$

Example 2

Change $\frac{3}{7}$ to a decimal.

Solution

$$\frac{3}{7} = 3 \div 7 \qquad \begin{array}{r} 0{\cdot}428\,571\,428\,571 \\ 7\overline{)3{\cdot}000\,000\,000\,000} \end{array}$$

$$= 0{\cdot}\overline{428\,571}$$

Example 3

Convert 1·208 to a fraction.

Solution

$$1{\cdot}208 = \frac{1208}{1000}$$

$$= \frac{151}{125}$$

$$= 1\frac{26}{125}$$

Activity 3J&K

1 Convert these fractions to decimals:

a $\frac{4}{5}$ **b** $\frac{3}{4}$ **c** $3\frac{7}{40}$

2 Write these recurring decimals in long form:

a $0{\cdot}\dot{4}$ **b** $0{\cdot}\overline{23}$ **c** $5{\cdot}1\dot{8}$

3 Change these decimals to fractions:

a 0·4 **b** 0·24 **c** 0·05

4 Write these decimals as mixed numbers in their simplest form:

a 1·75 **b** 2·4 **c** 5·008

d 6·315 **e** 14·12 **f** 9·875

5 Write these recurring decimals in short form:

a 0·222 222 222 …

b 3·181 818 181 …

c 14·077 777 777 …

d 3·192 192 192 …

6 Convert $0{\cdot}6\dot{3}$ to a fraction.

Answers 3J&K

1 **a** 0·8 **b** 0·75 **c** 3·175

2 **a** 0·444… **b** 0·232323… **c** 5·1888…

3 **a** $\frac{2}{5}$ **b** $\frac{6}{25}$ **c** $\frac{1}{20}$

4 **a** $1\frac{3}{4}$ **b** $2\frac{2}{5}$ **c** $5\frac{1}{25}$

d $6\frac{63}{200}$ **e** $14\frac{3}{25}$ **f** $9\frac{7}{8}$

5 **a** $0.\dot{2}$ **b** $3.\overline{18}$ **c** $3.\overline{192}$

6 $\frac{7}{11}$

3L,M&N • Percentages

LB Pages 69–71

Specific learning outcomes

Learners should be able to:

7.3.11.1 Define ‘percentage’.

7.3.11.2 Identify per cent and its properties.

7.3.12.1 Convert percentages to fractions.

7.3.12.2 Convert fractions to percentages.

7.3.13.1 Find the percentage of given quantities.

7.3.14.1 Solve and evaluate practical problems using percentages.

Teaching points

1. First define ‘percentage’. Help learners to understand that a **percentage** is a fraction that has a denominator of 100.
2. Get learners to practise converting simple fractions to equivalent fractions with a denominator of 100.
3. Explain Examples 1 and 2 on page 69 of the LB, to show the various ways in which percentages can be calculated.
4. Carefully outline how to calculate the percentages of quantities (see page 70 of the LB). Learners should be comfortable with calculating percentages in practical situations (see page 71 of the LB).

Suggested teaching approach

- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB or TG.
- Learners complete **Exercises 3L, 3M and 3N**, pages 69–71 in the LB, and **Activity 3L,M&N** in the TG below.

Additional notes

‘**Per cent**’ means ‘out of 100’. A **percentage** is a part out of every 100. We use the symbol % for ‘per cent’.

Percentages are special fractions with a denominator of 100. Knowing this helps when we need to change percentages to fractions.

Example

$$60\% = \frac{60}{100} = \frac{3}{5}$$

To change a fraction to a percentage, write it as a fraction with 100 as the denominator.

Example

Change $\frac{7}{20}$ to a percentage.

$$\frac{7}{20} = \frac{7}{20} \times \frac{5}{5} = \frac{35}{100} = 35\%$$

Finding the percentage of quantities

To work out a percentage of a quantity, multiply the percentage by the quantity.

Example

Calculate 15% of \$80.

Note: With fractions and percentages, the word ‘of’ means ‘multiply’.

15% of \$80

$$= \frac{15}{100} \times \$80 = 0{\cdot}15 \times \$80$$

$$= \$12$$

Calculating percentages

Percentages can be described as increases and decreases. The percentage compares the change to the old, or original, quantity.

Example

Rewa had a pay increase. Her wage increased by 15%. She used to earn $40 a day.

a How much was the increase?

b Calculate her new pay.

Solution

a Increase = 15% of $50

$= \frac{15}{100} \times 40$

$= 0{\cdot}15 \times 40$

= $6

b Rewa's new pay = $40 + $6

= $46 a day

Examples

Converting between fractions and percentages

Example 1

Convert 235% to a fraction.

Solution

$235\% = \frac{235}{100}$

$= \frac{47}{20}$

$= 2\frac{7}{20}$

Example 2

Write $\frac{23}{100}$ as a percentage.

Solution

$\frac{23}{100} = 23\%$

Example 3

Write 0·25 as a percentage.

Solution

$0{\cdot}25 = \frac{25}{100}$

= 25%

Finding percentages of quantities

Example 1

Find 10% of $350.

Solution

10% of $350

$= \frac{10}{100} \times \frac{350}{1}$

= $35

Example 2

Find 135% of $50.

Solution

135% of $350

$= \frac{135}{100} \times \frac{350}{1}$

= $472.50

Example 3

Tickets to the theatre cost $47 each. Emily is entitled to a 25% discount. How much is Emily's ticket?

Solution

100% − 25% = 75%

75% of \$47 $= \frac{75}{100} \times \frac{45}{1}$

$= \frac{3525}{100}$

= $35.25

Activity 3L,M&N

1 A town council finds that 86 out of every 100 ratepayers pay their rates on time.

a What percentage of ratepayers pay their rates on time?

b What percentage do not pay their rates on time?

2 Change these fractions to percentages:

a $\frac{4}{5}$ **b** $\frac{3}{20}$ **c** $\frac{6}{25}$

3 A carpet-layer allows for the weight of underlay to be 45% of the weight of the top layer. What is the weight of underlay needed when the top layer weighs 320 kg?

4 The owners of a popular shopping centre decide to increase the number of car-parking spaces by 30%. At present there are 250 spaces.

a How many extra spaces will be added?

b What will be the new number of spaces?

5 The following refrigerators are for sale:

Eski fridge: $~~1300~~ Discount: 35%

Chillaway: $~~1150~~ Discount: 20%

After the discount is taken off, one of these refrigerators will be cheaper than the other.

Calculate which refrigerator is the cheaper, and show your calculations.

6 Evaluate the following. If they don't work out exactly, then round to 2 decimal places (dp).

a $\sqrt{0{\cdot}49}$ **b** $\sqrt{7{\cdot}29}$ **c** $\sqrt{8{\cdot}32}$

Answers 3L,M&N

1 **a** 86% **b** 14%

2 **a** 80% **b** 15% **c** 24%

3 44 kg

4 **a** 75 **b** 325

5 Eski fridge:

100% − 35% = 65%

65% of 1300

$= \frac{65}{100} \times \frac{1300}{1}$

$= \frac{84500}{100}$

= $845

Chillaway:

100% − 20% = 80%

80% of 1150

$= \frac{80}{100} \times \frac{1150}{1}$

$= \frac{92000}{100}$

= $920

The Eski fridge will be the cheapest.

6 **a** 0·7 **b** 2·7 **c** 2·88

• Chapter Four •

Length and Perimeter

Overview

Calculating distances, lengths and the dimensions of objects and shapes is not new to the people of Solomon Islands. In our communities and societies, measurement is part of our daily life. In informal settings, we do it in our own ways, using our hands, feet and legs for steps. Even with these approaches, Solomon Islanders in the past and present are able to determine length and distances that enable them to build houses, make canoes, do gardening and many other activities. Good measurement skills are useful in many practical situations. For example, they enable a carpenter to work out how much wood is needed to construct a cupboard, a painter to calculate the volume of paint required to paint a room, and a gardener to determine the area of lawn to be planted.

Today, most countries use the metric system for measuring lengths and distances. One great advantage of this system is the ease of converting from one unit to another.

Contents

Chapter skills

This chapter covers the following skills:

- Selecting appropriate units to specify a quantity
- Using common prefixes and notation, and converting between units:

  1 cm = 10 mm

  1 m = 100 cm = 1000 mm

  1 km = 1000 m = 100 000 cm
- Using measuring instruments accurately
- Devising ways to accurately measure objects too big or too small to measure individually
- Reading a variety of scales accurately
- Calculating perimeters of shapes. Perimeter is the total distance around the outside of a shape.

Teaching plan

Lessons	Chapter sections	Class work and home work
1	• Intro • 4A: Units used to measure lengths	Learner's Book 1 • Exercise 4A, page 82
2	• 4B: Estimating by using known values	Learner's Book 1 • Exercise 4B, pages 83–84
3	• 4C: Estimating lengths	Learner's Book 1 • Learning task 4C, pages 85–86
4	• 4D: Reading scales when measuring	Learner's Book 1 • Exercise 4D, page 88
5–6	• 4E: Measuring lengths accurately	Learner's Book 1 • Exercise 4E, pages 89–90
7–9	• 4F: Converting length units	Learner's Book 1 • Exercise 4F, page 92
10–12	• 4G: Adding and subtracting lengths	Learner's Book 1 • Exercise 4G, pages 93–94
13–14	• 4H: Perimeter of shapes with straight sides	Learner's Book 1 • Exercise 4H, pages 96–98
15	• 4I: Exploring measurement in the past	Learner's Book 1 • Learning task 4I, page 99
15	• Revision/Test	Learner's Book 1 • Revision/Assessment, Exercises 4A–4H, pages 106–107 Teacher's Guide • Chapter 4 test, page 165

General learning outcomes

Learners should:

Units used to measure lengths

7.4.1 Understand that there are standard metric units for lengths and distances. (U)

7.4.2 Know how to identify appropriate metric units that would correspond to certain lengths and distances. (K)

Estimating by using known values and lengths

7.4.3 Understand how to make sensible estimates of lengths and perimeter by making comparison to known values and information. (U)

Estimating lengths

7.4.4 Know how to estimate lengths and sizes of objects, even with distracting lines or designs around them. (K)

Reading scales and lengths when measuring

7.4.5 Know how to read scales from measuring instruments and use them to measure lengths accurately. (K)

Measuring lengths accurately

7.4.6 Know how to accurately measure objects using appropriate measuring instruments. (K)

Converting length units

7.4.7 Know that lengths of objects can be changed from one metric unit to another. (K)

7.4.8 Know how to convert from one metric unit to another. (K)

Adding and subtracting lengths and distances

7.4.9 Know how to add and subtract lengths and distances. (K)

Perimeter of shapes with straight sides

7.4.10 Understand that the perimeter of a shape is the distance all around it. (U)

7.4.11 Know how to measure and calculate the perimeter of given shapes and objects. (K)

Exploring measurement in the past

7.4.12 Understand that there are different methods of measurements that were used in past civilisations. (K)

7.4.13 Know how to choose appropriate units for measurements in the past. (K)

4A • Units used to measure lengths

LB Page 82

Specific learning outcomes

Learners should be able to:

7.4.1.1 Identify common metric units that are used to measure lengths and distances: *millimetre (mm)*, *centimetre (cm)*, *metre (m)*, *kilometre (km)*.

7.4.2.1 Identify appropriate metric units that would go along with given lengths, e.g. centimetres are best for small lengths, kilometres best for long distances.

Teaching points

1. Learners should be able to identify some of the methods and approaches that were used in the past in the Solomon Islands to measure lengths and distances: feet, palm-span, rope, stick and so on.
2. Learners should be able to identify the metric units used to measure length and distance.
3. Learners should be able to identify the most appropriate units for measuring corresponding lengths and distances.

Suggested teaching approach

- Start the chapter section by doing the **Starter activities** provided.
- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercise 4A** on page 82 in the LB, and **Activity 4A** in the TG below.

Starter activities

Activity 1: Using your body to measure

Learners work in pairs to do the following tasks:

1. Each learner uses their feet (steps) to measure the length and width of the classroom.
2. Each learner uses their fingers to measure the length and width of their desk.
3. Each learner compares their measurements with their partner's. Are they the same?
4. Each pair compares their results with other pairs. Are they the same?
5. Learners should discuss their findings with the class, including:
   - what could be done to solve the irregularities in the measurements
   - which item was easiest to measure and which measuring 'device' was easiest to use.

Additional notes

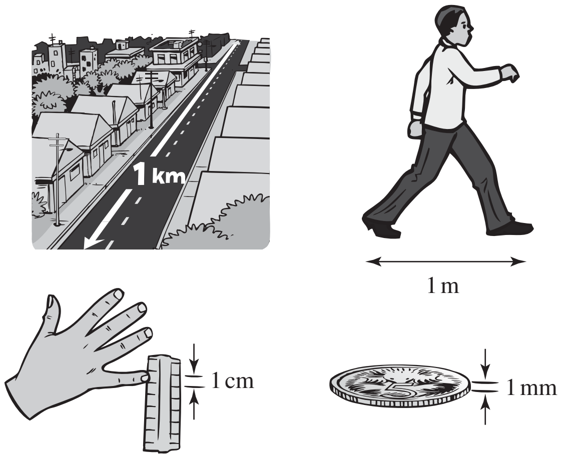
The system of measurement used by most countries until 1970 was the Imperial or British System, which uses units of length such as: inches, feet, yards, miles, chains and furlongs. In this system, converting between units is awkward and can be difficult to remember.

In the seventeenth century, French scientists created another system of measurement, known as the **metric system**. In the metric system, all lengths are derived by dividing or multiplying a standard length, the **metre**, by powers of 10 (10, 100, 1000, …). This makes it easy to convert between lengths. The metric system is now used in most countries in the world, including the Solomon Islands.

The most commonly used metric units of length are the **kilometre** (km), **metre** (m), **centimetre** (cm) and **millimetre** (mm).

- 1 kilometre (km) = 1000 metres (m)
- 1 metre (m) = 100 centimetres (cm)
- 1 centimetre (cm) = 10 millimetres (mm)

These pictures show some lengths and distances, with corresponding methods and units of measurement:



The table lists how we use metric units to measure lengths.

Unit	Used for	Example
millimetre (mm)	very accurate measurements	A thumbnail is about 17 mm long.
centimetre (cm)	small objects, people	The door is 190 cm high.
metre (m)	buildings, sport	The swimming pool is 50 m long.
kilometre (km)	distances	It is 372 km from Honiara to Gizo.

Activity 4A

1 Which units would you use to measure or estimate these lengths? Choose from: mm, cm, m, km.
   - **a** the width of the classroom teacher table
   - **b** the height of your desk or chair
   - **c** the distance between Point Cruz and Henderson Airport

2 Choose the most likely measurement for each distance or length:
   - **a** width of your thumb
   - **b** length of a pencil or pen
   - **c** distance between Munda and Hon
   - **d** width of a netball court
   - **e** width of a bush garden
   - **f** width of a dug-out canoe.

3 All these devices or instruments are used to measure length:
   - ruler – measures short, straight lengths
   - tape measure – used by builders
   - dressmaker's tape – used to measure around short curves
   - trundle wheel – used to measure short distances
   - odometer – linked by a cable to the wheels of a vehicle and measures the distance travelled.

   Which instrument from the list above would you use to measure each of these objects?
   - **a** distance from Henderson Airport to White River
   - **b** length of the running track at King George Sixth School
   - **c** your waist measurement
   - **d** width of the soccer field at Lawson Tama
   - **e** distance around the trunk of a coconut tree
   - **f** height of a Solbrew soft-drink bottle
   - **g** height of the Anthony Saru building at Point Cruz.

Answers 4A

1 **a** cm **b** cm **c** km

2 **a** mm **b** cm **c** km

d m **e** m **f** cm

3 **a** odometer
   - **b** trundle wheel
   - **c** dressmaker's tape
   - **d** trundle wheel
   - **e** tape measure or dressmaker's tape
   - **f** ruler
   - **g** none of the above (the ratio of your shadow to your height and the length of the building's shadow can be used to find the height of buildings).

4B • Estimating by using known values

LB Pages 83–84

Specific learning outcomes

Learners should be able to:

7.4.3.1 Estimate the lengths and distances of given objects by comparing the measurements of given objects.

Teaching points

Use the known values of given lengths of objects and distances to estimate lengths and distances.

Suggested teaching approach

- Start the chapter section by doing the **Starter activities** provided.
- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercise 4B** on pages 83–84 in the LB, and **Activity 4B** in the TG below.

Starter activities

Activity 1: Estimating lengths and distances around us

Ask learners to estimate the lengths and distances of the classroom, the administration building and other buildings around the school compound.

Additional notes

Example

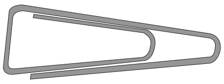
One quarter-length of the rugby field at the Solomon Islands College of Higher Education (SICHE) is 25 metres. Estimate the length of the field.

4 × 25 m = 100 metres

If the length of the try area is 10 metres for each end, then the total length of the rugby field is: 100 m + 10 m + 10 m = 120 m.

Activity 4B

1 A paper-clip is about 3 cm long.



   - **a** About how many paper-clips would stretch from the top to the bottom of your exercise book in a straight line? Choose from 5, 10 or 20.
   - **b** Explain how you worked out your answer.

2 **a** Estimate the length of your exercise book in centimetres (cm).
   - **b** Check the length of your exercise book by using a ruler to measure it.

Answers 4B

1 **a** 10
   - **b** Answers will vary

2 **a** 30 cm
   - **b** 297 mm

4C • Estimating lengths

LB Pages 85–86

Specific learning outcomes

Learners should be able to:

7.4.4.1 Estimate lengths and sizes of objects, even with distracting lines or designs around them.

Teaching points

Lines and other drawings added to a shape or a line can make it look smaller or larger.

Suggested teaching approach

- Start the chapter section by doing the **Starter activities** provided.
- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Learning task 4C** on pages 85–86 in the LB, and **Activity 4C** in the TG below.

Starter activities

Activity 1: Estimating the height of a tree

On a sunny day, have the learners to go out into the school yard, find a tall tree and estimate its height. To help estimate the height of the tree, learners can compare the length of the tree's shadow with their own shadow.

1. Learners go out into the yard and estimate the height of the tree.
2. Learners stand in the sun and have the length of their own shadow measured.
3. Learners measure the length of the tree's shadow.
4. Learners then compare the length of their shadow with the length of the tree's shadow – this will give them a ratio.
5. They then use the ratio to estimate the tree's height, because the same ratio will apply between the tree's height and their own height.

Examples

Example 1
Ask learners to name objects or everyday distances that have lengths that are approximately: 1 m, 100 m, 1000 cm, 2 m, 1000 m

and then: 0·1 m, 0·01 m, 0·001 m and 0·0001 m.

Example 2
Ask learners such questions as:

- how far is 5 km?
- how far is 1 km?
- how far is 1 cm? 3 m? 10 mm?

Learners should have a rough idea of the estimated lengths or distances of various measurements or distances such as 1 millimetre (mm), 1 centimetre (cm), 1 metre (m) and 1 kilometre (km).

Activity 4C

1. Ask learners to compare the lengths of the paces of learners in their class, by going out onto the oval and measuring their pace length.

   Learners should then answer the following questions:
   - **a** What could you use your pace length to measure?
   - **b** Does everyone have the same pace length?
   - **c** Is pace length a reliable method for measuring distances?
2. Estimate the length and width of:
   - **a** the soccer field
   - **b** the netball court
   - **c** the library building
   - **d** your classroom.

Answers 4C

1. **a** Sample answers: width of sporting field, distance between classrooms.
   - **b** No
   - **c** No, it is not consistent and therefore not accurate.
2. Answers will vary

4D • Reading scales when measuring

LB Pages 87–88

Specific learning outcomes

Learners should be able to:

7.4.5.1 Read scales on measuring instruments, and use them to measure lengths of lines and objects accurately.

Teaching points

1. Learners need to know how to use measuring equipment correctly.
2. Learners should know how to read the scales on measuring equipment correctly.

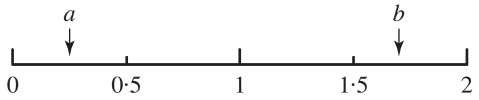
Suggested teaching approach

- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB.
- Learners complete **Exercise 4D** on page 88 in the LB, and **Activity 4D** in the TG below.

Additional notes

Measuring devices use scales to make them easy to read.

On this scale, each gap represents 0·5 units.

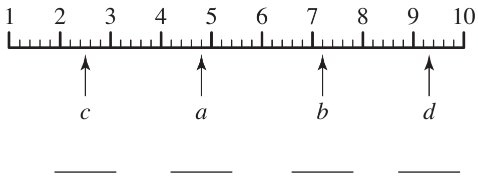


The arrow labelled *a* is pointing halfway between 0 and 0·5, and so it must be approximately 0·25.

The arrow labelled *b* reads about 1·7.

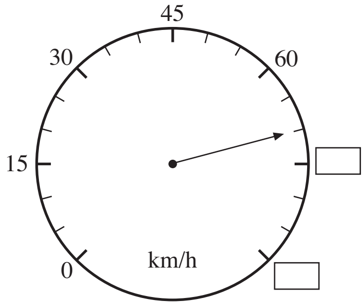
Activity 4D

1 On this scale, each small unit or division stands for 0·2 units.



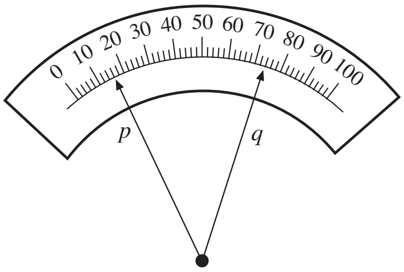
What are the readings shown by the arrows marked *a*, *b*, *c* and *d*?

2 The diagram shows the speedometer on a tractor.



- **a** What does each division on the scale represent?
- **b** Add the missing numbers to the two boxes on the scale.
- **c** What speed is shown by the arrow?

3 The measurements on this scale are in kilograms (kg). What are the two readings marked *p* and *q*?



p = __________

q = __________

Answers 4D

1 *a* = 4·8 units, *b* = 7·2 units, *c* = 2·5 units, *d* = 9·3 units

2 **a** 5 km/h

b 75, 90

c 70 km/h

3 *p* = 16 kg, *q* = 74 kg

4E • Measuring lengths accurately

LB Pages 89–90

Specific learning outcomes

Learners should be able to:

7.4.6.1 Use rulers to accurately measure lengths, objects, distances and lines.

Teaching points

1 Learners must be able to measure lengths and distances accurately using a ruler.

2 Other measuring instruments can also be used to measure lengths and distances accurately.

Suggested teaching approach

- Start the chapter section by doing the **Starter activities** provided.
- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB.
- Learners complete **Exercise 4E** on pages 89–90 in the LB, and **Activity 4E** in the TG below.

Starter activities

Activity 1: History of measuring

1 Ask learners to investigate how methods of measuring have changed over time.

2 Learners should find answers to the following questions:

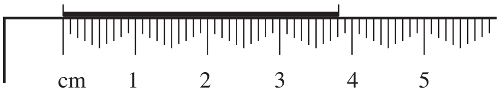
- What instruments were used in the past?
- What were they used for?

3 Learners should present their findings to the class.

4 The class can then discuss the instruments that were used in the past to measure items of all sizes.

Additional notes

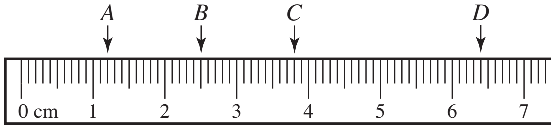
Rulers have scales marked in both millimetres (mm) and centimetres (cm).



The scale on this ruler shows that the length of the line is 3·8 cm or 38 mm.

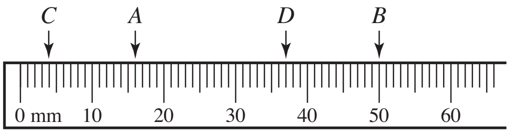
Activity 4E

1 This diagram shows part of a ruler with a centimetre scale. Complete the table to show the lengths represented by *A*, *B*, *C* and *D*.



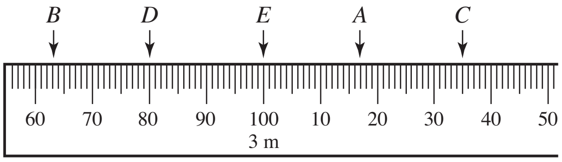
	Length to nearest cm	Length to nearest mm
A		12 mm
B	2·5 cm	
C		
D		

2 This diagram shows part of a ruler with a millimetre scale. Complete the table to show the lengths represented by *A*, *B*, *C* and *D*.



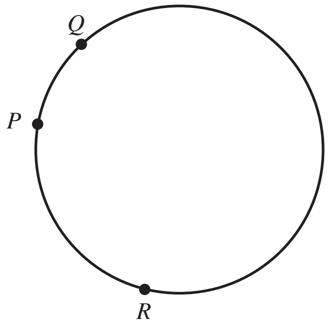
	Length to nearest cm	Length to nearest mm
A	1·6 cm	16 mm
B		
C		
D		

3 This diagram shows part of a builder's tape. It includes the section between 3055 mm and 3151 mm. Complete the table to give values for the lengths represented by *A*, *B*, *C*, *D* and *E*.



	Length to nearest cm	Length to nearest mm
A	3117 mm	3·117 m
B		
C		
D		
E		

4 **a** Use a ruler to measure these lengths in mm:



i P to Q in a straight line

ii Q to R in a straight line

iii P to R in a straight line.

b Estimate the diameter of the circle.

Answers 4E

1

	Length to nearest cm	Length to nearest mm
A	1·2 cm	12 mm
B	2·5 cm	25 mm
C	3·8 cm	38 mm
D	6·4 cm	64 mm

2

	Length to nearest cm	Length to nearest mm
A	1·6 cm	16 mm
B	5·0 cm	50 mm
C	0·4 cm	4 mm
D	3·7 cm	37 mm

3

	Length to nearest cm	Length to nearest mm
A	3117 mm	3·117 m
B	3064 mm	3·064 m
C	3135 mm	3.135 m
D	3080 mm	3·08 m
E	3100 mm	3·1 m

4 **a** **i** 12 mm = 1·2 cm

ii 33 mm = 3·3 cm

iii 26 mm = 2·6 cm

b ≈ 3·8 cm

4F • Converting length units

LB Pages 91–92

Specific learning outcomes

Learners should be able to:

7.4.7.1 Change metric units of lengths from one to another.

7.4.8.1 Use conversion factors to change one metric unit to another: *1 cm = 10 mm, 1 m = 100 cm, 1 km = 1000 m*

Teaching points

1 Learners can use the conversion factor table as a guide to help them convert between metric units.

2 Learners need to know which way the conversion units run, when converting from smaller units to larger, and from larger to smaller.

Suggested teaching approach

- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB and the TG.
- Learners complete **Exercise 4F** on page 92 in the LB, and **Activity 4F** in the TG below.

Additional notes

The great advantage of the metric system is the relative ease with which we can convert between metric units. To change between units, we only need to multiply or divide by powers of 10. The conversion diagram below shows how to convert.

Larger units Smaller units

$$\begin{tikzcd}
\text{km} \arrow[r, bend left, "\times 1000"] & \text{m} \arrow[l, bend left, "\div 1000"] \arrow[r, bend left, "\times 100"] & \text{cm} \arrow[l, bend left, "\div 100"] \arrow[r, bend left, "\times 10"] & \text{mm} \arrow[l, bend left, "\div 10"]
\end{tikzcd}$$

To convert from a larger unit to a smaller unit, we *multiply*.

To convert from a smaller unit to a larger unit, we *divide*.

For example, as the conversion diagram shows:

- when converting from kilometres to metres, we multiply by 1000
- when converting from centimetres to metres, we divide by 100
- when converting from kilometres to centimetres, we multiply by 1000, then by 100.

Examples

Example 1

State the factor that can be applied to convert:

a kilometres to metres

b centimetres to metres

Solution

a Multiply by 1000

b Divide by 100

Example 2

Use a conversion factor to express:

a 500 m in kilometres

b 70 cm in millimetres

Solution

a 500 m (÷ 1000) = 0·5 km

b 70 cm (× 10) = 700 mm

Example 3

Which is longest: a pencil case that is 25 cm long or a pencil that is 224 mm long?

Solution

The units used are centimetres and millimetres.

Choose to work in millimetres.

Step 1: Convert 25 cm to millimetres: 250 mm.

Step 2: Compare the lengths and choose the longest: 250 mm or 224 mm. 250 mm is longer. This is the pencil case.

Activity 4F

1 Change these measurements to metres:

a 4·8 km **b** 600 cm

c 42 mm **d** 0·5 km

2 Change these measurements to cm:

a 4 m **b** 300 mm

c 67 mm **d** 1·82 mm

3 Complete these conversions so that the lengths are changed correctly:

a 5000 m = ______ km **b** 38 cm = ______ mm

c 6600 mm = ______ m **d** 50 mm = ______ cm

4 Donga walks from Mbaranba to the Oba bus stop at Ranandi (550 metres) and catches a bus to Point Cruz (about 5·7 km), then walks 30 metres to her working place. Calculate how far she travelled, in:

a metres **b** kilometres

c centimetres.

5 A spring onion measuring 24 cm is chopped into pieces. Each piece measures 5 mm. How many pieces are there?

Answers 4F

1 **a** 4800 m **b** 6 m

c 0·042 m **d** 500 m

2 **a** 400 cm **b** 30 cm

c 6·7 cm **d** 0·182 cm

3 **a** 5 km **b** 380 mm

c 6·6 m **d** 5 cm

4 **a** 6280 m **b** 6·28 km

c 628 000 cm

5 48 pieces

4G • Adding and subtracting lengths

LB Pages 93–94

Specific learning outcomes

Learners should be able to:

7.4.9.1 Add and subtract lengths and distances using appropriate metric units.

Teaching points

1. When measuring different lengths, convert lengths of different units to the same units.
2. To avoid using numbers with decimal points, it is better to use the smaller metric unit.

Suggested teaching approach

- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercise 4G** on pages 93–94 in the LB, and **Activity 4G** in the TG below.

Additional notes

When calculating lengths, make sure the units are the same. Choosing smaller units helps to avoid having to use decimal numbers.

Example

A pre-cut shelf measures 2·4 m. It is too long, and 48 mm needs to be removed to make it fit. How long will the shelf be after it is cut?

Length before cutting: 2·4 m = 2·4 × 1000 = 2400 mm

Finished length: 2400 mm – 48 mm = 2352 mm

Examples

Example 1

Find the answer to the following:

6 km + 2400 m

Solution

Convert units to metres:

6 km + 2400 m
= 6000 m + 2400 m
= 8400 m or 8·4 km

Example 2

Find the answer to the following:

6·7 cm – 24 mm

Solution

Convert units to millimetres:

6·7 cm – 24 mm
= 67 mm – 24 mm
= 43 mm or 4·3 cm

Activity 4G

1 Calculate the following:
   - **a** 46 cm + 2 m
   - **b** 30 cm – 13 mm
   - **c** 500 m + 2·5 km
   - **d** 4 km – 650 m

2 Karen walks from home to the bus stop (750 m) and then catches a bus to town (8·5 km). She then walks the remaining 500 m to work. Calculate how far she travels altogether:
   - **a** in m
   - **b** in km.

3 Calculate the perimeters of these shapes:
   - **a** an equilateral triangle, sides 10 cm
   - **b** a square, sides 15 cm
   - **c** a rectangle, sides 7·3 cm and 2 m.

4 At the start of a journey, this was the reading from an odometer in a car. It displays the distance travelled to the nearest tenth of a kilometre.

4	3	0	9	5	8

At the end of the journey, the reading was:

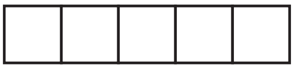
4	7	8	0	6	2

   - **a** Work out the length of the journey. Give your answer to the nearest tenth of a kilometre.
   - **b** How much further would the car need to travel until the odometer reads as follows?

0	0	0	0	0	0

   - **c** Write down the decimal subtraction you did to calculate the answer to question **b**.

5 Five squares are placed in a line, to make a rectangle.



The perimeter of the rectangle is 72 cm. Find the length of the base of the rectangle.

Answers 4G

1 **a** 2·46 m or 246 cm
   - **b** 28·7 cm or 287 mm
   - **c** 3 km or 3000 m
   - **d** 3·35 km or 3350 m

2 **a** 9750 m
   - **b** 9·75 km

3 **a** 30 cm
   - **b** 60 cm
   - **c** 414·6 cm

4 **a** 4710·4 km
   - **b** 52193·8 km
   - **c** 100 000 – 47 806·2

5 30 cm

4H • Perimeter of shapes with straight sides

LB Pages 95–98

Specific learning outcomes

Learners should be able to:

7.4.10.1 Define ‘perimeter’.

7.4.10.2 Identify the perimeter of given shapes and objects.

7.4.11.1 Calculate the perimeter of shapes and objects with straight sides.

Teaching points

1 The **perimeter** is the distance around the outside of a shape.

2 To find the perimeter of a shape, change all the measurements to the same metric unit, then add them together.

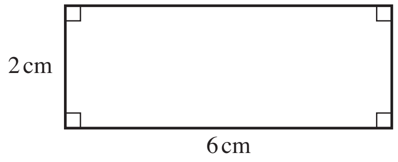
Suggested teaching approach

- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercise 4H** on pages 96–98 in the LB, and **Activity 4H** in the TG below.

Additional notes

The **perimeter** of a figure is the total length of its sides.

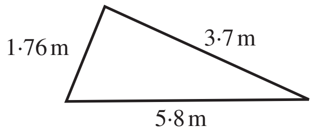
The perimeter of this rectangle is 16 cm.



This is because 2 + 6 + 2 + 6 = 16

Examples

Example 1
Find the perimeter of the triangle.

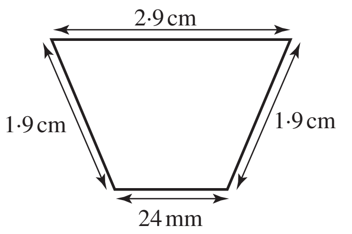


Solution

As the lengths are all measured in metres, add them up:

1·76 m + 3·7 m + 5·8 m = 11·26 m

Example 2
Find the perimeter of this shape:



Solution

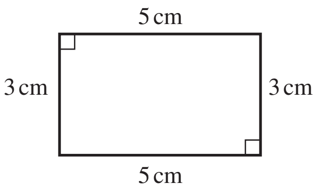
Change the units so that they are all the same, and then add them up:

1·9 cm + 24 mm + 1·9 cm + 2·9 cm
= 19 mm + 24 mm + 19 mm + 29 mm
= 91 mm
= 9·1 cm

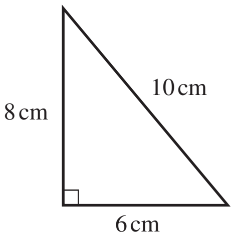
Activity 4H

1 Calculate the perimeter of these shapes:

a



b

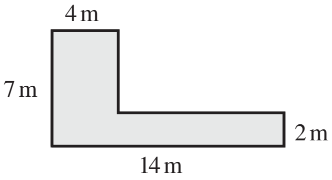


2 Calculate the perimeter of these shapes:

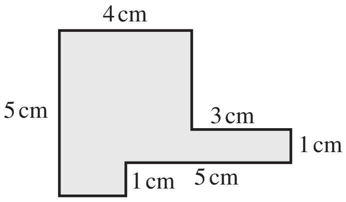
- a an equilateral triangle with sides of length 8 cm
- b a square with sides of length 12 cm.

3 Calculate the perimeter of the shapes below.

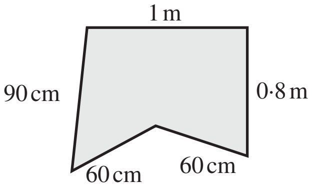
a



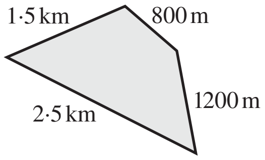
b



c



d



4 Calculate the perimeter of a square with side lengths of 6·3 cm.

Additional activity

5 Learners are to sketch the shape of the various sports fields around the school: basketball court, tennis court, netball court and football or soccer field.

Divide the class into interest groups to go and measure each of these fields. Each group should bring back to the class an accurate sketch with all lengths marked in.

The class can then use these sketches to calculate the perimeter of each of the sports fields.

Answers 4H

1 **a** 16 cm
 b 24 cm
2 **a** 2 cm
 b 48 cm
3 **a** 42 m
 b 24 cm
 c 3·9 m
 d 6 km
4 25·2 cm
5 Answers will vary

4I • Exploring measurement in the past

LB Page 99

Specific learning outcomes

Learners should be able to:

7.4.12.1 Identify some of the methods that were used in past civilisations for measurements.
7.4.13.1 Choose appropriate units that can be used to measure lengths and objects in the past.

Teaching points

1 The Egyptians were the first to use the cubit as a unit of measurement (elbow to fingertips). Compare this to the use of feet and palms for measuring.

2 Learners could find out about other methods and units used in the past to measure lengths and distances.

Suggested teaching approach

- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB.
- Learners complete **Learning task 4I** on page 99 in the LB, and **Activity 4I** in the TG below.

Additional notes

The **metric system** of measurement we use today was introduced less than 300 years ago. Before that, there was a wide variety of measurements, and many were based on the size of body parts.

For example, the length unit known as a **foot** was based on the length of a typical (adult male) human foot.

1 foot = approx. 30·5 cm
Convert 4 feet to cm: 4 × 30·5 = 122 cm
Convert 100 cm to feet: 100 ÷ 30·5 = 3·28 feet

The following extract about sea travel in the 1950s includes measurements from the past, and measurements used at sea.

Postcard from Columbo

Tonight we sail on the *Southern Cross* from here to Fremantle. The *Southern Cross* was built by Harland and Wolff in Belfast and launched in 1954 by Queen Elizabeth II. It is 604 feet long. The ship can travel at a maximum speed of 21 knots, and the journey of 2730 nautical miles will take us just over 5 days. The entrance to the port here at Colombo is only 4 fathoms deep, which means we have to leave at high tide.

Activity 4I

1 Convert 604 feet to:

- **a** cm
- **b** m

2 Complete these statements by adding a suitable metric unit to each. Choose from: m, km/h, km.

- **a** 1 nautical mile = 1·85 ___
- **b** 1 fathom = 2 ___
- **c** 1 knot = 1·85 ___

3 Change the measurements in the last two sentences of the postcard to metric units:

- **a** 21 knots =
- **b** 2730 nautical miles =
- **c** 4 fathoms =

Answers 4I

1 **a** 18 422 cm
- **b** 184·22 m

2 **a** 1·85 km
- **b** 2 m
- **c** 1·85 km/h

3 **a** 38·85 km/h
- **b** 5050·5 km
- **c** 8 m

• Chapter Five •

Statistics

Overview

In the Solomon Islands, information is collected in an informal way on all kinds of things in our community, such as genealogy, harvesting of gardens, number of pigs and so on. Most of this information is collected and passed on orally from parents to children. Nowadays, Solomon Islanders are starting to collect and record information they need for making decisions.

Statistics is the study of information based on quantitites expressed in numbers, such as the number of children in a family, or the number of drop-outs in Year 9. Statistical information (data) is collected, interpreted and then presented to make sense of the data collected. Different methods are used to collect data – a survey is one method. The information collected can be grouped into categories: categorical data, ordinal data, discrete data and continuous data.

This chapter focuses on how to find and measure the centre of a set of data. The three main approaches that can be used to measure the centre of a set of scores are: mean, median and mode. These are all measures of centre, but each is calculated in a different way and gives different information about the data we are interpreting. Learners will also see different ways of presenting data, such as graphs, dot plots, stem-and-leaf plots, tables and Venn diagrams, and how to interpet these.

Contents

Chapter skills

This chapter covers the following skills:

- Recognising the different types of data:

  Discrete numerical data is numerical data that involves distinct values

  Continuous numerical data is numerical data where every number on a scale has meaning
- Collecting and organising different types of data
- Designing a simple database to collect data
- Representing numerical data in histograms, dot plots and stemplots
- Finding the angles in a pie graph:

  $\frac{\text{Frequency of the category}}{\text{Total frequency}} \times 360 = \text{number of degrees}$
- Finding summary statistics:

  The mode is the most frequently occurring value

  The mean = $\frac{\text{Sum of the numerical values}}{\text{Number of values}}$

  The median is the middle value when the results are written in order. If there is an even number of results, it is the average of the middle pair

  The range is a measure of the spread of the data – it is the difference between the highest and the lowest result
- Using means to compare two data sets
- Using Venn diagrams and two-way tables to display data
- Interpreting line graphs.

Teaching plan

Lessons	Chapter sections	Class work and home work
1	• Intro • Count the numbers of learners in class: group them into islands, provinces, language etc	• Group class into: Provinces Islands Languages Sexes
2	• 5A: Collecting data	Learner's Book 1 • Exercise 5A, pages 112–113
3	• 5B: Creating and interpreting tables	Learner's Book 1 • Exercise 5B, page 115
4	• 5C: Column and bar graphs	Learner's Book 1 • Exercise 5C, pages 117–119
5–6	• 5D: Interpreting line graphs	Learner's Book 1 • Exercise 5D, page 121
7	• 5E: Pie graphs	Learner's Book 1 • Exercise 5E, page 123
8	• 5F: Dot plots and mode	Learner's Book 1 • Exercise 5F, pages 124–126
9–10	• 5G: The mean	Learner's Book 1 • Exercise 5G, pages 127–128
11	• 5H: The median and the range	Learner's Book 1 • Exercise 5H, pages 129–130
12	• 5I: Stem-and-leaf plots	Learner's Book 1 • Exercise 5I, page 131
13	• 5J: Venn diagrams	Learner's Book 1 • Exercise 5J, pages 133–134

Lessons	Chapter sections	Class work and home work
14	• 5K: Two-way tables	Learner's Book 1 • Exercise 5K, pages 135–137
15	• Revision/test	Learner's Book 1 • Revision/Assessment, Exercises 5A, 5C–5K, pages 144–147 Teacher's Guide • Chapter 5 test, page 167

General learning outcomes

Learners should:

Collecting data

7.5.1 Understand statistics and how information (data) are collected and represented. (U)

7.5.2 Know that data that are collected are grouped into two types. (K)

7.5.3 Know how to tabulate collected data into a frequency table. (K)

Creating and interpreting tables

7.5.4 Know that the simplest and easiest way to display and interpret data is to put them into tables. (K)

Column and bar graphs

7.5.5 Know that another way of displaying data are bar graphs and column graphs. (K)

7.5.6 Know how to interpret bar and column graphs. (K)

Interpreting line graphs

7.5.7 Know that graphs can be used to get real and visual information about life. (K)

Pie graphs

7.5.8 Understand how a pie graph is used to display collected categorical data. (U)

7.5.9 Know how to construct pie graphs. (U)

Dot plots and the mode

7.5.10 Understand that dot plots are a pictorial way of displaying discrete numerical data. (U)

7.5.11 Know how to use those dot plots to find the modal score. (K)

The mean

7.5.12 Understand that mean is the measurement of the centre of a set of scores. (U)

The median and the range

7.5.13 Understand that median is the middle number when the set of scores are arranged in ascending or descending order. (U)

7.5.14 Know range as the difference between the highest and the lowest score. (K)

Stem-and-leaf plots

7.5.15 Understand how stemplots can be used to plot 'two-numerical' data using tens for stems and ones for leaves. (U)

7.5.16 Know how to use stem-and-leaf plots to tabulate and display data. (K)

Venn diagrams

7.5.17 Understand how a Venn diagram can be used to classify and display data or elements. (U)

7.5.18 Understand that some of the elements that are given in a Venn diagram can be classified or appear in both circles. (U)

Two-way tables

7.5.19 Know how two-way tables can be used to display categorical data. (K)

5A • Collecting data

LB Pages 110–113

Specific learning outcomes

Learners should be able to:

7.5.1.2 Identify ways of collecting data: *questionnaires, polls and surveys*.

7.5.2.1 Identify two types of data that can be collected.

7.5.2.2 Define and differentiate between *discrete* and *continuous* data.

7.5.3.1 Tabulate collected data into a frequency table.

7.5.3.2 Solve word problems.

Teaching points

1. Three methods of collecting data are: questionnaire, poll and survey.
2. Types of **data** are:

   discrete numerical data – data based on counting

   continuous numerical data – data based on measuring

   categorical data – data that can be classified by name. For example: shirt colour can be red, blue etc.

   ordinal data – categorical data that can be ordered. For example, a soccer team can be rated as very poor, poor, average, good, very good etc.

Suggested teaching approach

- Start the chapter section by doing the **Starter activities** provided.
- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB and the TG.
- Learners complete **Exercise 5A** on pages 112–113 of the LB, and **Activity 5A** in the TG below.

Starter activities

Activity 1: Class survey

1. Survey the class and find out which province learners come from.
2. Tally the results to find out which provinces are represented in the class.

Additional notes

Types of data

Types of data are listed in the table, with examples.

Type of data	Example
Categorical data • Can be classified by name	Admission prices: Child, Student, Adult, Senior citizen
Ordinal data • Used in ratings	A school report card: Excellent, Very good, Good, Fair, Poor
Discrete numerical data • Collected by *counting* • Is usually whole numbers	Number of people in the house: 0, 1, 2, 3, 4 …
Continuous numerical data • Collected by *measuring* • Can be any number in a range and has to be grouped into classes	Weights (in kilograms): 30–<40, 40–<50, 50–<60, 60–<70

Example

Suppose you asked pet owners the following questions about their pets.

1 What type of pet do you own?

2 How many pets do you own?

3 What does each of your pets weigh?

Answers

What kind of data will we get from each answer?

- *First question* – categorical data, because the answers will be in the form of names: cat, dog, rat, tortoise, rabbit etc.
- *Second question* – discrete data, because the answers will be whole numbers: 1, 2, 3, 4 etc.
- *Third question* – continuous data, because it is measured: 5·3 kg, 34·7 kg, 24·3 kg, 2·6 kg etc.

Frequency table

A frequency distribution table show a summarised grouping of data into mutually exclusive classes, and the number of occurrences in each class. Any data collected can be recorded in a frequency table.

Each time a piece of data occurs, it is recorded in the tally column. We count the data in the tally column and write this number in the frequency column. Frequency means the number of times an event occurs.

The data are collected, organised and arranged into classes in the frequency table, and can then be interpreted.

Example

Here are some of the ages of learners who attended White River Community High School.

12, 12, 12, 13, 13, 13, 13, 13, 13, 13, 13, 14, 14, 14, 14, 15, 15, 15, 15, 15, 15, 15, 16, 16, 16, 16, 16, 18, 18

Show this information in a frequency table.

Age	Tally	Frequency
12	|||	3
13	𝍸 |||	8
14	||||	4
15	𝍸 ||	7
16	𝍸	5
17		0
18	||	2

Activity 5A

1 What types of data will be collected from these surveys? Choose from: categorical, ordinal, numerical.

- **a** the number of electrical posts between King George Sixth School and Burns Creek
- **b** the results of your class in the maths exams: High distinction, Distinction or Credit
- **c** the weight of the school bag of each student in your class
- **d** the colour of the school bags
- **e** the total amount of time each student spent doing maths homework last week

2 Here is a list of the number of raffle tickets bought by each customer at Tenaru National Secondary School's annual bazaar:

0, 2, 1, 0, 1, 4, 3, 1, 1, 0, 2, 0, 1, 6, 0, 2, 0, 1, 3, 1, 0, 2, 1, 3, 4, 0, 0, 1, 0, 1, 0, 1

a Complete the frequency table to summarise the information.

No. of tickets	Tally	Frequency
0		
1		
2		
3		
4		
5		
6		

b What was the highest number of tickets bought by any of these customers?

c What is the most likely number of tickets a customer will buy? Explain your answer.

3 Conduct a survey to find out the most popular subject in your class. To do this, ask students to raise their hand, then count the hands for each subject.

Tally your results in the Tally column, and then find the frequency.

Subject	Tally	Frequency
Maths		
Social science		
Business studies		
Technology (ind. arts)		
English		
Science		
	TOTAL	

Answers 5A

1 **a** discrete numerical data

b ordinal data

c continuous numerical data

d categorical data

e continuous numerical data

2 **a**

No. of tickets	Tally	Frequency
0	𝍸 𝍸 |	11
1	𝍸 𝍸 |	11
2	||||	4
3	|||	3
4	||	2
5		0
6	|	1

b 6

c 0 or 1

3 Answers will vary

5B • Creating and interpreting tables

LB Pages 114–115

Specific learning outcomes

Learners should be able to:

7.5.4.1 Read and interpret data that are given in a table.
7.5.4.2 Construct tables to display collected data.

Teaching points

1. Learners should be able to read and interpret data that are in tables and data that are not in tables.
2. Learners should be able to tabulate collected data.

Suggested teaching approach

- Read through the **Additional notes** provided
- Model the **Examples** provided in the LB and TG
- Learners complete **Exercise 5B** on page 115 in the LB, and **Activity 5B** in the TG below.

Additional notes

Tables can be used to summarise categorical data as well as numerical data.

Examples

The data in the table below are taken from Year 7 learners.

Name	Gender (F or M)	Boarding or day	Favourite subject
Faisi	M	B	Science
Kiuato	F	D	Maths
Paiata	F	B	Home Ec
Kwaimani	M	D	Maths
Taiki	M	B	Maths
Manebona	M	D	Science
Rachel	F	D	English

Answer the questions below.

1. How many of the learners are at boarding school? (3)
2. Whose favourite subject is maths? (Kiuato, Kwaimani, Taiki)
3. How many students chose english as their favourite subject? (1)
4. How many students were involved in the survey? (7)
5. Who chose home economics as a favourite subject? (Paiata)

Activity 5B

1 The table gives information about the prices of root crops sold at the Honiara Main Market.

Name	Weight	Length	Price
Cassava	600 g	30 cm	1·20
Pana	250 g	25 cm	2·25
Yam	1·2 kg	27 cm	3·00
Taro	200 g	19 cm	3·50
Potato	325 g	23 cm	0·90

a Which is the most expensive root crop?
b Which is the heaviest?
c Which is the cheapest?
d List the root crops in order of length, from shortest to longest.

2 The frequency table below shows the responses from a group of children who were asked “What is your favourite colour?”. Only one response per student was recorded.

Colour	White	Red	Green	Blue	Silver	Other
Frequency	42	6	5	12	18	17

a Which colour is the most popular?
b Which colour has a score of 18?
c How many learners chose green, and how many chose silver?
d What is the total number of learners who took part in the survey?

3 A survey of Grade Six learners was carried out at the Seventh Day Adventist (SDA) Kukum Valley Primary School. Learners were asked about the pets or animals they have in their home.

Pet	Number
Dog	17
Cat	13
Parrot	7

a How many learners have a dog?
b Which pet scored the lowest number?
c What was the total number of learners surveyed?

Answers 5B

1 a Taro
b Yam
c Potato (however, cassava is the cheapest per gram)
d Taro, potato, pana, yam, cassava

2 a White
b Silver
c Green – 5, silver – 18
d 100

3 a 17
b Parrot
c 37

5C • Column and bar graphs

LB Pages 116–119

Specific learning outcomes

Learners should be able to:

7.5.5.1 Define and differentiate column and bar graphs.

7.5.5.2 Construct column and bar graphs to represent the collected data.

7.5.6.1 Interpret given bar and column graphs to get extra information.

Teaching points

1. A **bar graph** is a graph drawn using rectangular bars to show how large each value is. The bars are horizontal.
2. A **column graph** is the same as a bar graph, except that the bars are vertical.
3. Learners should be able to construct bar and column graphs.
4. Learners should be able to analyse and interpret bar and column graphs.

Suggested teaching approach

- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercise 5C** on pages 117–119 in the LB, and **Activity 5C** in the TG below.

Additional notes

Column and bar graphs

Column graphs present data in vertical columns, with a space between each column.

Bar graphs are the same as column graphs, except that the bars are horizontal.

Column or bar graphs should be used for categorical data and for ungrouped discrete data.

Drawing a column graph

All column graphs should include:

1. a title
2. categories or a numerical scale with equally spaced intervals (gaps) between the numbers on the horizontal axis (*x*-axis)
3. a numerical scale with equally spaced intervals (gaps) between the numbers on the vertical axis (*y*-axis)
4. a label for the horizontal axis (*x*-axis) that explains the variable being represented
5. a label for the vertical axis (*y*-axis) that shows the frequency
6. a small gap between each column (usually half a column width) to show that each column is categorical or discrete (counted) data.

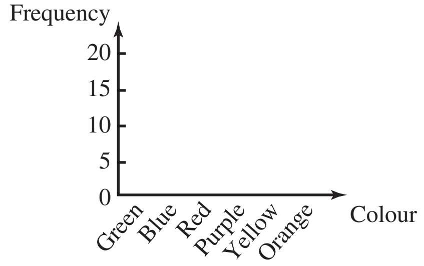
Examples

Example 1

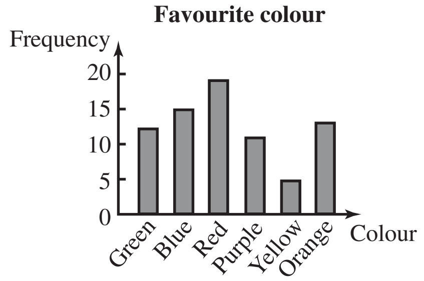
The frequency table below shows the responses from a group of children who were asked "What is your favourite colour?" Only one response per student was recorded. Draw a column graph to represent this information.

Colour	Green	Blue	Red	Purple	Yellow	Orange
Frequency	12	15	19	11	5	13

Step 1 Draw the *x*- and *y*-axes. Add a scale to each axis and label both axes appropriately.



Step 2 Use the frequency values to draw a rectangular column for each category. (Here, each rectangle represents a different colour.) The length of the rectangle indicates the frequency. Ensure that all rectangles are the same width on the *x*-axis. Insert a small space between each category. Add a title to the graph.



Example 2

Two groups of 100 students from two different schools were surveyed to find out their opinions on school uniforms. They were asked to consider the statement that: "All schools should abolish school uniforms". They were asked whether they agree, don't care or disagree with the statement.

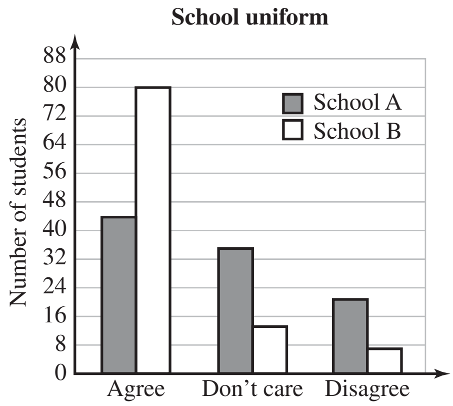
The results for school A were:

School A	Results
Agree	44
Don't care	35
Disagree	21

The results for school B were:

School B	Results
Agree	80
Don't care	13
Disagree	7

We can compare the two schools using parallel columns or stacked column graphs like this:



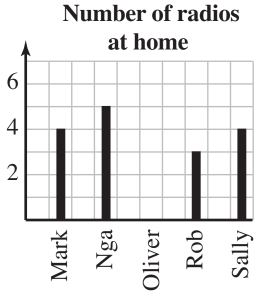
Activity 5C

1 Draw a column graph to show the number of cartons of ice-cream sold in the Frangipani ice-cream shop in a day.

Flavour	Cartons sold
Vanilla	8
Raspberry	3
Banana	4
Chocolate	1
Mixed	7

- **a** Which is the most popular flavour?
- **b** How many cartons of ice-cream were sold in total?
- **c** Which flavour is the least popular?
- **d** How many cartons of banana ice-cream were sold in a week?

2 Five students were asked how many radios their families have at home. This column graph shows the results.



- **a** How many radios are at Rob's home?
- **b** Whose home has no radio?
- **c** The families of which students have the same number of radios at home?
- **d** How many radios do the families of the five students have altogether?

Answers 5C

1 **a** Vanilla
- **b** 23
- **c** Chocolate
- **d** 4

2 **a** 3
- **b** Oliver
- **c** Mark and Sally
- **d** 16

5D • Interpreting line graphs

LB Pages 120–121

Specific learning outcomes

Learners should be able to:

7.5.7.1 Interpret and get information from data summarised in line graphs.

Teaching points

Students should be able to interpret line graphs, and get extra information from them.

Suggested teaching approach

- Read through the **Additional notes** provided
- Model the **Examples** provided in the LB and TG
- Learners complete **Exercise 5D** on page 121 in the LB, and **Activity 5D** in the TG below.

Additional notes

A line chart or **line graph** is a type of chart that displays information as a series of data points connected by straight line segments. All the data points are joined together by the line. The line graph shows change over a period of time.

The data come from measurements taken at regular time intervals.

The time intervals are shown on the horizontal axis.

Data values are read from the vertical axis.

A line graph is used when we have data that shows changes over time. This is useful if we are trying to identify a trend in the data. That means we are looking for a general pattern. We can then use that pattern to predict future values in the data set.

Line graphs are used only for *continuous* data, such as mass, height, profits or temperatures. These are all data that can be measured over time.

All line graphs should include the following:

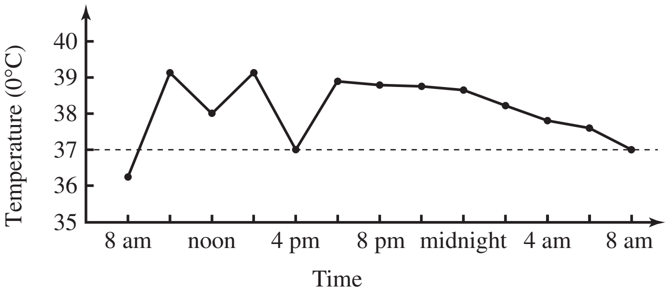
1. a title
2. the independent variable on the horizontal axis (*x*-axis)
3. a scale across the horizontal axis that uses equally spaced intervals and is clearly labelled, including any relevant unit of measurement
4. a scale on the vertical axis (*y*-axis) that also uses equally spaced intervals and is clearly labelled, including any relevant unit of measurement.

Steps to follow when constructing a line graph

1. Use the data from the table to choose an appropriate scale. Look for the highest value to be graphed. *All scales start at zero (0).*
2. For the *y*-axis, decide how tall you want your graph to be. For example, if you want your graph to be 10 cm tall, then take the highest value and divide it by 10 cm to give you an idea of the scale to use.
3. For the *x*-axis, decide how wide you want the graph to be. Then identify the number of data points to be plotted, and space them equally along the axis.
4. Draw the *x*- and *y*-axes, and put in the scales.
5. Label the *x*- and *y*-axes.
6. Give a title to the graph.
7. Plot the data points, then join up the points with a line.

Examples

Example 1
The temperature of a patient at the Honiara Referral Hospital was measured several times in one day, and the data are shown in the graph below. The dotted horizontal line is the normal (expected) body temperature.



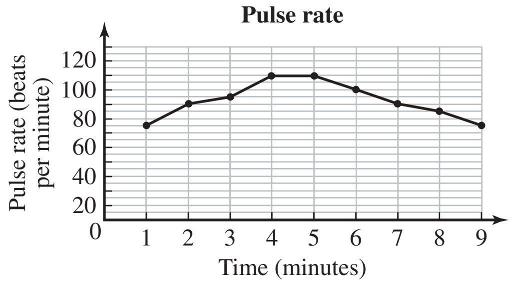
1. What was the highest temperature recorded, and at what time? (39°C, at 9 am and at 1 pm)

2 At what time was the temperature below normal temperature? (8 am)

3 At what times was the temperature normal? (4 pm, 8 am on day 2)

Example 2

Piko's pulse rate was measured before, during and after strenuous exercise. The results are summarised in this line graph.



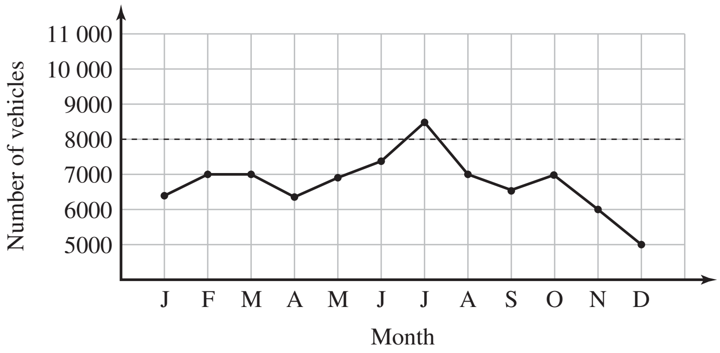
1 What was Piko's highest pulse rate? (110 bpm)

2 When was his pulse rate highest? (between 4 and 5 minutes)

3 How long did Piko's heart take to return to its original rate from the highest rate? (4 minutes)

Activity 5D

1 The graph below shows the number of vehicles crossing the Mataniko Bridge in Honiara each month during 2013. The dotted line shows the expected number.



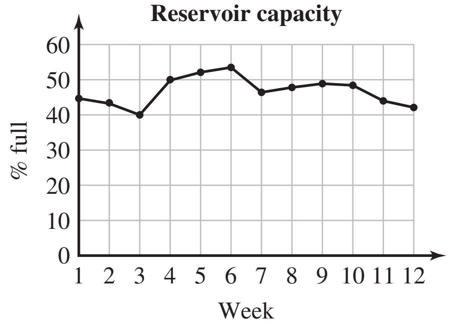
a In what month did the highest number of vehicles cross the bridge?

b In what month did the least number of vehicles cross?

c What was the trend from October to December?

d Did the number of cars crossing the bridge reach the expected figure?

2 Each week, the amount of water in the Kola Ridge Water Reservoir is recorded as a percentage of its maximum capacity. The graph shows the results over a number of weeks.



a How full was the reservoir in Week 4?

b There was heavy rain during a particular week. Which week shows this?

c A large quantity of water was released from the reservoir to flush out the downstream areas. The measurement for which week most likely shows the result of this action?

Answers 5D

1 **a** July

b December

c decreasing

d only in July

2 **a** 50%

b Week 3

c Week 6

5E • Pie graphs

LB Pages 122–123

Specific learning outcomes

Learners should be able to:

7.5.8.1 Read and interpret data collected and represented by pie graphs.

7.5.9.1 Construct pie graphs by converting data collected into number of degrees.

Teaching points

1 Students should be able to read and interpret data given in pie graphs.

2 Students should be able to construct pie graphs using given data.

Suggested teaching approach

- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercise 5E** on page 123 in the LB, and **Activity 5E** in the TG below.

Additional notes

A **sector graph** is often called a **pie graph** because it resembles a pie divided into pieces from the centre of the circle. A pie graph shows how the whole is divided up into different parts.

We calculate the angles at the centre by working out what fraction of 360° they are.

Example

Gerry earns $90 a week from an after-school job. Here is where the money goes:

Tax:	$20
Spending:	$45
Saving:	$25
Total:	$90

Here is how each part (sector) of the pie is calculated:

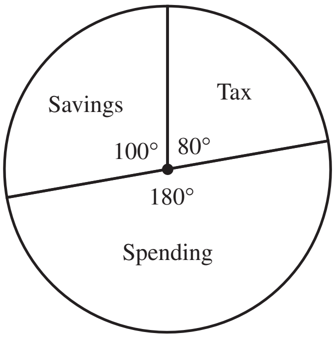
One dollar of earnings equals $\frac{1}{90}$ of the total earnings.

And so one dollar is represented by 4° in a pie chart (because $\frac{1}{90}$ of 360° = 4°).

The angle for tax is therefore 20 × 4° = 80°

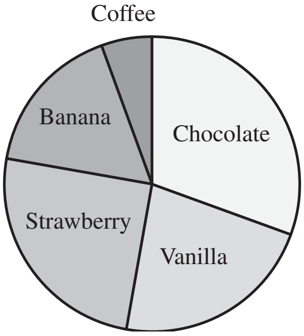
The angle for spending is 45 × 4° = 180°

The angle for saving is 25 × 4° = 100°



Steps to follow when constructing a pie or sector graph

1. Add the various parts to find a total.
2. Divide each part by the total to obtain fractional parts of the whole.
3. Multiply each fraction by 360° to find the sector angle.
4. Use a protractor to divide a circle into the various parts, and draw the graph.
5. Give the graph a title and a key that identifies each of the sectors.



Examples

Example 1

The data in the table represent the number of dried coconut fruits collected by Fred during the week.

Days	Coconut fruits
Monday	78
Tuesday	65
Wednesday	39
Thursday	26
Friday	52

Use the data in the table to draw a pie or sector graph.

Solution

Step 1 Convert the quantities to fractions of the total.

Days	Coconut fruits	Fraction of the whole
Monday	78	$\frac{78}{260}$
Tuesday	65	$\frac{65}{260}$
Wednesday	39	$\frac{39}{260}$
Thursday	26	$\frac{26}{260}$
Friday	52	$\frac{52}{260}$
Total	260	1

1 Add the number of responses to find the TOTAL.

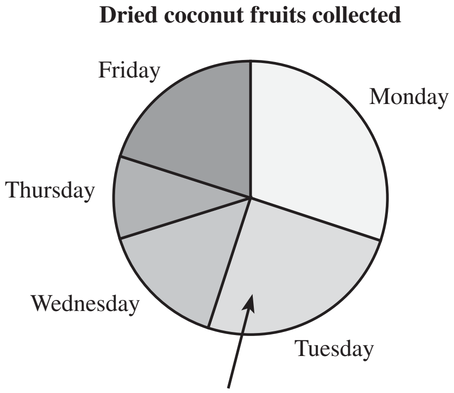
2 Find the fraction of the whole by dividing the number recorded for each type by the total and record your results in a table.

Step 2 Convert the fractions to angles (sectors).

Days	Coconut fruits	Fraction of the whole	Sector angle (°)
Monday	78	$\frac{78}{260}$	108
Tuesday	65	$\frac{65}{260}$	90
Wednesday	39	$\frac{39}{260}$	54
Thursday	26	$\frac{26}{260}$	36
Friday	52	$\frac{52}{260}$	72
Total	260	1	360

3 Multiply the fraction for each type by 360° and round your answer to the nearest degree. Check that the sum of your angles is 360°. (It may be very slightly more or less after rounding.)

Step 3 Draw the pie graph.


Dried coconut fruits collected

4 Rule a line from the centre to the edge of the circle. Use this line and a protractor to measure the sector angles and rule each sector. Give your graph an informative title and provide a key for each of the sectors.

Example 2

Draw a pie graph for the 'Favourite subject' data shown in the table.

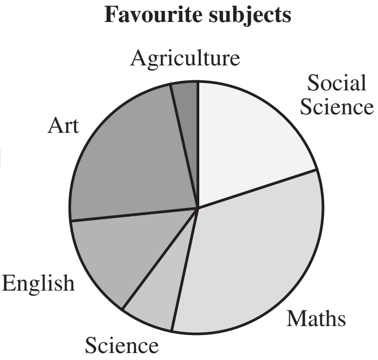
Subject	Frequency	Angle
Social science	6	72°
Mathematics	10	120°
Science	2	24°
English	4	48°
Art	7	84°
Agriculture	1	12°
Total	30	360°

The table indicates that 6 out of 30 learners surveyed consider social science their favourite subject. To find the angle for this in the pie graph:

$\frac{6}{30} \times 360° = 72°$

Show the learners how to calculate the angles for the other subjects.

When we have calculated all the angles, we can carefully draw a pie graph using a protractor.



Activity 5E

1 For the data in each of the following tables, draw a pie graph.

  a Belinda picked some vegetables from her garden and recorded the number of each type of vegetable.

Vegetable	Number
Tomato	20
Pawpaw	12
Cucumber	8
Pineapple	10

  b Fifty people were asked their favourite music style.

Music style	Rock & roll	Hip hop	Techno	Rap	Punk	Pop
Number	10	9	6	3	5	17

2 The pie graph below shows the favourite sports of Year 7 learners at Goldie College.

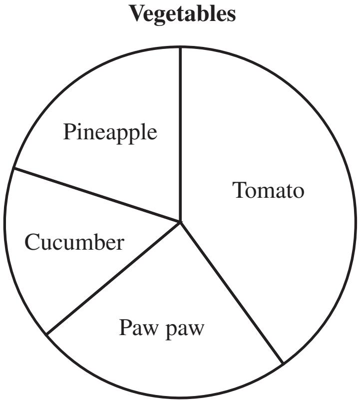
  a Which sport is the most popular?

  b What fraction of learners did not play sport?

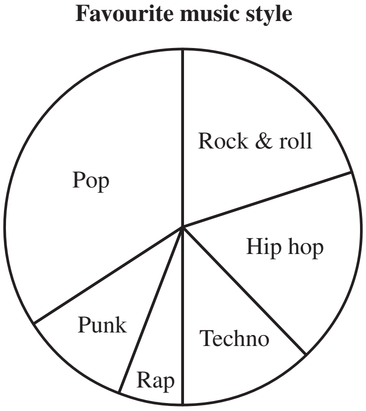
  c Calculate the angle represented by the rugby sector.

Answers 5E

1 a



b



2 a netball b $\frac{1}{10}$ c 72°

5F • Dot plots and the mode

LB Pages 124–126

Specific learning outcomes

Learners should be able to:

7.5.10.1	Identify dot plot graphs.
7.5.10.2	Display given data as a dot plot and identify their frequencies.
7.5.11.1	Find the mode for a set of scores using dot plots.
7.5.11.2	Interpret and analyse dot plot graphs.

Teaching points

1 Learners should know what a dot plot graph is, and be able to identify dot plot graphs.

2 Learners should be able to construct a dot plot graph, and display data on a dot plot graph.

4 Learners should be able to analyse and interpret dot plot graphs.

5 Learners should know what the **mode** is, and be able to find the mode of a given set of scores.

Suggested teaching approach

- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercise 5F** on pages 124–126 in the LB, and **Activity 5F** in the TG below.

Additional notes

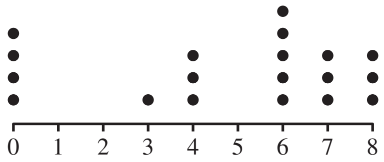
Dot plots

A **dot plot** is a very simple statistical graph where, for each data value, a dot is placed on a scale. When drawing a dot plot, it is important to space the dots evenly, to give an accurate picture of the data set. A dot plot can be used for categorical or discrete data, such as car colour or the number of people who live in each of the houses in a village.

- A dot plot uses a marked scale.
- Each time an item is counted, it is marked by a dot.

Example

This dot plot shows the number of passengers in the school minibus for all the journeys of the bus in one week.



The dot plot shows that there were four journeys with no passengers, and that the highest number of passengers carried was 8.

Mode

The **mode** of a set of numbers is the one that occurs most often.

Example

What is the mode of the numbers {6, 8, 9, 9, 10, 6, 7, 9, 8}?

The mode is 9.

Note: A set of numbers can have no mode, or more than one mode. For example:

- {4, 6, 8, 3, 7, 5} has no mode
- {3, 1, 0, 1, 5, 0, 6} has two modes: 0 and 1

Examples

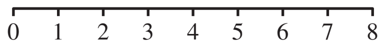
Example 1

Draw a dot plot to illustrate the following data, which represents the number of pets owned by each student in a class:

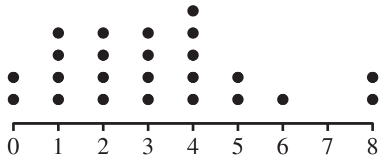
2, 5, 8, 6, 2, 4, 3, 4, 2, 1, 8, 3, 4, 0, 3, 1, 0, 3, 5, 1, 4, 2, 1, 4

To draw the dot plot, follow these steps.

Step 1: Identify the lowest and the highest values, and make these the end points of a scale.



Step 2: Complete the plot by marking a dot for each of the data values, being careful to space them evenly.



Example 2

The results from a survey of the ages of students can be displayed as a dot plot graph. The results were as follows:

10, 11, 11, 12, 12, 12, 13, 13, 13, 13, 13, 13, 14, 14, 14, 14, 15, 15, 16, 16, 16, 16.

To display this data as a dot plot graph:

1 Draw a number line from 10 to 16.

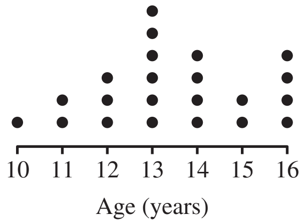
2 Place one dot above 10 (first person).

3 Place two dots above 11 (second and third people), three dots above 12, and so on.

4 Keep the dots evenly spaced, or the picture will not be accurate.

5 Compare your dot plot with the frequency table.

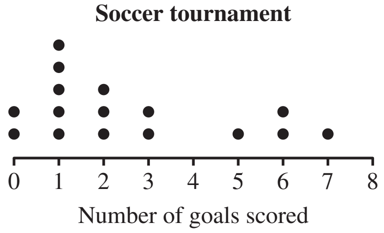
Age	Frequency
10	1
11	2
12	3
13	6
14	4
15	2
16	4
Total	22



The number of dots above the number line should be the same as the number in the frequency column of the table.

Activity 5F

1 This dot plot shows the number of goals scored by each of the 16 teams at a one-day soccer tournament.



- **a** What was the highest number of goals scored by a team?
- **b** How many teams scored two goals?
- **c** What was the most common number of goals scored by these teams?
- **d** How many goals were scored altogether?

2 Write down the mode for each of these sets of numbers:

- **a** {11, 14, 13, 14, 16}
- **b** {6, 33, 8, 9, 38, 12, 41, 19}
- **c** {1, 8, 0, 4, 1, 8, 5, 0, 7, 5, 0, 0, 1, 8}
- **d** {17, 19, 18, 14, 14, 15, 17, 16}

Answers 5F

1 **a** 7
b 3
c 1
d 41 goals

2 **a** 14
b no mode
c 0
d 14 and 17

5G • The mean

LB Pages 127–128

Specific learning outcomes

Learners should be able to:

7.5.12.1 Define and identify mean.
7.5.12.2 Find the mean of a set of scores.
7.5.12.3 Compare sets of scores using the mean from the sets of scores.

Teaching points

1 The **mean** is the average of a set of numbers.

2 To find the mean, add up all the results (the set of scores), then divide the total (the sum of all the scores) by the number of results (the number of scores).

3 Sets of scores can be compared by using the calculated mean of each set of scores.

Suggested teaching approach

- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercise 5H** on pages 127–128 in the LB, and **Activity 5G** in the TG below.

Additional notes

In everyday life, people talk about 'the average temperature' and 'the average number of points a team scored in a basketball match'. The **mean**, commonly known as the **average** of a set of numbers, is a value we use to represent the centre of the data.

The mean of a set of numbers is calculated by dividing the total of the values by how many numbers there are:

$$\text{Mean} = \frac{\text{sum of values}}{\text{number of values}}$$

Examples

Example 1
Calculate the mean of the numbers 3, 8, 9, 11, 0, 11.

There are six values. So to find the mean, add up the total of the values and divide this by 6.

$$\text{mean} = \frac{3 + 8 + 9 + 11 + 0 + 11}{6}$$
$$= \frac{42}{6}$$
$$= 7$$

Note that 0 is included as one of the values.

Example 2
Find the mean of the following set of test results:

9, 4, 5, 7, 8, 7, 2

1 Write down the rule for finding the mean:

$$\text{Mean} = \frac{\text{sum of values}}{\text{number of values}}$$

2 Substitute data into the rule:

$$= \frac{9 + 4 + 5 + 7 + 8 + 7 + 2}{7}$$

3 Simplify and evaluate:

$$= \frac{42}{7}$$

4 Write down the mean:

Mean = 6

Example 3
Find the mean of the following set of data, correct to two decimal places.

The results of a Year 7 mathematics test are:

100, 77, 93, 93, 93, 87, 93, 40, 75, 22, 100, 87, 100, 87, 87, 100, 100, 83, 93, 100, 83, 74, 89, 81, 52, 94

Solution

The total of these results is 2183.

There are 26 students in the class.

$$\text{The mean} = \frac{2183}{26}$$
$$= 83{\cdot}96$$

Activity 5G

1 Calculate the mean for each of these sets of numbers:
  a {4, 8, 12, 4, 1, 1}
  b {40, 50}
  c {21, 0, 19, 20}

2 Calculate the mean for each of these sets of numbers. Give each answer correct to 2 dp.
  a {84, 31, 101, 6, 47, 89, 49, 55, 111, 39, 98}
  b {1083, 417, 37·8, 946}

3 A rugby pack of 8 schoolboy players with a mean weight of 62 kg is pushing against a pack of 6 adult players with a mean weight of 81 kg. Which pack of players is heavier? Explain your answer.

4 Consecutive numbers follow each other in sequence. An example is: 15, 16, 17, 18, 19.
  Four consecutive numbers add up to 34.
  a What is the mean of the numbers?
  b What are the numbers?

5 Jelena and her brother have a mean height of 165 cm. Her brother is 172 cm tall. How tall is Jelena?

Answers 5G

1 **a** 5
  b 45
  c 15

2 **a** 64·55
  b 620·95

3 8 school boys

4 **a** mean = 8·5
  b {7, 8, 9, 10}

5 158 cm

5H • The median and the range

LB Pages 129–130

Specific learning outcomes

Learners should be able to:

7.5.13.1 Define median and range of the set of scores.
7.5.13.2 Find the median of a set of scores.
7.5.14.1 Find the range of the set of scores.

Teaching points

1. The **median** is the middle number in a set of scores or numbers.
2. The **range** is the difference between the highest and the lowest score in a set of data.
3. Learners should be able to find the median and the range of a set of scores.

Suggested teaching approach

- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercise 5H** on pages 129–130 in the LB, and **Activity 5H** in the TG below.

Additional notes

Median

The median is the *middle* value of an ordered data set.

To calculate the median:

1. Arrange the data set in ascending order.
2. Count the number of data values.
3. If the number of values is odd, select the middle value. If the number of values is even, select the two middle values. Add them together and divide by 2.

   Example The median of the numbers {0, 9, 31, 38, 42} is 31.

Range

The range is the difference between the highest and lowest values.

Example The range of a set of temperatures with the highest value 24·6°C and the lowest value 15·6°C is 9°C.

Examples

Example 1
Calculate the median of these temperatures:

18·9, 15·6, 22·1, 20·3, 17·0, 16·9, 24·6, 17·1

First arrange the values in ascending order.

15·6, 16·9, 17·0, 17·1, 18·9, 20·3, 22·1, 24·6

There are two middle values, so the median is half way between the two.

Median = $\frac{17{\cdot}1 + 18{\cdot}9}{2} = \frac{36}{2}$ = 18°C

Example 2
The results of a Year 7 mathematics test are:

100, 77, 93, 93, 93, 87, 93, 40, 75, 100, 87, 100, 87, 87, 22, 100, 100, 83, 93, 100, 83, 74, 89, 81, 52, 94

Mary got 93. Use the median to compare her results with the rest of the group.

Solution

To find the median, first write the results in ascending order:

22, 40, 52, 74, 75, 77, 81, 83, 83, 87, 87, 87, 87, 89, 93, 93, 93, 93, 93, 94, 100, 100, 100, 100, 100, 100.

There are 26 results. The middle pair is the 13th and 14th results. These are 87 and 89. So the median is $\frac{87 + 89}{2}$ = 88.

Mary's result was higher than the median.

Example 3
Find the range for the set of data given in Example 2.

Solution

The highest value is 100.
The lowest value is 22.
The range = 100 – 22 = 78.
There is a large variation in these test results.

Activity 5H

1. Write down the median of each of these sets of numbers:
   a {12, 19, 22, 28, 31}
   b {0, 6, 9, 11, 19, 20}
2. Write down the range of each set of numbers in Question 1.
3. Write these sets of numbers in ascending order, then write down their median:
   a {49, 62, 31}
   b {7, 5, 9, 8, 3, 1, 8, 6, 5}
   c {31, 38, 27, 59, 41, 30}
4. Write down the range of each set of numbers in Question 3.

Answers 5H

1 **a** 22 **b** 10
2 **a** 19 **b** 20
3 **a** {31, 49, 62}; median = 49
b {1, 3, 5, 6, 7, 8, 8, 9}; median = 6
c {27, 30, 31, 38, 41, 59}; median = 34·5
4 **a** 31 **b** 8 **c** 32

5I • Stem-and-leaf plots

LB Page 131

Specific learning outcomes

Learners should be able to:

7.5.15.1 Identify a stem-and-leaf plot and its features.
7.5.15.2 Find median and range using a stemplot.
7.5.16.1 Tabulate and display information (data) using stem-and-leaf format.

Teaching points

1. Learners should be able to identify a stem-and-leaf plot (stemplot) and its features, and use it to tabulate data.
2. Learners should be able to use a stem-and-leaf plot to find the median and the range.

Suggested teaching approach

- Start the chapter section by doing the **Starter activities** provided.
- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercise 5I** on page 131 in the LB, and **Activity 5I** in the TG below.

Additional notes

A **stem-and-leaf plot** summarises a group of numbers. Here is how a stem-and-leaf plot works for a collection of two-digit numbers:

- The tens digits are placed in the vertical stem.
- The units or last digits are placed in the horizontal leaves.
- In an ordered stem-and-leaf plot, the numbers in the leaf are written from smallest to largest.

Examples

Example 1

The points scored by the Renbel Provincial Basketball Team during the Solomon Games in Auki were:

67, 85, 56, 69, 99, 97, 59, 65, 84, 97, 49, 72, 89, 78, 66, 81, 92, 88, 87, 73, 79, 85, 82, 53, 61

If you display these scores in the order in which they were listed, on a stem-and-leaf plot, they look like this:

Basketball scores

4 | 9 means 49

4	9
5	6 9 3
6	7 9 5 6 1
7	2 8 3 9
8	5 4 9 1 8 7 5 2
9	9 7 7 2

Rewriting the leaves in numerical order produces an ordered stem-and-leaf plot:

Basketball scores

4	9
5	3 6 9
6	1 5 6 7 9
7	2 3 8 ⑨
8	1 2 4 5 5 7 8 9
9	2 7 7 9

We can use this ordered stem-and-leaf plot to find the median, because it resembles a list. There are 25 results in this table. We know this by counting the leaves. The middle number in the list is the 13th leaf, counting across the stem-and-leaf plot.

The 13th leaf is the 9 shown circled, and 7 | 9 means 79, so the median score is 79.

Example 2

Several villages in the Arosi district in West Makira, Makira Province, were surveyed to find out how many dried coconuts each village collected each morning for the Arosi District Copra Project. The results are given below.

89, 79, 105, 53, 92, 99, 72, 81, 53, 90, 42, 111, 85, 56, 79, 69, 119, 68, 99, 64, 49, 55

These results can be organised in order using a stem-and-leaf plot to show the data from smallest to largest:

4	2 9
5	3 3 5 6
6	4 8 9
7	2 9 9
8	1 5 9 9
9	0 2 9 9
10	5
11	1 9

The median is the middle number in the list. In this example it is the 12th value, which is 79. This means 79 coconuts.

Activity 5I

1 Janet is interested in genealogy. She has studied her family tree to get information about her possible life expectancy. This stem-and-leaf plot shows for how many years some of her recent ancestors lived.

0	0 6
1	
2	3
3	
4	
5	9
6	4 5 6 7
7	3 3 4 4 5 8 9
8	0 0 1 2 3
9	2 4 4 5
10	0 1

  a How many of Janet's ancestors reached 100 years of age?

  b How many people's ages are shown altogether?

  c Is it likely or unlikely that Janet will reach 70 years of age? Explain your answer.

  d One of Janet's cousins died at 6 months of age. Circle the number that represents this cousin's age.

2 Here are the times (to the nearest minute) that the triathlon competitors clocked during the swimming competition at the Kakabona beach, at one of their weekend competitions.

43	39	29	72	19	53	24	31	22	26
29	78	27	55	21	61	25	86	18	37
32	38	22	60	24	19	40	26	38	26

Construct an ordered stem-and- leaf plot for these data.

  a What was the lowest time for the race?

  b What was the winner's time?

3 This stem-and-leaf plot shows the ages of elephants in some zoos. Write down the median age.

0	1 1 2 5 9
1	0 8 9
2	4 7 8
3	3
4	0 2 5
5	6
6	3

Answers 5I

1 **a** 2

  b 26

  c likely; 18 of the 26 ancestors lived past 70 years of age

  d 0 | 0

2

1	8 9 9
2	1 2 2 4 4 5 6 6 6 7 9 9
3	1 2 7 8 8 9
4	0 3
5	3 5
6	0 1
7	2 8
8	6

3 24 (the 9th value)

5J • Venn diagrams

LB Pages 132–134

Specific learning outcomes

Learners should be able to:

7.5.17.1 Identify different parts of the Venn diagram.
7.5.17.2 Interpret and analyse data that are given in a Venn diagram.
7.5.18.1 Identify elements that are shared and classified in both circles which appear in the intersection area of the Venn diagram.

Teaching points

1. Learners should be able to identify a Venn diagram and its features.
2. Learners should be able to analyse and interpret information given in a Venn diagram.
3. Learners should be able to identify elements that are in Venn diagrams.

Suggested teaching approach

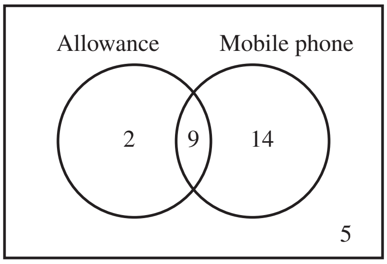
- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercise 5J** on pages 133–134 in the LB, and **Activity 5J** in the TG below.

Additional notes

A **Venn diagram** shows sets of categorical data. Sometimes the sets overlap.

Example

There are over 30 students in a class: 11 get an allowance (pocket money) from their parents, and 23 have their own mobile phone. Nine (9) students are in both categories – that is, they get an allowance *and* have their own mobile phone. Five (5) students are in neither category – they do not get an allowance and they do not have a mobile phone. This is shown in the Venn diagram below.



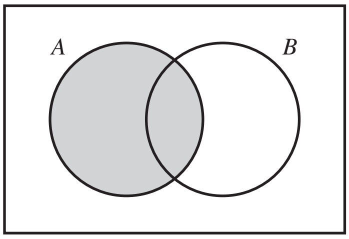
Notice that the numbers in each circle add up to the total in each category.

Examples

Example 1

Give students a page of 6–10 Venn diagrams and get them to practise shading the correct area, such as:

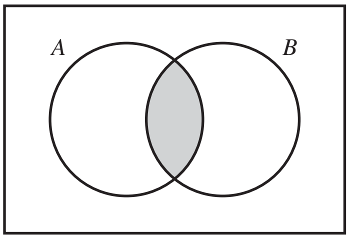
a in *A*



A

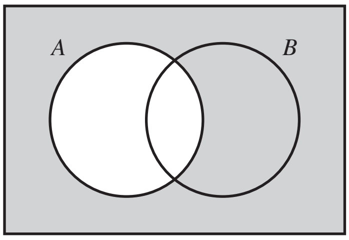
b in *B*

c in both *A* and *B*



$A \cap B$

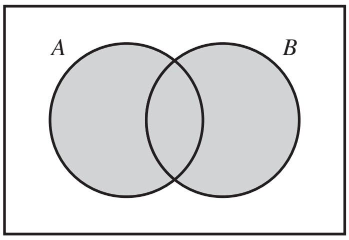
d *A*′ (this means the complement of *A* – those things that are not in *A*)



A'

e *B*′

f in *A* or *B*



$A \cup B$

Example 2

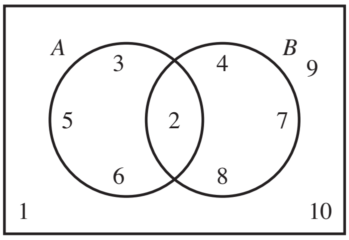
Sets *A* and *B* contain the following elements from the numbers 1 to 10 inclusive.

$A = \{2, 3, 5, 6\}$

$B = \{2, 4, 7, 8\}$

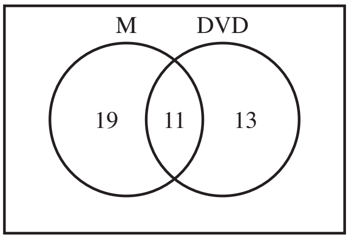
Set this information out in a Venn diagram.

Solution



Activity 5J

1 This Venn diagram shows the results of a survey about whether each of 50 teenagers had been to the movies (M) or hired a DVD in the past month.



a How many had been to the movies?

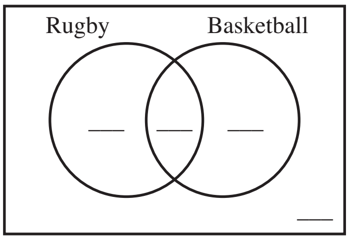
b How many had hired a DVD?

c Shade the region in the diagram that represents the teenagers who had done both.

d How many students had done neither?

2 A survey of 100 students at a high school showed that 19 played only rugby, 12 played only basketball and 2 played both rugby and basketball.

a Use this information to complete the Venn diagram. Write the correct numbers in the four positions.



b How many students played basketball but did not play rugby?

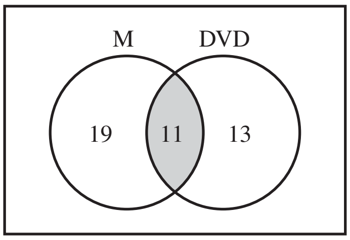
c Explain what the region outside both circles represents.

Answers 5J

1 **a** 30

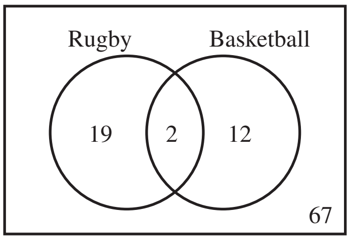
b 24

c



d 7

2 **a**



b 12

c Students who played neither rugby or basketball

5K • Two-way tables

LB Pages 135–137

Specific learning outcomes

Learners should be able to:

7.5.19.1 Read information from two-way tables and construct two-way tables to display categorical data

Teaching points

1 Learners should be able to identify a **two-way table** and its features.

2 Learners should able to construct a two-way table to display data.

Suggested teaching approach

- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercise 5K** on pages 135–137 in the LB, and **Activity 5K** in the TG below.

Additional notes

Some kinds of categorical data can be displayed in a two-way table.

Example

A survey was taken of 200 participants during the Pasifika Festival of Arts held in Honiara, Solomon Islands. Participants were asked whether they wanted to visit Doma in West Guadalcanal or Gizo in the Western Province. The two-way table summarises the results.

	Plan to visit Doma	Do not plan to visit Doma	Total
Plan to visit Gizo	16	17	33
Do not plan to visit Gizo	28	139	167
Total	44	156	200

The table shows that 44 of the group plan to visit Doma.

Activity 5K

1 The table below shows the sports played by boys at a primary school. Some of the numbers in this two-way table are missing. Use addition and/or subtraction to complete the table.

	Play netball	Do not play netball	Total
Play soccer	57	12	
Do not play soccer			
Total	68		110

Answers 5K

1

	Play netball	Do not play netball	Total
Play soccer	57	12	69
Do not play soccer	11	30	41
Total	68	42	110

• Chapter Six •

Algebra Symbols

Overview

Algebra is a language used by mathematicians to communicate mathematical ideas and information clearly. It uses letters and symbols to communicate general rules that are found from patterns. These rules enable us to solve problems by manipulating the letters and symbols and using the four operations.

Learners need to learn this language in the same way that they learn any other language – they need to learn the words and conventions (rules that everyone agrees to follow) that will help them to read, speak, write and understand mathematics.

Mathematical statements are called expressions, and these are made up of terms that can be simplified. Expressions can be evaluated by substituting values into them, expanding brackets or using a formula that connects all the terms in an expression or an equation. This chapter looks at how mathematical terms, expressions and variables are created and how they are manipulated to give results. It also provides an avenue for learners to recognise patterns, terms, expressions and equations, to understand the relationships between them, and to solve equations.

Contents

Chapter skills

This chapter covers the following skills:

- Simplifying expressions and collecting like terms
- Working with symbols and pronumerals
- Translating verbal statements into mathematical expressions
- Substituting into expressions
- Writing algebraic rules
- Applying the distributive law $a(b + c) = ab + ac$
- Using a graphics calculator to evaluate expressions and store values
- Exploring triangular, square and pentagonal numbers
- Applying simple formulas
- Deducing a formula in a modelling situation and testing its validity.

Teaching plan

Lessons	Chapter sections	Class work and home work
1	• Intro • 6A: Writing expressions	Learner's Book 1 • Exercise 6A, pages 150–151
2	• 6B: Pronumerals	Learner's Book 1 • Exercise 6B, pages 152–153
3–5	• 6C: Multiplying and dividing pronumerals	Learner's Book 1 • Exercise 6C, pages 154–155
6–7	• 6D: The distributive law: Expanding brackets	Learner's Book 1 • Exercise 6D, pages 156–157
8–9	• 6E: Substituting into expressions	Learner's Book 1 • Exercise 6E, pages 158–159
10–11	• 6F: Exploring dot patterns	Learner's Book 1 • Learner's task 6F, page 160
12–13	• 6G: Exploring match patterns	Learner's Book 1 • Exercise 6G, page 161
14–15	• 6H: Rules and formulas	Learner's Book 1 • Exercise 6H, pages 162–163
15	• Revision/test	Learner's Book 1 • Revision/Assessment, Exercises 6A–6F, 6H, pages 170–171 Teacher's Guide • Chapter 6 test, page 169

General learning outcomes

Learners should:

Writing expressions

7.6.1 Understand that algebra is part of maths where verbal statements of problems are expressed using mathematical symbols. (U)

7.6.2 Know how to express verbal statements as mathematical expressions. (K)

7.6.3 Understand that symbols in an algebraic expressions can be simplified by grouping the same symbols together. (U)

Pronumerals

7.6.4 Know that letters are being used as pronumerals to represent missing values in an expression. (U)

7.6.5 Know how to group or put together same letters or objects. (U)

Multiplying and dividing pronumerals

7.6.6 Know how to simplify expressions by multiplying them. (U)

7.6.7 Know how to simplify algebra expressions by dividing them. (U)

Distributive law

7.6.8 Know how to apply the Distributive Law to algebraic expressions which can be expanded by removing brackets. (U)

Substituting into expressions

7.6.9 Understand that when values are substituted into an expression it is evaluated to give a result. (U)

Exploring patterns

7.6.10 Know how to create patterns using dots and matchsticks. (U)

Rules and formulas

7.6.11 Understand that when an equals sign is used in an expression, the result becomes a 'result'. (U)

6A • Writing expressions

LB Pages 150–151

Specific learning outcomes

Learners should be able to:

7.6.1.1 Define 'algebra'.

7.6.1.2 Define 'terms' and 'expressions'.

7.6.2.1 Translate maths problem statements into algebraic expressions by using symbols and objects.

7.6.3.1 Use symbols, pronumerals and other objects to create mathematical expressions by grouping same symbols, pronumerals and objects together.

Teaching points

1. **Algebra** is a branch of mathematics that looks at the structure and relationships of letters and objects used to represent numbers and values, and how they are **evaluated** by manipulating the four basic operations.
2. A **term** is a component, or part, of a mathematical expression.
3. An **expression** is a mathematical statement. It is made up of more than one term separated by addition and subtraction signs.
4. Symbols can be used to change mathematical statements into expressions.
5. Symbols, objects, pronumerals and variables can be used to represent missing numbers and values.
6. Symbols, pronumerals and terms can be grouped together to create mathematical expressions.

Suggested teaching approach

- Start the chapter section by doing the **Starter activities** provided.
- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB or TG.
- Learners complete **Exercise 6A** on pages 150–151 in the LB, and **Activity 6A** in the TG below.

Starter activities

Starter Activity 1: Think of a number

Play this game with equations that have one variable only, for addition and subtraction. For example:

I am thinking of a number. I add 5 to it to give a total of 12. What was the number I was thinking of?

$x + 5 = 12$

Therefore $x = 7$

Additional notes

The language of algebra

To be competent in working with algebra, it is important that learners understand the terms in the following list.

Constant

A **constant** is a number by itself. Here are some examples of constants: 2, 9, ⁻37, 4·6

Term

A **term** is part of a mathematical expression. It can have one or more pronumerals, or it can be just a number. For example, mn means $m \times n$ and is the same as $n \times m$ or nm. The pronumerals are often multiplied by a number that is written first.

Here are some examples of terms: $5a$, $7q$, $3pr$, z, abc, 4, $^-2{\cdot}32x$

Coefficient

A **coefficient** is a number written in front of a pronumeral. It includes the sign (+ or –) of the number. For example: in $9x$, the coefficient of x is 9. In $9x - 3y$, the coefficient of y is ⁻3.

Expression

An **expression** is a mathematical statement. It is made up of more than one term, separated by addition and/or subtraction signs. For example, the expression $5a + 7q -12$ has three terms. An expression can also consist of just one term. For example, $5a$ or 4 could each be called an expression.

Here are some more examples of algebraic expressions: $x + 3$, $2x$, $2x + 3$, $5a + 7q$, $5a + 7q - 12$, $9xy - z$, $2(p - 7)$, $2x + 49$, $^-3t \times 5p \div 10$

Equation

An **equation** contains an equals (=) sign. It is made by writing two expressions that are equal to each other. An equation has a left-hand side (LHS) and a right-hand side (RHS), on either side of the equals sign.

Here are some examples of equations:

$9xy + z = 17$

$y = 6h$

$2(p - 7) = p + 10$

$3xy - 7z^2 + 5 = 16 + x$

- Each of these is an equation because it has an equals sign.
- h, p, x, y and z are **pronumerals**. Pronumerals represent variables.

In the equation:

$3xy - 7z^2 + 5 = 16 + x$

- 3 is the coefficient of xy and ⁻7 is the coefficient of z^2.
- $3xy - 7z^2 + 5$ and $16 + x$ are expressions.
- $3xy$, $^-7z^2$, 5, 16 and x are all terms.
- 5 and 16 are constants.

Note: The four operations (+, –, × and ÷) are used to separate terms in an expression. The tables below show examples of using the operations in an expression.

Examples using + and –

Expressed in English	Algebraic expression
A number with 6 added on	$x + 6$
The result of taking 2 away from a number, or '2 less than a number'	$x - 2$

Examples using × and ÷

Expressed in English	Algebraic expression
7 lots of x, or 7 times x	7x
x divided by 15	$\frac{x}{15}$

Notice that in the algebraic expressions above, we do not use the × or ÷ symbol.

Algebraic conventions

Mathematicians like to write algebra as simply as possible, and so it is acceptable to leave out the × symbol between a number and a pronumeral and between different pronumerals. This means we can write $2 \times n$ as $2n$, and $x \times y$ as xy. It has also been agreed that the ÷ symbol can be replaced by a fraction bar, and so $n \div 2$ is written as $\frac{n}{2}$. Decisions like this are called algebraic conventions.

Algebraic conventions ensure that all mathematicians use the same mathematical language. Some conventions used in algebra are listed below.

- When working with variables, the same words are used to describe the four operations as when working with numbers:
  + add, sum, total
  – subtract, less than, minus
  × multiply, product, lots of
  ÷ divide, quotient, share equally.
- The order of operations, including the use of brackets, is also the same.
- Leave out the × symbol between a number and a pronumeral, and between different pronumerals (e.g. $2 \times n$ is written as $2n$, and $n \times y$ is written as ny).
- Replace ÷ with a fraction bar (e.g. $n \div 2$ is written as $\frac{n}{2}$).
- Numbers are always written in front of the pronumeral (e.g. $n \times 2$ is written as $2n$).
- When multiplying more than one pronumeral, write the letters in alphabetical order (e.g. $f \times a \times c \times e$ is written as $acef$).
- Brackets change the order of operations. For example, they can show that addition or subtraction needs to be done before multiplication or division.
- Brackets can be left out when using a fraction bar. For example, $(a + b) \div 2$ can be written as $\frac{a+b}{2}$.
- When a pronumeral is raised to a power, we use the same notation as we do for numbers (e.g. $2 \times 2 \times 2 \times 2 = 2^4$, so we write $c \times c \times c \times c = c^4$ and p squared as p^2).
- Constants are usually, but not always, written last in an expression (e.g. $6a + 7$).

Examples

Example 1

Think of two different numbers, x and y. Write an expression representing half the sum of the two numbers.

Solution $x + y$ represents the sum of the two numbers, so $\frac{1}{2}(x + y)$ represents half of the sum of the two numbers. Because half of the sum is the same as the sum divided by 2, alternative answers are $(x + y) \div 2$ and $\frac{x+y}{2}$.

Activity 6A

1 Write an algebraic expression for each of these:

a a number with 1 subtracted from it

b a number multiplied by 9

c a number with 100 added to it

d a number divided by 22

2 Write the following situations using algebra.

a There are p books in Jacob's basket. How many books are left after Jacob takes out three for class?

b There are k people in the line to the dining hall. Nine more people join the end of the line. How many people are lined up now?

c A group of 4 people won a prize of x dollars, which they shared equally. How much did each person receive?

3 Write these expressions without using multiplication or division signs:

a $2 \times x$

b $x \div 3$

c $50 \times y$

d $6 \div x$

4 Explain in words what these expressions mean:

a $p - 4$

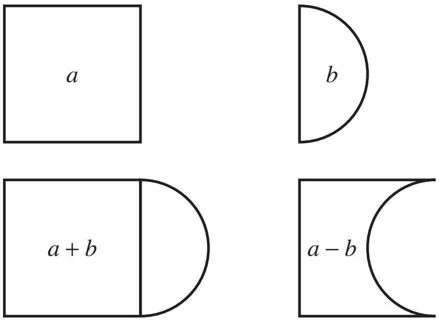
b $\frac{p}{4}$

5 Explain what we use instead of a ÷ sign in algebra.

Additional activity

6 Area algebra, like the example shown below, can be used to represent any given algebraic expressions.

Encourage learners to write down five algebraic expressions of their own and illustrate them.



Answers 6A

1 **a** $x - 1$

b $x + 100$

c $\frac{x}{22}$

2 **a** $x - 3$

b $x + 9$

c $\frac{x}{4}$

3 **a** $2x$

b $\frac{x}{3}$

c $50y$

d $\frac{6}{x}$

4 **a** Four subtracted from a number

b A number divided by 4

5 A division is written as a fraction

6 Answers will vary

6B • Pronumerals

LB Pages 152–153

Specific learning outcomes

Learners should be able to:

7.6.4.1 Define ‘pronumerals’ and ‘variables’.

7.6.4.2 Use letters to represent missing numbers.

7.6.5.1 Simplify expressions by matching and grouping objects, symbols etc. of the same kind.

Teaching points

1. It is vital that learners understand the terms *pronumeral* and *variable* so that they are not confused about when and where to use them in algebra.
2. Learners must know how letters are used in algebra – letters (pronumerals) are used to represent unknown values.
3. Learners must be able to identify the letters, so they can group the correct pronumerals together.

Suggested teaching approach

- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercise 6B** on pages 152–153 in the LB, and **Activity 6B** in the TG below.

Additional notes

Pronumerals

A **pronumeral** (also know as a **variable**), is a letter that is used to represent a number (or numeral) in a problem. An **unknown** is the actual number that the pronumeral represents.

For example, the formula for the area of a rectangle is:

Area of a rectangle = length × width

If:

A represents the area of the rectangle

l represents the length of the rectangle and

w represents the width of the rectangle,

then we can write the formula for the area of the rectangle as follows:

$A = l \times w$

In this formula, the letters A, l and w are pronumerals.

Variables

An unknown number is described as a variable if its value can change.

For example, using algebra, we can use x as a pronumeral to represent an unknown number of lollies in a packet. If the number of lollies in the packet can vary, then x is called a variable.

If we are given 3 extra lollies, we now have $x + 3$ lollies.

If we buy another identical packet of lollies, we have $x + x$, or $2 \times x$ lollies.

If we have 2 identical packets and 3 extra lollies, we have $2 \times x + 3$ lollies in total.

Like and unlike terms

When we have different variables, we need to use different pronumerals.

For example, if we represent the number of boys in a class with the pronumeral b, we need to use a different pronumeral, such as g, to represent the number of girls in the class. The total number of students in the class is the sum of the two unknowns and can be written as $b + g$.

Any two letters can be used to represent the number of boys and girls, so the number of students in the class could be written as $x + y$ or $p + r$.

When adding or subtracting several lots of the same number, we can simplify.

Examples

$p + p + p + p + p = 5p$

$8x - 7x = x$

Like terms are those that include exactly the same letter or combination of letters. Examples of like terms:

x and $5x$

$6p$, $8p$, $5p$

ab, $10ab$, ^-2ab

Examples of **unlike terms**:

$4x$, 7

$3x$, $3y$

Like terms can be grouped together and added or subtracted.

Example: Simplify $8x + 5 + x + 2$

$$\begin{aligned} 8x + 5 + x + 2 &= (8x + x) + (5 + 2) \\ &= 9x + 7 \end{aligned}$$

Note that $9x$ and 7 are unlike terms, so $9x + 7$ is the final answer. It cannot be simplified any further.

Expressions with like terms can have both addition and subtraction. These operations go with the terms on their *right*.

Example: Simplify $2x + y - x + 8y$

$$\begin{aligned} 2x + y - x + 8y &= (2x - x) + (y + 8y) \\ &= x + 9y \end{aligned}$$

Examples

Example 1

Simplify the following expression:

$x + x + x + x + x$

Solution

$x + x + x + x + x = 5x$

Example 2

Simplify the following expression:

$2xyz + 5xyz + yxz$

Solution

$2xyz + 5xyz + yxz = 8xyz$

Example 3

Simplify the following expression:

$3a + 9 + 6b - 4 + 2a - 5b + 2c$

Solution

$$\begin{aligned} &3a + 9 + 6b - 4 + 2a - 5b + 2c \\ &= 3a + 2a + 6b - 5b + 9 - 4 + 2c \\ &= 5a + b + 2c + 5 \end{aligned}$$

Example 4

Write each of the following using algebra:

- **a** the product of e, f and 7.
- **b** c is divided by 4, then 1 is subtracted.
- **c** The sum of x and 5 is *multiplied* by 3.

Solution

- **a** 'Product' means multiply. Write the number first, then the pronumerals in alphabetical order, with no multiplication signs between them. ($7ef$)
- **b** Division is done first, then subtraction. Use a fraction bar to show division. ($\frac{c}{4} - 1$)
- **c** Addition is done first, then multiplication. Brackets are needed to show this order of operations. ($3(x + 5)$)

Activity 6B

1. Write each of the following using algebra:
   - **a** the sum of x and 2
   - **b** the product of 4 and y
   - **c** t is subtracted from 5
   - **d** the quotient when k is divided by 7
   - **e** the product of h, 6 and g
   - **f** d is multiplied by 10, then 8 is added
   - **g** 8 is added to d, and the result is multiplied by 10
   - **h** the sum of y and 9 is divided by 4
   - **i** the sum of r, s and t is divided by 3, then 11 is added
   - **j** y is multiplied by itself, then 20 is added
   - **k** x is squared, *then* multiplied by 8
2. Nadine has 7 bags with x lollies in each bag, plus 9 extra lollies. Use algebra to write the total number of lollies Nadine has altogether.
3. The sum of z and 6 is divided by 2. Write this using algebra.
4. Write these expressions as simply as possible:
   - **a** $c + c + c + c + c + c$
   - **b** $y + y + y$
   - **c** $x + x$
5. Simplify the following:
   - **a** $3h + 5h$
   - **b** $4x - x$
   - **c** $x + 2x$
   - **d** 15y – 6y
   - **e** $10x + x + 2x$
   - **f** $20x + 4x - 6x$
   - **g** $x + 5x - 3x$
   - **h** $10x - 7x + 3x$
   - **i** $5x - 2x - x$
6. Mr and Mrs Smith each have a car. Mr Smith's car has needed 6 tyres and 2 batteries since new. Mrs Smith's car has needed 9 tyres and 1 battery.
   - **a** How many tyres and batteries have the Smiths needed altogether?
   - **b** Use t to stand for tyre and b to stand for battery. Write down an expression and then simplify it to show how to get your answer to part **a**.

Answers 6B

1 **a** $x + 2$ **b** $4y$ **c** $5 - t$

d $\frac{k}{7}$ **e** $6gh$ **f** $10d + 8$

g $10(d + 8)$ **h** $\frac{y + 9}{4}$ **i** $\frac{rst}{3} + 11$

j $y^2 + 20$ **k** $8x^2$

2 $7x + 9$

3 $\frac{z + 6}{2}$

4 **a** $6c$ **b** $3y$ **c** $2x$

5 **a** $8h$ **b** $3x$ **c** $3x$

d $9y$ **e** $13x$ **f** $18x$

g $3x$ **h** $6x$ **l** $2x$

6 **a** 15 tyres and 3 batteries

b $6t + 2b + 9t + b = 15t + 3b$

6C • Multiplying and dividing pronumerals

LB Pages 154–155

Specific learning outcomes

Learners should be able to:

7.6.6.1 Simplify expressions by multiplying their algebraic terms.

7.6.7.1 Simplify expressions by dividing their algebraic terms.

Teaching points

1. When terms are multiplied, they can be simplified.
2. When terms are divided, terms and numbers with a common factor can be cancelled out.
3. Division is normally expressed as 'bar division'.

Suggested teaching approach

- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercise 6C** on pages 154–155 in the LB, and **Activity 6C** in the TG below.

Additional notes

When simplifying an expression that has multiplication, do the following steps:

1. Remove the multiplication sign and then put the terms together.
2. When numbers and letters are multiplied together, do the following:
   - Multiply whole numbers or coefficients like ordinary numbers.
   - Remove the multiplication sign.
   - Put the letters or variables together.

These rules are summarised in the table.

Rule for multiplying	Example
If there are any numbers in the expression, multiply them.	$5 \times 6x = 30x$
If there is more than one letter, write the letters in alphabetical order.	$2q \times 7p = 14pq$
Place numbers in front of letters.	$x \times 3y = 3xy$

In algebra, we leave out the multiplication sign and put together letters and numbers that are multiplied together.

For division, coefficients (numbers that are in front of letters) can be simplified by cancelling them, like any ordinary division using a common factor.

Example: Simplify $\frac{25x}{20}$

$$\frac{25x}{20} = \frac{5 \times 5x}{5 \times 4} = \frac{5x}{4}$$

Examples

1 Simplify: $3 \times x$

Solution: $3 \times x = 3x$

2 Simplify: $2 \times x \times z$

Solution: $2 \times x \times z = 2xz$

3 Simplify: $4x \times 3y$

Solution: $4x \times 3y$
$= 4 \times x \times 3 \times y$
$= 4 \times 3 \times x \times y$
$= 12xy$

4 Simplify: $5x \times 7x$

Solution: $5x \times 7x$
$= 5 \times 7 \times x \times x$
$= 35x^2$

5 Simplify: $x \div 5$

Solution: $x \div 5 = \frac{x}{5}$

6 Simplify: $7x \div y$

Solution: $7x \div y = \frac{7x}{y}$

7 Simplify: $20a \div 5$

Solution: $20a \div 5$
$= \frac{20a}{5}$
$= 4a$

8 Simplify: $b \times 6 \div a$

Solution: $b \times 6 \div a = \frac{6b}{a}$

Activity 6C

1 Simplify these expressions:

a $6 \times 2x$
b $5 \times x$
c $p \times q$
d $7 \times 2x$
e $d \times 3c$
f $4x \times y$

2 Write these expressions without multiplication signs:

a $3 \times x + 2$
b $8 \times q + 5$
c $1 \times y - 6$
d $10 \div 2 \times x$
e $p \times q + 1$

3 Circle the algebraic fraction that cannot be simplified:

A $\frac{2x}{10}$ **B** $\frac{10x}{2}$ **C** $\frac{25x}{24}$

4 Simplify these algebraic fractions by cancelling common factors:

a $\frac{3x}{12}$
b $\frac{12y}{18}$
c $\frac{21x}{14}$
d $\frac{32}{4x}$

Answers 6C

1 a $12x$
b $5x$
c pq
d $14x$
e $3cd$
f $4xy$

2 a $3x + 2$
b $8q + 5$
c $y - 6$
d $5x$
e $pq + 1$

3 C

4 a $\frac{x}{4}$
b $\frac{2y}{3}$
c $\frac{3x}{2}$
d $\frac{8}{x}$

6D • The Distributive Law: Expanding brackets

LB Pages 156–157

Specific learning outcomes

Learners should be able to:

7.6.8.1 Use the Distributive Law to expand expressions with brackets, e.g. $a(b + c) = ab + ac$

Teaching points

The **Distributive Law** says that, to remove the brackets from an expression, multiply the term outside the brackets by each term inside the brackets. Removing the brackets in this way is known as **expanding** the brackets.

Suggested teaching approach

- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercise 6D** on pages 156–157 in the LB, and **Activity 6D** in the TG below.

Additional notes

An expression such as 7(3 + 10) can be worked out in two ways. Usually we would calculate the part inside the brackets first:

$$\begin{aligned} 7(3 + 10) &= 7 \times 13 \\ &= 91 \end{aligned}$$

However, we get the same result if we multiply each number inside the brackets by 7, and do the adding last:

$$\begin{aligned} 7(3 + 10) &= 7 \times 3 + 7 \times 10 \\ &= 21 + 70 \\ &= 91 \end{aligned}$$

This process of removing the brackets is called expanding brackets. It also works in algebra.

Examples

1 Expand the brackets in $8(x + y)$.

Solution: $8(x + y) = 8x + 8y$

2 Expand the brackets in $10(p - q)$.

Solution: $10(p - q) = 10p - 10q$

Remember the rules for multiplying pronumerals when there are letters in front of the brackets.

Examples

1 Expand the brackets in $p(x + y)$.

$p(x + y) = px + py$

2 Expand the brackets in $x(3x - 4y)$.

$x(3x - 4y) = x \times 3x - x \times 4y = 3x^2 - 4xy$

3 Expand the brackets in $3x(x + 2)$.

$3x(x + 2) = 3x \times x + 3x \times 2 = 3x^2 + 6x$

4 Expand the brackets in $4x(2x - 5)$

$4x(2x - 5) = 4x \times 2x - 4x \times 5 = 8x^2 - 20x$

In some cases you can simplify further by collecting like terms after expanding.

Example

Expand and simplify $3(x + 2y) + 4(3x - 5y)$.

$3(x + 2y) + 4(3x - 5y)$
$= 3x + 6y + 12x - 20y$
$= (3x + 12x) + (6y - 20y)$
$= 15x - 14y$

Examples

Example 1

Expand: $4(3x - 8)$

Solution

$4(3x - 8)$
$= 4 \times 3x - 4 \times 8$
$= 12x - 32$

Example 2

Expand: $2m(3n + 4p)$

Solution

$2m(3n + 4p)$
$= 2m \times 3n + 2m \times 4p$
$= 6mn + 8mp$

Example 3

Expand: $8(3x - 2) + 20$

Solution

$8(3x - 2) + 20$
$= 24x - 16 + 20$
$= 24x + 4$

Activity 6D

1 Expand these brackets:

a $2(x + y)$ **b** $15(x + y)$ **c** $9(p - q)$
d $10(x + y + z)$ **e** $8(c \div d - e)$

2 Expand these brackets:

a $x(y + z)$ **b** $c(d - e)$ **c** $x(p + 2)$
d $x(x + 8)$ **e** $x(2x - 3)$ **f** $x(4x - 1)$
g $2p(q + r)$ **h** $2x(3x - 4)$

3 Expand and simplify these expressions:

a $5(x + y) + 2(x + y)$ **b** $2(x + y) + 4(2x + y)$
c $3(2x + y) + 6(x + 2y)$ **d** $2(x + 3) + 4(x + 6)$

Answers 6D

1 a $2x + 2y$ **b** $15x + 15y$ **c** $9p - 9q$
d $10x + 10y + 10z$ **e** $\frac{8c}{d} - 8e$

2 a $xy + xz$ **b** $cd - ce$ **c** $xp + 2x$
d $x^2 + 8x$ **e** $2x^2 - 3x$ **f** $4x^2 - x$
g $2pq + 2pr$ **h** $6x^2 - 8x$

3 a $7x + 7y$ **b** $10x + 6y$
c $12x + 15y$ **d** $6x + 30$

6E • Substituting into expressions

LB Pages 158–159

Specific learning outcomes

Learners should be able to:

7.6.9.1 Evaluate algebraic expressions by substituting values into variables in the expressions.

Teaching points

Learners should know how to evaluate expressions by substituting values into the variables in an equation.

Suggested teaching approach

- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercise 6E** on pages 158–159 in the LB, and **Activity 6E** in the TG below.

Additional notes

A pronumeral (such as x) often represents a number. The value of an expression such as $5x$ depends on the value of x.

Example

If $x = 6$, then the value of $5x$ is 30. This is called **substituting**.

When we evaluate algebraic expressions, we always do multiplication and division before addition and subtraction.

Example

If $y = 5$, calculate the value of:

a $10y + 3$

b $\frac{10}{y} - 1$

Solution

a $10y + 3 = 10 \times 5 + 3$
$= 50 + 3$
$= 53$

b $\frac{10}{y} - 1 = \frac{10}{5} - 1$
$= 2 - 1$
$= 1$

Some expressions have more than one variable.

Example

The values of p, q and r are given by:

$p = 8, q = 4, r = 40$

Calculate:

a $p + r$

b pq

Solution

a $p + r = 8 + 40 = 48$

b $pq = p \times q = 8 \times 4 = 32$

Examples

Find the values of the following expressions where $x = 3$ and $y = 4$.

Example 1

$7xy$

Solution

$$\begin{aligned} 7xy &= 7 \times 3 \times 4 \\ &= 84 \end{aligned}$$

Example 2

$\frac{12y}{x}$

Solution

$$\begin{aligned} \frac{12y}{x} &= \frac{12 \times 4}{3} \\ &= \frac{48}{3} \\ &= 16 \end{aligned}$$

Example 3

$8(x + y)$

Solution

$$\begin{aligned} 8(x + y) &= 8 \times (3 + 4) \\ &= 8 \times 7 \\ &= 56 \end{aligned}$$

Example 4

$2x^2 + 5x - y$

Solution

$$\begin{aligned} &2x^2 + 5x - y \\ &= 2 \times 3^2 + 5 \times 3 - 4 \\ &= 2 \times 9 + 15 - 4 \\ &= 18 + 15 - 4 \\ &= 29 \end{aligned}$$

Activity 6E

1 $p = 4n - 5$. Calculate the value of p when:

a $n = 6$ **b** $n = 20$

2 Calculate the value of each of these expressions when $x = 8$:

a $5x + 3$ **b** $4x - 11$

c $\frac{x}{2} + 6$ **d** $20 - 2x$

3 A firm of joiners makes doors. Each door needs 3 hinges.

One rule the firm uses is: number of doors = $\frac{y}{3}$

a What does y stand for in this expression?

b How many doors can be made if the joiners have 60 hinges?

c Explain whether the rule gives a sensible answer when $y = 38$.

4 An animal shelter gives cats 2 meals per day, and dogs 1 meal per day.

The staff use this rule for the total number of meals served each day:

total = $2x + y$

a Explain what x and y each stand for in this rule.

b What is the value of $2x + y$ when $x = 10$ and $y = 8$?

c Explain in words what you have worked out in part **b**.

Answers 6E

1 a 19 **b** 75

2 a 43 **b** 21

c 10 **d** 4

3 a Number of hinges

b 20

c No, 38 ÷ 3 = 12·6666…

4 a x is the number of meals for cats, y is the number of meals for dogs

b 28

c When there are 10 cats and 8 dogs, 28 meals are required daily.

6F • Exploring dot patterns

LB Page 160

Specific learning outcomes

Learners should be able to:

7.6.10.1 Create triangular, square and pentagonal-shaped patterns with dots.

Teaching points

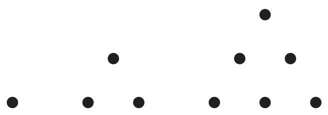
Students should be able to identify and create **dot patterns**.

Suggested teaching approach

- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Learning task 6F** on page 160 in the LB, and **Activity 6F** in the TG below.

Examples

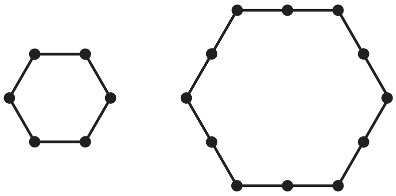
This pattern shows the first three triangular numbers.



Ask learners what the next triangular number is. Get them to write down the first ten triangular numbers. Can they describe to each other and then explain in words or symbols how they move from one triangular number to the next?

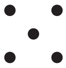
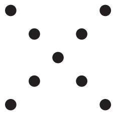
Activity 6F

1 Dots can be arranged in the shape of a hexagon.
The first two shapes in the pattern are shown.



- **a** Draw the next shape in the pattern.
- **b** Write down the number of dots in each of the first three of these 'hexagon' patterns.
- **c** Describe the pattern in your own words.
- **d** Write down the number of dots in each of the first 12 of these shapes.

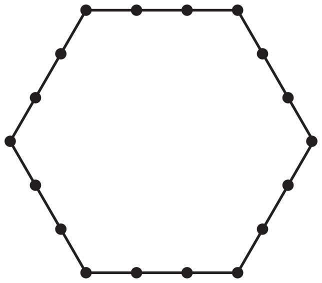
2 These dots are arranged in 'cross' patterns:

Cross			
Number of dots	1		

- **a** Complete the table.
- **b** Draw the next shape in the pattern.

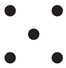
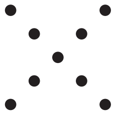
Answers 6F

1 a

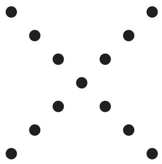


- **b** 6, 12, 18
- **c** 6 is added each time
- **d** 6, 12, 18, 24, 30, 36, 42, 48, 54, 60, 66, 72

2 a

Cross			
Number of dots	1	5	9

b



6G • Exploring match patterns

LB Page 161

Specific learning outcomes

Learners should be able to:

7.6.10.1 Create triangular, square and pentagonal-shaped patterns with matchsticks.

Teaching points

Students should be able to identify and create patterns using matchsticks (**match patterns**).

Suggested teaching approach

- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Learning task 6G** on page 161 in the LB, and **Activity 6G** in the TG below.

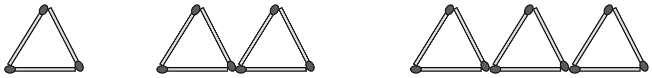
Additional notes

A strategy that is often used in problem solving is to look for a pattern in the results. Algebra can help us describe a pattern, which can often be written as a general rule, or formula.
We can then use the formula to solve problems without having to draw endless patterns.

Matchsticks also can be used to show how identifying patterns can help us solve problems with the help of algebraic concepts.

Examples

Example 1
Here is a matchstick pattern of triangles.



Number of triangles (t)	1	2	3	4	5
Number of matches (m)					

- **a** Copy and complete this table of values by continuing the pattern.
- **b** Find a general rule that connects the number of triangles in the pattern (t) to the number of matches used (m). Write the rule in words and in algebra.
- **c** Use your ruler to find the number of matches required to make 100 triangles.

Solution

1. Construct the table of values. Fill in any information you know from the pattern provided.
2. Continue the pattern by adding matches to create more triangles.
3. Count the number of matches used for the continued pattern (formed with four and five triangles) and fill in the table.

Number of triangles (t)	1	2	3	4	5
Number of matches (m)	3	6	9	12	15

4 Identify the number of matches that are being added on each time to make a new shape (3). This is the multiplication factor in the rule (× 3).

$m = 3 \times t$

5 Write the rule that links the two variables (t and m) in the table, in words and in algebra.

The number of matches is 3 times the number of triangles.

$m = 3 \times t$

6 Substitute $t = 100$ into the rule, and evaluate.

$t = 100$

$m = 3 \times 100$

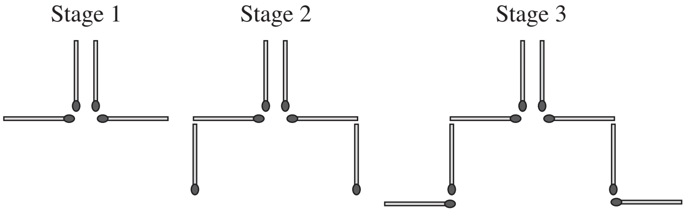
$m = 300$

7 Write the answer in words.

300 matches are needed to make 100 triangles.

Example 2

Learners look at the match pattern below. Ask them to continue the pattern for the next two stages. One of the stages needs 102 matches to form the pattern. Can they use backtracking to find out which stage it was?



Solution

$M = 2n + 2$

$102 = 2n + 2$

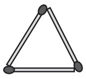
$100 = 2n$

$n = 50$

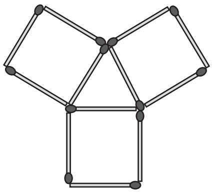
At stage 50 you would use 102 matches.

Example 3

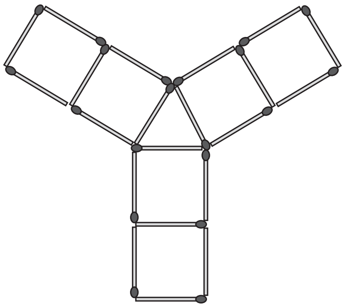
The example given below shows that 9 extra matches are added to the first triangle each time to get the next shape in the sequence. Write the first four terms of the sequence.



3



12



21

Solution

The first shape, which is the triangle, has 3 matches.

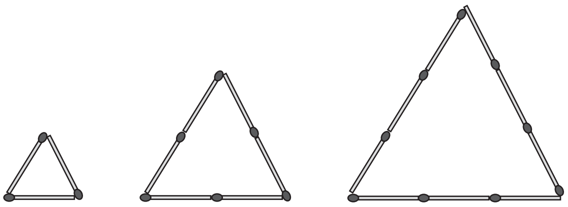
The second shape has 12 matches in the sequence.

The third shape has 21, and the sequence continues. The next after 21 would be 30 … and so the pattern continues.

The sequence is: 3, 12, 21, 30, …

Activity 6G

1 This match pattern uses equilateral triangles.



a Draw the next shape in the pattern.

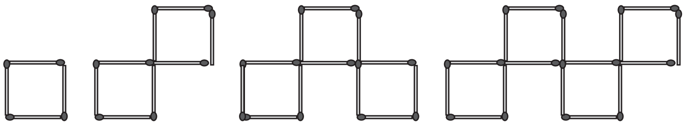
b Complete this table to show how many matches are used at each stage.

Shape number	1	2	3	4
Number of matches	3			

c How many matches would you expect to use to make shape number 8 in this pattern?

d Describe how you can work out the number of matches when you know the shape number you want.

2 Here is a matchstick pattern of squares.



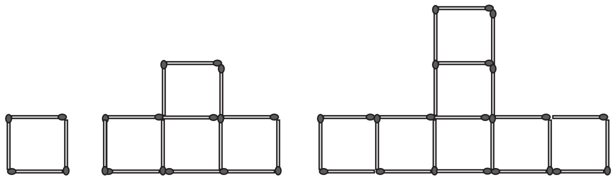
a Copy and complete the table of values by continuing the pattern.

Number of squares (s)	1	2	3	4	5	6	7	8
Number of matches (m)								

b Find a general rule that connects the number of squares in the pattern (s) to the number of matches used (m). Write the rule in words and in algebra.

c Use your rule to find the number of matches required to make 100 squares.

3 This is another matchstick pattern.



a Complete this table to show how many matches are used for shapes 1, 2 and 3.

Shape number	1	2	3		
Number of matches					

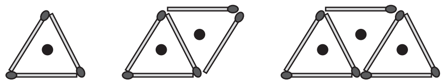
b How many extra matches are added each time?

c Use your answers to part **a** and part **b** to complete the last two columns in the table.

d Complete the following:

"The rule for this pattern is: We start with ____ matches, and then add ____ matches each time."

4 This pattern is made up of matches and dots.



a Draw the next shape in the pattern.

b Copy and complete this table to show how the pattern continues.

Number of dots (*s*)	1	2	3	4	5	6
Number of matches (*m*)						

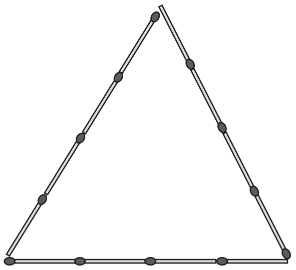
c How many matches would there be if there were:

- **i** 8 dots?
- **ii** 10 dots?
- **iii** 100 dots?

d Explain in words what to do to the number of dots to work out the number of matches.

Answers 6G

1 **a**



b

Shape number	1	2	3	4
Number of matches	3	6	9	12

c 24

d Multiply the shape number by 3.

2 **a**

Number of squares (*s*)	1	2	3	4	5	6	7	8
Number of matches (*m*)	4	8	12	16	20	24	28	32

b $m = 4s$

c $m = 4 \times 100$; $m = 400$

3 **a**

Shape number	1	2	3		
Number of matches	4	13	22		

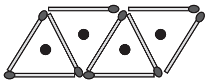
b 9 is added each time.

c

Shape number	1	2	3	4	5
Number of matches	4	13	22	31	40

d The rule for this pattern is: We start with 4 matches, and then add 9 matches each time.

4 **a**



b

Number of dots (*s*)	1	2	3	4	5	6
Number of matches (*m*)	3	5	7	9	11	13

c **i** 19 **ii** 23 **iii** 203

d Multiply the number of dots by 2 and then add 3.

6H • Rules and formulas

LB Pages 162–163

Specific learning outcomes

Learners should be able to:

7.6.11.1 Use rules and formulas to evaluate and solve for missing numbers represented by pronumerals e.g. $P = 2L \times 2W$.

Teaching points

1. Learners need to be able to find the formula or rule that explains how to calculate the quantity.
2. Learners should be able to use the formula to solve and evaluate.

Suggested teaching approach

- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercise 6H** on pages 162–163 in the LB, and **Activity 6H** in the TG below.

Additional notes

An expression has no equals (=) sign in it. If an equals sign is added to the expression, then it becomes an equation or formula.

A **formula** is a rule that explains how to calculate some quantity.

For example, the formula $n = c + 1$ gives the number of pieces (n) that result when a piece of string is cut c times.

When $c = 2$:

$n = 2 + 1 = 3$

Some formulas use more than one pronumeral.

Examples

Example 1

Use the formula $P = 2L + 2W$ to find the perimeter of a rectangle of width 2 m and length 5 m.

Solution

$P = 2L + 2W$

$P = 2 \times 5 + 2 \times 2$

$P = 10 + 4$

$P = 14$ metres

Example 2

The cost C (\$) of hiring a surfboard for t hours is given by the formula:

$C = 20 + 5t$

where there is a \$20 standing charge, plus a charge of \$5 for each hour the board is in use.

Find the cost of hiring the board for:

a 1 hour

b 4 hours

Solution

a $C = 20 + 5 \times 1$
$= \$25$

It costs $25 to hire the board for 1 hour.

b $C = 20 + 5 \times 4$
$= \$40$

It costs $40 to hire the board for 4 hours.

Activity 6H

1 Out Telekom company in Honiara uses this formula to charge people for phone calls to Bellona island in the Rennell and Bellona Province:

$C = 0{\cdot}25t + 1$

C is the cost in dollars.

t is the length of the call, in minutes.

The number 1 in the formula shows that there is a charge of $1 for making the connection.

a Calculate the cost of a call that lasts for:

  i 8 minutes

  ii 15 minutes.

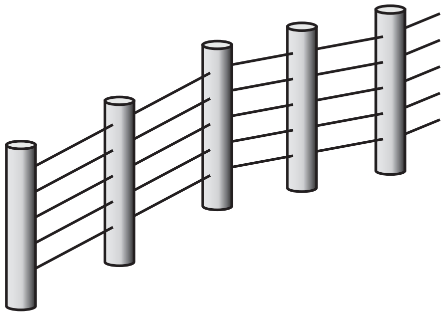
b Explain how the formula shows that the cost per minute for calls to Bellona Island is 25 cents.

c The company charges for calls to the Middle East as follows:

"There is a charge of $2 for making the connection, and the cost per minute is $1.75." Write down a formula for this rule: $C =$ _______

2 This formula gives the number of strands of wire needed in a fence that has n posts:

$S = 5n - 5$



The formula says that to work out the number of strands, you take the number of posts, multiply by 5, and then subtract 5 from the result.

a Calculate S when $n = 3$.

b How many strands of wire will a fence with 10 posts have?

c Explain what happens if you substitute $n = 1$ into this formula.

d Howard substitutes $n = 4{\cdot}2$ and gets a result of 16 for S. Explain whether it is sensible to substitute a number such as 4·2 into this formula.

3 A cinema uses this formula to calculate the cost in dollars of tickets (t) for groups of adults in the group, and c stands for the number of children:

$t = 10a + 6c$

Calculate the cost of tickets for these groups:

a 4 adults and 9 children

b 2 adults and 1 child

c 5 adults

Answers 6H

1 a **i** $3

  ii $4.75

b The formula multiplies t (time in minutes) by 0·25, which is 25 cents.

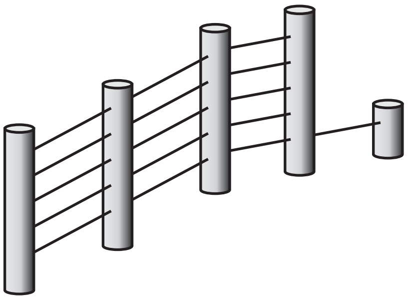
c $C = 1{\cdot}75t + 2$

2 a $S = 10$

b 45 strands

c There would be negative strands of wire, an impossibility.

d It is not sensible to have a portion of a post. However, it is possible. A fence with 4·2 posts might look like this:



This diagram shows 16 wires with 4·2 posts.

3 a $94

b $29

c $50

• Chapter Seven •

Angles

Overview

Solomon Islanders have been working with angles for many centuries, in activities as diverse as arts and crafts and using dug-out canoes to travel from one island to another. People from Langalanga and other parts of the Solomons create shell money, and those from Temotu province produce ornaments that have many angles in them. People from Rennell and Bellona and western parts of the Solomons use the angles between the stars, moon and sun to fish and to travel between islands.

An angle is the space between two lines that start at the same point. This point is called the vertex of the angle and the lines form the arms of the angle. The size of an angle is the amount of turn from one arm to another. When an arm is rotated completely around a circle for one full turn, it is called a revolution, and we divide the revolution into 360 parts. It is thought that the ancient Babylonians, who counted in lots of 60 and divided a year into 360 days, established this convention.

In this chapter, learners will work with different types of angles. They will learn about relationships between angles, solve simple problems involving angles, and use a protractor to measure and draw angles.

Contents

Chapter skills

This chapter covers the following skills:

- Naming and classifying different types of angles
- Identifying the relationships between complementary and supplementary angles: complementary angles add to 90°, supplementary angles add to 180°, angles in a circle add to 360°
- Solving simple problems involving complementary and supplementary angles, and angles in a circle
- Measuring an angle of any size using a protractor
- Using a protractor to draw an angle of any size.

Teaching plan

Lessons	Chapter sections	Class work and home work
1	• Intro • 7A: Naming angles	Learner's Book 1 • Exercise 7A, page 174
2	• 7B: Types of angles	Learner's Book 1 • Exercise 7B, pages 175–176
3	• 7C: Measuring angles	Learner's Book 1 • Exercise 7C, pages 177–180
4–5	• 7D: Using a protractor to draw angles	Learner's Book 1 • Exercise 7D, page 181
6	• 7E: Complementary angles	Learner's Book 1 • Exercise 7E, pages 182–183
7	• 7F: Supplementary angles	Learner's Book 1 • Exercise 7F, pages 184–185
8–9	• 7G: Angles in a circle	Learner's Book 1 • Exercise 7G, pages 186–187
10	• Revision/test	Learner's Book 1 • Revision/Assessment, Exercises 7A–7G, pages 194–195 Teacher's Guide • Chapter 7 test, page 171

General learning outcomes

Learners should:

Naming angles

7.7.1 Understand that angles are formed when two lines meet at a point. (U)

7.7.2 Know how to name angles by using alphabetical letters to represent where line segments meet. (K)

Types of angles

7.7.3 Understand that angles are grouped together according to their sizes. (U)

7.7.4 Know how to classify angles according to their sizes. (K)

Measuring angles

7.7.5 Know how to measure angles with protractors. (K)

Using a protractor to draw angles

7.7.6 Know how to construct angles of any size using a protractor. (K)

Complementary angles

7.7.7 Understand that angles have properties to identify them. (U)

7.7.8 Know how to find missing angles represented by pronumerals using properties of complementary angles. (K)

Supplementary angles

7.7.9 Know how to identify supplementary angles. (K)

7.7.10 Know how find to find missing angles that are represented by variables. (K)

Angles in a circle

7.7.11 Know that there are 360° in a full turn and that this is called a perigon. (K)

7.7.12 Know how to find missing angles represented by pronumerals in a full or complete turn. (K)

7A • Naming angles

LB Page 174

Specific learning outcomes

Learners should be able to:

7.7.1.1 Identify the vertex of an angle.

7.7.2.1 Draw and name angles using alphabetical letters, such as $\angle ABC$.

Teaching points

1. Learners should be able to name angles using alphabetical letters.
2. Learners should be able to identify the vertex of an angle that is made with straight lines.

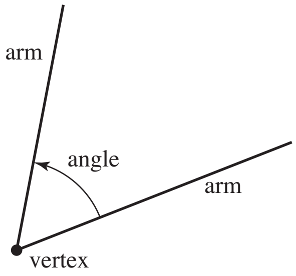
Suggested teaching approach

- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercise 7A** on page 174 in the LB, and **Activity 7A** in the TG below.

Additional notes

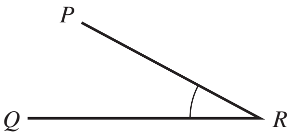
Parts of an angle

The corner point of an angle is called the **vertex**. The two straight sides are called arms, rays or lines. The **angle** is the amount of turn between each arm.



Naming angles

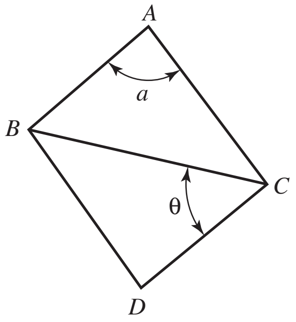
We name an angle using three letters. The middle letter gives the vertex, which is the point where the lines meet.



This angle is named $\angle PRQ$. Another possible name is $\angle QRP$.

Another way to label angles is to use one lower-case letter or Greek letter, e.g. angle a, angle b, angle α, angle θ.

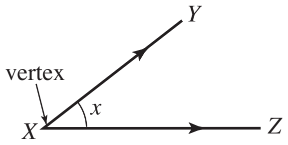
In the example shown below, angle a is the same as angle BAC. Angle θ is the same as angle BCD.



Examples

Example 1

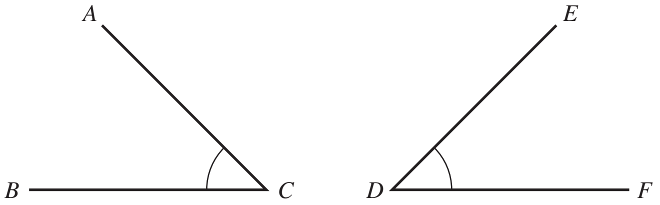
Name the following angle:



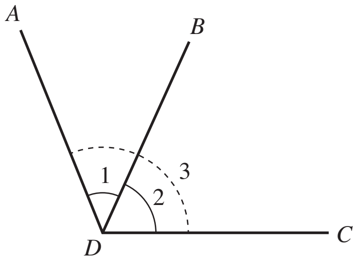
Solution When naming angles, we can use the three letters positioned at the end points of the lines that form the angle. The angle shown is known as $Y\hat{X}Z$ or $Z\hat{X}Y$ or $\angle YXZ$ or $\angle ZXY$ or $\angle x$.

Activity 7A

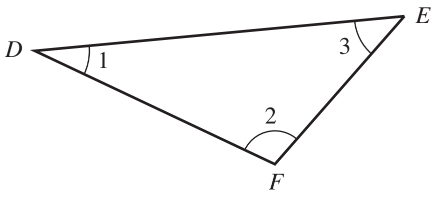
1 Name the marked angles. Use three letters for each angle.



2 This diagram has three marked angles. All have D as the vertex. Name the three angles.



3 Name the three angles inside this triangle (numbered 1 to 3):



Answers 7A

1 **a** ∠ACB or ∠BCA
  b ∠EDF or ∠FDE

2 Angle 1: ∠ADB, Angle 2: ∠BDC, Angle 3: ∠ADC

3 Angle 1: ∠EDF, Angle 2: ∠DFE, Angle 3: ∠DEF

7B • Types of angles

LB Page 175

Specific learning outcomes

Learners should be able to:

7.7.3.1 Group angles together and give them names according to the amount and size of degrees they have.

7.7.4.1 Identify different types of angles and give their names according to their sizes: *acute angle, right angle, obtuse angle, straight line angle, reflex angle and perigon or full circle.*

Teaching points

1. Learners should be able to group angles according to their sizes.
2. Learners should be able to classify and name angles according to their sizes: acute, right, obtuse, straight or reflex.

Suggested teaching approach

- Start the chapter section by doing the **Starter activities** provided.
- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercise 7B** on pages 175–176 in the LB, and **Activity 7B** in the TG below.

Starter activities

Activity 1: Making angles

Break the class into groups of 3 to 4 learners, and ask them to do the following:

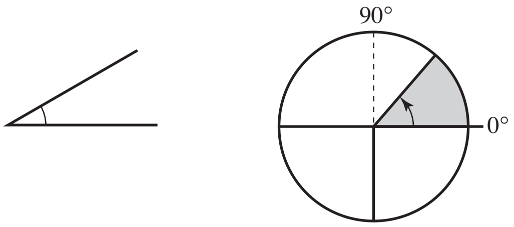
1. One of the members uses their arms to make angles, and the others identify the angle type: acute, right, obtuse, straight or reflex.
2. Each learner calls the name of an angle, and the others demonstrate the shape of the angle using their arms.
3. Learners discuss the various attributes of each type of angle.
4. *Variation*: Learners go outside and use shadows to create angles.

Additional notes

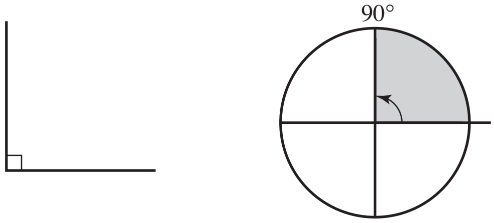
The types of angles

Angles are named using alphabetical letters. They are also named according to their size.

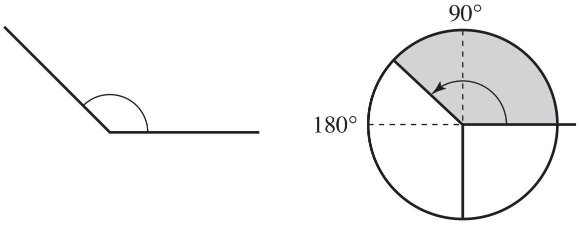
1 **Acute angle** – greater than 0° but less than 90°.



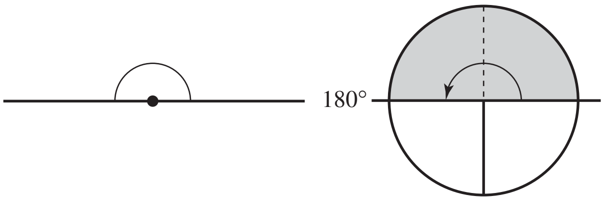
2 **Right angle** – exactly 90°, a $\frac{1}{4}$ turn. A small square is drawn in the corner of an angle to indicate that it is a right angle.



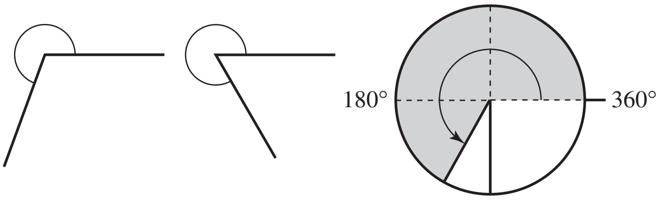
3 **Obtuse angle** – more than 90° but less than 180°.



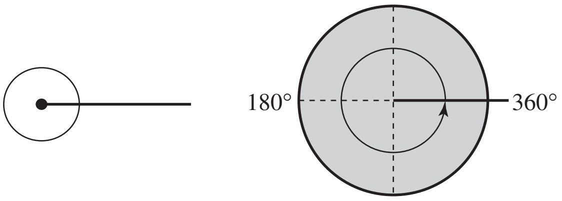
4 **Straight angle** – exactly 180°, a straight line angle, a half turn.



5 **Reflex angle** – greater than 180° but less than 360°.



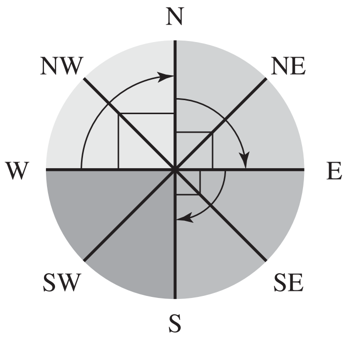
6 **Revolution** – 360°, a full turn or **perigon**.



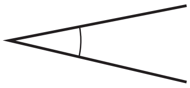
Comparing angles with right angles

A right angle is a turn through a quarter of a circle. A right angle is 90°.

This compass diagram shows a clockwise turn from the direction W (west) to S (south). The turn is three right angles.

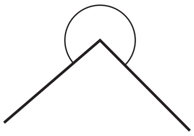


An acute angle is less than 90° (one right angle).



An obtuse angle is between 90° (one right angle) and 180° (two right angles).

A reflex angle is more than 180° (two right angles).



Examples

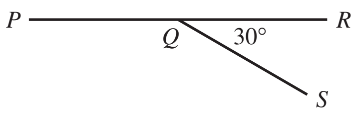
Example 1

1 Draw a straight line and label three points, *PQR*.

Now draw another line, *SQ*, that meets the first line so that the angle formed, *SQR* = 30°.

- **a** Name the obtuse angle in the diagram.
- **b** What is the size of the obtuse angle in the diagram?

Solution



- **a** The obtuse angle is angle *PQS*.
- **b** Angle *PQS* = 150°

2 If angle *RPM* = *x*°, find an expression for the following angles:

- **a** the reflex angle *RPM*
- **b** the complement of angle *RPM*
- **c** the supplement of angle *RPM*

Solution

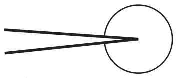
- **a** Angle *RPM* = 360° – *x*°
- **b** The complement of angle *RPM* = 90° – *x*°
- **c** The supplement of angle *RPM* = 180° – *x*°

Activity 7B

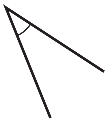
1 State the type of angle shown in each case.

a

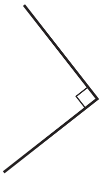
b



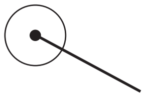
c



d



e

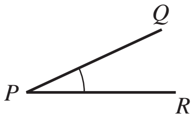


2 Classify the following angles (acute, obtuse, right etc.):

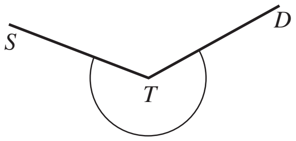
- **a** 23°
- **b** 117°
- **c** 275°
- **d** 360°
- **e** 180°
- **f** 75°
- **g** 90°
- **h** 165°
- **i** 341°

3 Name the following angles:

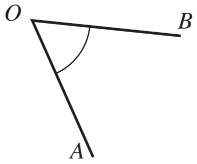
a



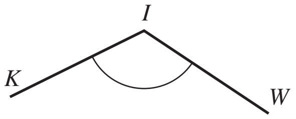
b



c

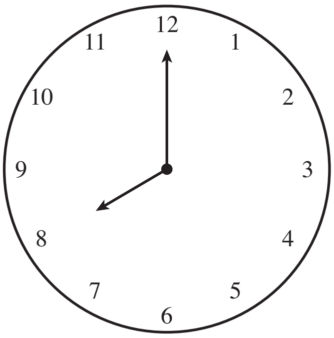


d



4 How many right angles does the hour hand of a clock move through when moving from:

- **a** 2 o'clock to 8 o'clock?
- **b** 10 o'clock to 7 o'clock?



5 The hour hand of a clock starts at 8 o'clock. Where will it be when it has moved though:

- **a** 1 right angle?
- **b** 3 right angles?

Answers 7B

1 **a** straight **b** reflex
c acute **d** right angle
e revolution (or perigon)

2 **a** acute **b** obtuse
c reflex **d** revolution
e straight **f** acute
g right **h** obtuse
I reflex

3 **a** ∠QPR or ∠RPQ **b** ∠STD or ∠DTS
c ∠BOA or ∠AOB **d** ∠KIW or ∠WIK

4 **a** twice every hour = 12 times **b** 18 times

5 **a** 8:27 **b** 9:33

7C • Measuring angles

LB Pages 177–180

Specific learning outcomes

Learners should be able to:

7.7.5.1 Use a protractor to measure given angles in degrees.

Teaching points

Learners should be able to use a protractor to measure different types of angles.

Suggested teaching approach

- Start the chapter section by doing the **Starter activities** provided.
- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercise 7C** on pages 178–180 in the LB, and **Activity 7C** in the TG below.

Starter activities

Activity 1: Measuring angles

This activity can be done if learners have access to a clinometer.

Divide the class into small groups. Take them outside and show them how to use the clinometer to measure angles.

Give them time to move around the school yard, estimating and then measuring various angles, and recording their results in a table like the one shown.

Variation: Measure the angles of depression and elevation.

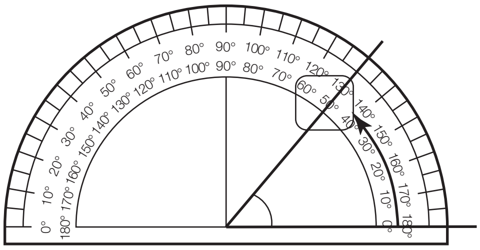
Angle	Estimated					Measured
	Less than 90°	Approx. 90°	90–180°	Approx. 180°	Bigger than 180°	
1						
2						
3						
4						
5						
6						

Additional notes

Using a protractor to measure angles

We measure angles in degrees. To do this we use an instrument called a **protractor**, which has two sets of scales marked in degrees around the outside. One set runs from left to right, and the other set runs from right to left.

The diagram below shows that the angle measured is 50°.

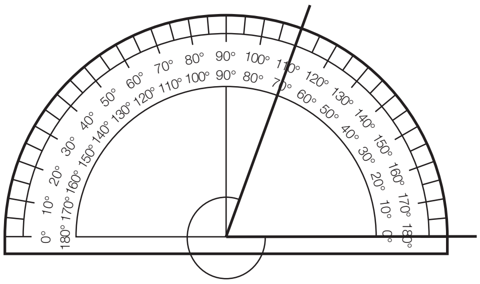


When measuring an angle less than 180°, follow these steps:

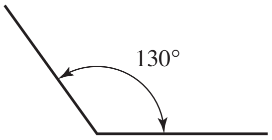
1. Place the centre point of the protractor over the vertex of the angle. Align the baseline of the protractor with an arm of the angle.
2. Use the scale that has 0° aligned with one arm of the angle. In the example shown above, it is the scale that runs from right to left (the inner scale). Count the degrees. In the protractor shown above, the angle is 50°.

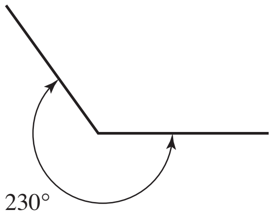
When measuring an angle more than 180°, follow these steps:

1. Place the centre point of the protractor over the vertex of the angle. Align the baseline of the protractor with an arm of the angle.
2. Use the scale that has 0° aligned with one arm of the angle. In the example shown below, it is the scale that runs from right to left (the inner scale). Measure the smaller angle and subtract this angle from 360°. In the diagram below, the small angle measures 70°, so the marked angle must be 360° – 70° = 290°



Note: Be careful what you measure. In the two diagrams below, the arms are the same but the angles are different. The angle at left is an obtuse angle, 130°. The angle at right is a reflex angle, 230°. Always check that you are measuring and naming the correct angle.

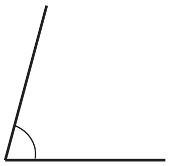




Examples

Example 1

Use a protractor to measure the size of the angle shown. Write your answer to the nearest degree



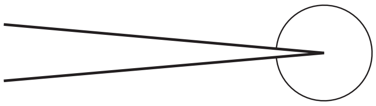
Solution

1. Place the centre point of the protractor over the vertex of the angle and align the baseline of the protractor with an arm of the angle.
2. Use the scale on the protractor that starts with 0°. In this case use the scale that runs from right to left.
3. Count the number of degrees. The angle above measures 75°.

Activity 7C

1. Use a protractor to measure the size of the two angles shown. Write your answers to the nearest degree.

a

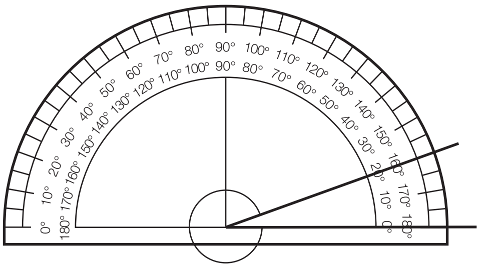


b

2. Toata uses a semicircular protractor to measure an angle larger than 180°. Find the size of the actual angle (larger than 180°) if the smaller angle she has measured is:

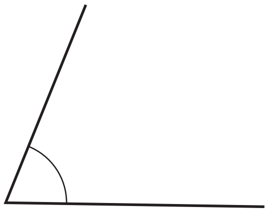
a 30° **b** 115°

c 160°

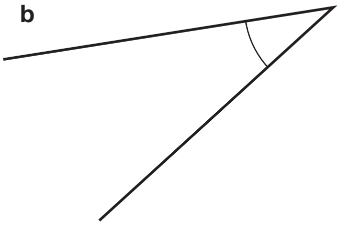


3. Measure these angles with a protractor:

a

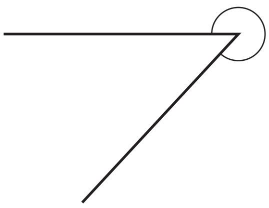


b

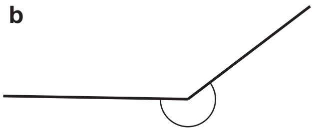


4. Use a protractor to measure these reflex angles:

a



b



Answers 7C

1 **a** 360° – 10° = 350° **b** 15°

2 **a** 340° **b** 245°

c 200°

3 **a** 69° **b** 32°

4 **a** 310° **b** 219°

7D • Using a protractor to draw angles

LB Page 181

Specific learning outcomes

Learners should be able to:

7.7.6.1 Use a protractor to draw angles of any size.

Teaching points

1. Learners should be able to identify different parts of the protractor.
2. Learners should know how to use a protractor to draw angles.

Suggested teaching approach

- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercise 7D** on page 181 in the LB, and **Activity 7D** in the TG below.

Additional notes

When drawing angles using a protractor, follow these steps:

1. Draw a baseline and mark the vertex at one end.
2. Place the baseline of the protractor with its centre on the vertex.
3. Place another dot at the desired angle.
4. Remove the protractor and rule a line joining the vertex and the dot.
5. Label the angle with an arc, and name it clearly.

Examples

Example 1

Use a protractor to draw the following angles:

a 75°

b 200°

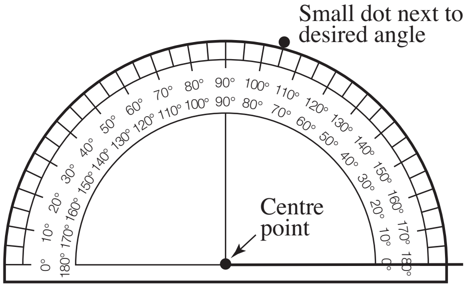
Solution

a For angles less than 180°:

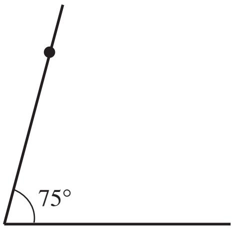
1. Draw a straight horizontal line.

2. Place the centre point of the baseline of the protractor on one end of the straight line. (*Note:* The base line is *not* the edge of the protractor. Make sure you use the scale starting at the end of your line segment.)

3 Locate the desired angle and mark a small dot, as shown (in this case, 75°).



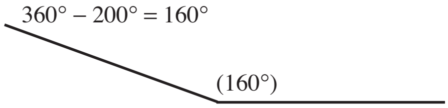
4 Remove the protractor and join the dot with the end of the line where the centre point was located. Mark the angle.



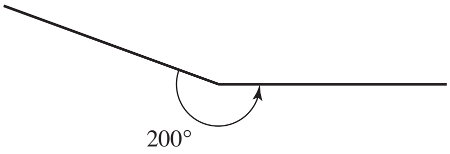
b For angles larger than 180°:

1 Subtract the angle from 360° to get the smaller angle needed to make a full turn. For example: 360° – 200° = 160°

2 Draw the smaller angle first. For example, to draw 200° we need to first draw 160°.



3 Label the larger angle (200°).



Activity 7D

1 Use a protractor to draw the following angles:

a 10° **b** 70° **c** 100°

d 175° **e** 290° **f** 265°

2 To draw a 250° angle with a semicircular protractor, which angle would you draw first?

A a 50° angle

B a 90° angle

C a 110° angle

D a 200° angle

3 Draw the following using your protractor:

a a wire holding a vertical flagpole attached at 38° to the ground

b a ramp with a slope of 12°

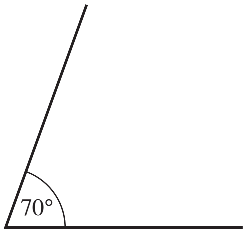
c a ladder leaning against a vertical wall at 62° to the ground

d a round birthday cake sliced into 6 equal pieces

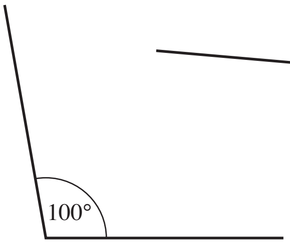
Answers 7D

1 a

b

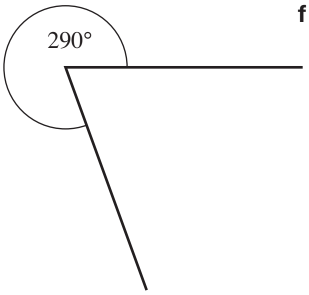


c

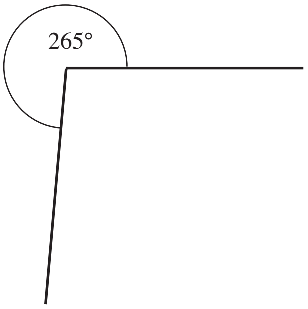


d

e

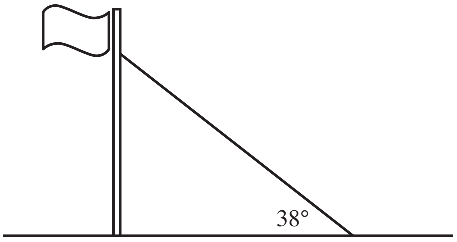


f



2 C

3 a



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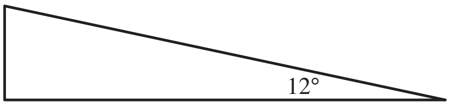

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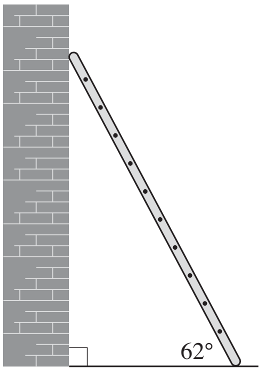
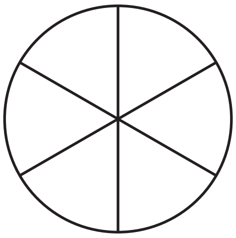


d



7E • Complementary angles

LB Pages 182–183

Specific learning outcomes

Learners should be able to:

7.7.7.1 Define and identify 'complementary (adjacent) angles': *angles that stay next to each other (adjacent) and add to 90°.*

7.7.8.1 Use the properties of complementary angles to find the size of missing angles represented by the pronumerals.

Teaching points

1 **Complementary angles** are angles that are next to each other (adjacent) and add to 90°.

2 The properties of complementary angles can be used to find missing angles.

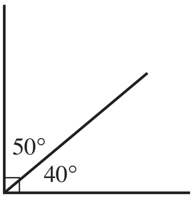
Suggested teaching approach

- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercise 7E** on pages 182–183 in the LB, or **Activity 7E** in the TG below.

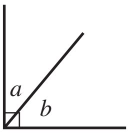
Additional notes

Complementary angles add to 90° (a right angle). For example, 40° and 50° are complementary angles because they add to 90°.

If two angles are complementary, we say one is the complement of the other. For example, 40° is the complement of 50°.



Complementary angles add to 90°. In the diagram below, $a + b = 90°$



Examples

Example 1

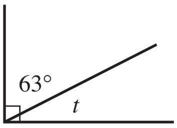
What is the complement of 48°?

Solution

The complement of 48° is 42°, because 90° – 48° = 42°

Example 2

Find angle *t* in the diagram below:



Solution

Angle *t* and 63° are complementary, so subtract 63° from 90° to find *t*.

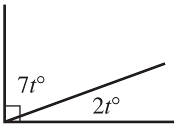
$90° - 63° = 27°$

$t = 27°$

Example 3

Find *t* in the diagram below:

Solution



7*t* and 2*t*° add to give 90°

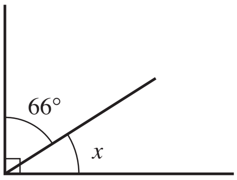
$7t + 2t = 90°$

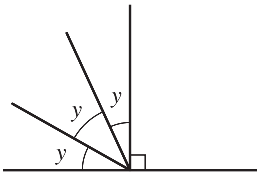
$9t = 90°$

$t = 10°$

Activity 7E

1 Use complementary angles to work out the size of angles *x*° and *y*°.



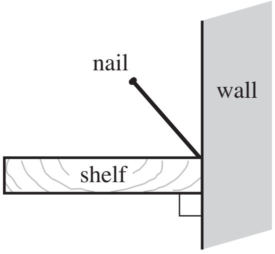


2 Write down the complement of these angles:

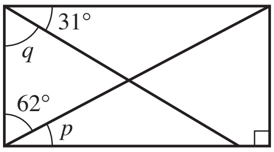
a 50° **b** 6° **c** 83°

3 What angle has itself as its complement?

4 The angle between the wall and the nail is 29°. What is the angle between the nail and the shelf?



5 A rectangle has four right angles. Use this property to work out angles *p*° and *q*°.



Answers 7E

1 **a** $x = 24°$ **b** $y = 30°$

2 **a** 40° **b** 84° **c** 7°

3 45°

4 61°

5 $p = 28°$, $q = 59°$

7F • Supplementary angles

LB Pages 184–185

Specific learning outcomes

Learners should be able to:

7.7.9.1 Define ‘supplementary angles’*: angles next to each other that add to 180°.*

7.7.10.1 Use the properties of supplementary angles to find the size of missing angles represented by the pronumerals.

Teaching points

1. **Supplementary angles** are angles that are next to each other and add to 180° (degrees).
2. Learners should be able to use the properties of supplementary angles to find missing angles.

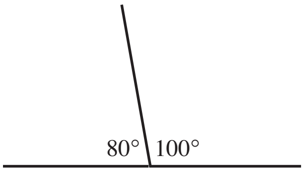
Suggested teaching approach

- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercise 7F** on pages 184–185 in the LB, and **Activity 7F** in the TG below.

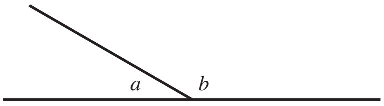
Additional notes

Supplementary angles add to 180° (a straight angle).
For example, 100° and 80° are supplementary angles because they add to 180°.

If two angles are supplementary, we say one is the supplement of the other. For example, 100° is the supplement of 80°.



Supplementary angles add up to 180°: $a + b = 180°$



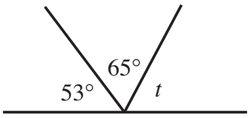
Examples

Example 1
What is the supplement of 75°?

Solution

180° – 75° = 105°.

Example 2
Find the angle *t* in the diagram below:



Solution

53°, 65° and *t* are supplementary, so subtract 53° and 65° from 180° to find the supplement.

$180° - 53° - 65° = 62°$

$t = 62°$

Activity 7F

1 Write down the supplement of these angles:

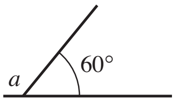
a 140°

b 9°

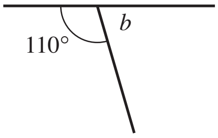
c 53°

2 Work out the size of each marked angle:

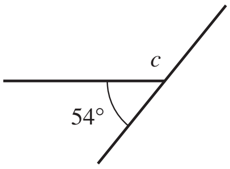
a



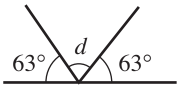
b



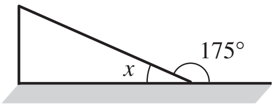
c



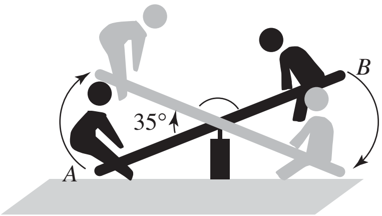
d



3 Calculate the angle between the ground and the sloping part of this concrete ramp.



4 The diagram shows a see-saw. Person A turns through 35° when their end of the see-saw goes up.



What angle does person *B* turn through? Explain how you worked out your answer.

Answers 7F

1 **a** 40°

b 171°

c 127°

2 **a** 120°

b 70°

c 126°

d 54°

3 $x = 5°$

4 35°. The angles are vertically opposite each other. They are equal.

7G • Angles in a circle

LB Pages 186–187

Specific learning outcomes

Learners should be able to:

7.7.11.1 Find the total number of degrees in a full turn or perigon.

7.7.12.1 Find the size of missing angles represented by letters.

Teaching points

1. Learners should know the total number of degrees in a full turn (360°).
2. Learners should know how to find missing angles in a turn of a circle.

Suggested teaching approach

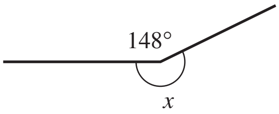
- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercise 7G** on pages 186–187 in the LB, and **Activity 7G** in the TG below.

Additional notes

When a group of angles meet at a single point, they add to 360°. This is because there are 360° in a full circle, or one complete revolution (a perigon).

Example

What is the size of the angle marked $x°$?

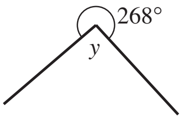


$x° + 148° = 360°$
$x° = 360° - 148°$
$= 212°$

Examples

Example 1

Find the size of angle y:

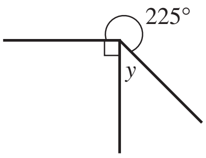


Solution

y and 268° = 360°
$y + 268° = 360°$
$y = 360° - 268°$
$y = 92°$

Example 2

Find the size of angle y:



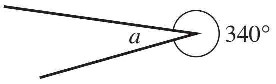
Solution

$y + 90° + 225° = 360°$
$y = 360° - (90° + 225°)$
$y = 45°$

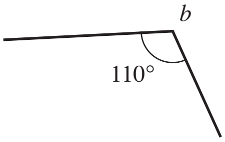
Activity 7G

1 Work out the size of the marked angles:

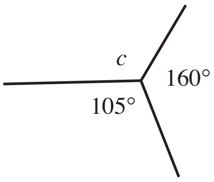
a



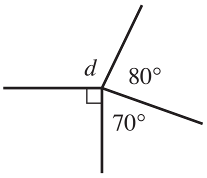
b



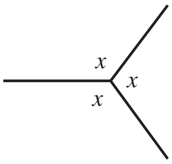
c



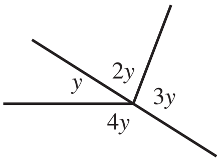
d



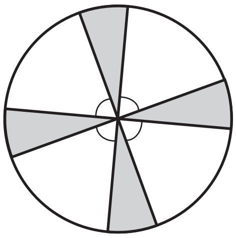
e



f



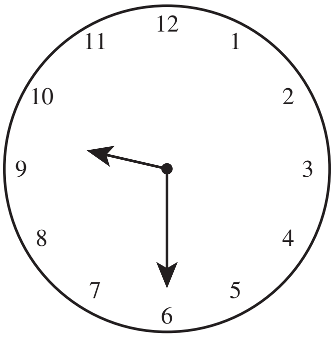
2 The angles at the centre of the grey parts of this circle add to 90°.



a What do the angles at the centre of the white parts add to?

b What fraction of the whole circle is white?

3

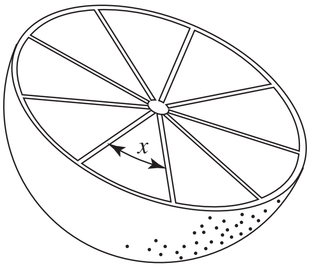


a Write down a calculation using a division sign (÷) that shows that the hour hand on a clock moves through 30° every hour.

b What angle does the hour hand on a clock move through in half an hour?

c What is the angle between the hour hand and the minute hand at half past nine?

4 When an orange is sliced across the middle, you can see that it has nine identical sections.



Work out the angle at the centre of each section (including the pith).

Answers 7G

1 **a** 20°

b 250°

c 95°

d 120°

e 120°

f $y = 36°$

2 **a** 270°

b $\frac{3}{4}$

3 **a** 360 ÷ 12 = 30°

b 180°

c 105°

• Chapter Eight •

Directed Numbers

Overview

The numbers that we have dealt with until now are mainly positive integers (numbers). In this chapter, learners work with both positive and negative numbers. A negative number has a negative (minus, ⁻) sign in front of it. On a number line, negative numbers are to the left of zero. Numbers to the right of zero on the number line are called positive numbers, and they have a positive (plus, +) sign. When numbers have a positive or negative sign, they are called *directed numbers*. Directed numbers have both size and direction (positive or negative).

Directed numbers are used in practical ways in the Solomon Islands – for example, high and low ocean tides, consuming agricultural products, and goods being added or used up, are all practical situations that involve both positive and negative quantities.

Contents

Chapter skills

This chapter covers the following skills:

- Extending the number line to include negative numbers
- Comparing, ordering and completing patterns by using directed numbers: < is less than; > is greater than
- Applying directed numbers to real-life situations
- Practising addition, subtraction, multiplication and division of directed numbers: like signs give a positive; unlike signs give a negative
- Applying BODMAS to questions involving directed numbers:
  - **B** Work out the calculations inside the brackets first. If the brackets contain more than one operation, they must also follow the rules of BODMAS.
  - **O** If the question contains a fraction 'of' a number then this is calculated next.
  - **D** Work out the division *and*
  - **M** Multiplication calculations, working across the page from left to right
  - **A** Work out the addition *and*
  - **S** Subtraction calculations, working across the page from left to right.
- Locating positive and negative numbers on a Cartesian plane.

Teaching plan

Lessons	Chapter sections	Class work and home work
1	• Intro • 8A: Directed numbers	Learner's Book 2 • Exercise 8A, pages 4–5
2	• 8B: Number patterns	Learner's Book 2 • Exercise 8B, page 6
3	• 8C: Comparing directed numbers	Learner's Book 2 • Exercise 8C, pages 7–9
4	• 8D: Exploring addition	Learner's Book 2 • Learning task 8D, page 10
4	• 8E: Adding directed numbers	Learner's Book 2 • Learning task 8E, page 11
5	• 8F: Exploring subtraction	Learner's Book 2 • Learning task 8F, page 12
5	• 8G: Subtracting directed numbers	Learner's Book 2 • Exercise 8G, page 13
6	• 8H: Multiplying directed numbers	Learner's Book 2 • Exercise 8H, page 14
7	• 8I: Dividing directed numbers	Learner's Book 2 • Exercise 8I, page 15
8–9	• 8J: Order of operations	Learner's Book 2 • Exercise 8J, page 16
10–12	• 8K: Miscellaneous directed numbers	Learner's Book 2 • Exercise 8K, page 17
13–14	• 8L: The coordinate plane	Learner's Book 2 • Exercise 8L, pages 18–19
15	• 8M: Exploring board games with directed numbers	Learner's Book 2 • Learning task 8M, pages 20–21
15	• Revision/test	Learner's Book 2 • Revision/Assessment, Exercises 8A–8C, 8E, 8G–8J, 8L, pages 28–29 Teacher's Guide • Chapter 8 test, page 173

General learning outcomes

Learners should:

Directed numbers

7.8.1 Understand that directed numbers indicate both the magnitude (size) and the direction of the number. (U)

7.8.2 Know how to describe the positions of various objects using a number line that has negative and positive numbers on the scale. (K)

Number patterns

7.8.3 Understand that number patterns can be created using directed numbers. (U)

7.8.4 Know how to create numbers using negative and positive numbers. (K)

Comparing directed numbers

7.8.5 Understand that inequality signs such as 'greater than' and 'less than' signs (< and >) are used to compare values of numbers. (U)

7.8.6 Know how to use inequality signs to make statements true or false. (U)

7.8.7 Know how to compare values of directed numbers and arrange in ascending and descending order. (K)

Addition and subtraction

7.8.8 Know how to use the number line to add and subtract directed numbers. (K)

Multiplication and division

7.8.9 Know how to apply the positive and negative signs when multiplying and dividing directed numbers. (K)

Order of operations

7.8.10 Understand how to apply the rule of BODMAS to solve problems that involved a mixture of operations (+, −, ×, ÷). (U)

Miscellaneous directed numbers

7.8.11 Know how to solve and evaluate directed number problems. (K)

The coordinate plane

7.8.12 Know that the coordinate plane is a two-dimensional number line. (K)

7.8.13 Know how to find the coordinates of the positions of objects on the coordinate plane using the *x*- and *y*-axes. (K)

7.8.14 Know how to plot coordinate pairs on a set of *x*- and *y*-axes on a coordinate plane. (K)

8A • Directed numbers

LB Pages 4–5

Specific learning outcomes

Learners should be able to:

7.8.1.1 Define and identify directed numbers.

7.8.1.2 Construct a number line with positive numbers.

7.8.1.3 Extend the number line to have both negative and positive numbers.

7.8.2.1 Indicate and identify the positions of various objects and letters that are given on the number line.

Teaching points

1. **Directed numbers** are numbers that have a direction and a size. They can be positive or negative. Positive and negative are opposites. Once a direction is chosen as positive (+), the opposite direction is taken as negative (–).
2. Learners should be able to extend a number line to include negative numbers. These are numbers that continue to the left of zero on the number line.
3. Learners should be able to construct a number line to include positive and negative numbers.
4. Learners should be able to add a scale to a number line.
5. Learners should be able to identify the positions of objects shown on a number line.

Suggested teaching approach

- Start the chapter section by doing the **Starter activities** provided.
- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercise 8A** on pages 4–5 in the LB, and **Activity 8A** in the TG below.

Starter activities

Activity 1: Directed-number BUZZ

This 10-minute game is an excellent way to begin the chapter.

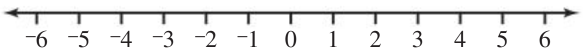
1. Ask learners to stand up.
2. Work around the class, with learners taking it in turns to count in numbers (integers).
3. When any learner comes to three, or a multiple of three, or a number containing three, they must say "Buzz". For example: 1, 2, buzz … 20, buzz, 22, buzz, buzz, 25 …
4. If a learner makes a mistake, they sit down. Continue until there is only one student left standing.
5. Now do the game using *negative* numbers.

Additional notes

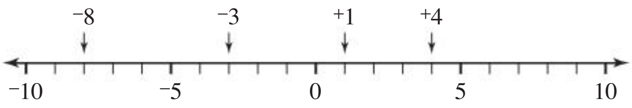
A positive (+) or a negative (–) sign is used to show the direction of a number. We use directed numbers in real life – for example, a temperature of $^{-}10$°C is colder than a temperature of 6°C.

Some words associated with **negative numbers** are: *down, loss, below, decrease, lose, withdrawal*. Some words associated with **positive numbers** are: *up, profit, above, increase, gain, deposit*. For example, a deposit of \$50 into your bank account could be written as $^{+}50$, whereas a withdrawal of \$180 could be written as $^{-}180$.

Directed numbers include positive numbers, zero and negative numbers. They can be shown on a **number line**:



The numbers on a number line get larger in value as we move from left to right. They get smaller as we go from right to left.

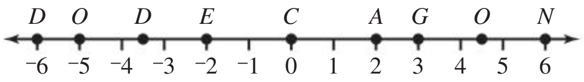


If a number has no sign in front of it, we assume it is positive. For example, 4 = $^{+}4$

Examples

Example 1

Give the position of each letter on this number line:



Solution

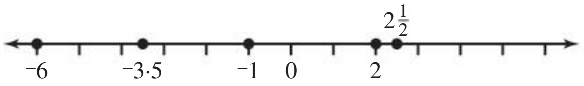
D: −6, *O*: −5, *D*: $-3\frac{1}{2}$, *E*: −2, *C*: 0, *A*: 2, *G*: 3, *O*: $4\frac{1}{2}$, *N*: 6

Example 2

Place the following values on a number line:

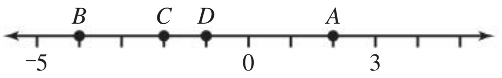
−6, 2, −1, −3·5, $2\frac{1}{2}$

Solution



Activity 8A

1 Write down the correct directed number for each of *A*, *B*, *C* and *D* below.



2 Write directed numbers on either side of 0 on the number line below. Count up, and down, in ones.

What is the last number on the left end of the number line?

3 What is the last number on the right end of the number line below?

4 Write down the missing words or numbers:

a 15 m *above* sea level is 15

__________ sea level is −40

b 2 floors above ground is 2

3 floors below ground is ____

5 Use each of the number lines below to represent these situations:

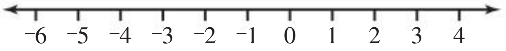
a Anna owes $75 on a credit card.

b A swimming pool is 5 m deep. There is a diving board 2 m above the surface.

Answers 8A

1 A:2, B: −4, C: −2, D: −1

2



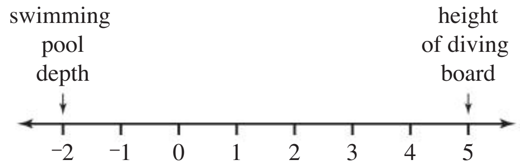
3 −7

4 **a** 40 m below

b −3

5 **a**

b



8B • Number patterns

LB Page 6

Specific learning outcomes

Learners should be able to:

7.8.3.1 Identify number patterns that are created using the positive and negative.

7.8.4.1 Create patterns using positive and negative numbers.

Teaching points

1. Learners should be able to identify patterns that are made from directed numbers.
2. Learners should be able to create patterns using directed numbers.

Suggested teaching approach

- Start the chapter section by doing the **Starter activities** provided.
- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercise 8B** on page 6 in the LB, or **Activity 8B** in the TG below.

Additional notes

Some number patterns increase or decrease by the same amount each time.

Example: 12, 9, 6, 3, 0, −3, −6 …

Examples

Complete the following number patterns:

a 15, 11, 7, ___, ___, ___, ___, ___

b −13, −10, −7, −4, ___, ___, ___, ___

c −2·8, −2·4, −2, −1·6, ___, ___, ___, ___, ___, ___

Solution

a (subtract 4) 15, 11, 7, 3, −1, −5, −9, −13

b (add 3) −13, −10, −7, −4, −1, 2, 5, 8

c (add 0·4) −2·8, −2·4, −2, −1.6, −1·2, −0·8, −0·4, 0, 0·4, 0·8

Activity 8B

1 Complete these number patterns:
   - **a** 3, 2, 1, ___, ___, ___, ___
   - **b** 4, 1, −2, ___, ___, ___, ___
   - **c** −6, −4, −2, ___, ___, ___, ___
   - **d** −11, −8, −5, ___, ___, ___, ___
   - **e** −14, −19, −24, ___, ___, ___, ___

2 Sonia has a phone card. It currently has a credit of $1.70. Each time she phones within the city it costs 35 cents.
   - **a** Write down a number pattern to show what happens to the credit on the card each time she makes a call within the city.

     $1.70, ___, ___, ___, ___, ___, ___,
   - **b** How many calls within the city will she be able to make?

3 Kerry owes his father $105. The arrangement is that he will pay back $12 each week. Kerry writes down the amount owing each week. Here is how the number pattern starts:

   −105, −93 …
   - **a** Write down directed numbers to show what happens.
   - **b** How much should the final payment be?

Answers 8B

1 **a** 3, 2, 1, 0, −1, −2, −3
   - **b** 4, 1, −2, −5, −8, −11, −14
   - **c** −6, −4, −2, 0, 2, 4, 6
   - **d** −11, −8, −5, −2, 1, 4, 7
   - **e** −14, −19, −24, −29, −34, −39, −44

2 **a** $1.70, $1.35, $1.00, $0.65, $0.30, −$0.05, −$0.40
   - **b** 4

3 **a** −105, −93, −81, −69, −57, −45, −33, −21, −9
   - **b** $9

8C • Comparing directed numbers

LB Pages 7–9

Specific learning outcomes

Learners should be able to:

7.8.5.1 Use inequality signs, < and >, to compare numbers and place them on the number line.

7.8.6.1 Insert inequality signs, < and >, to make statements either true or false.

7.8.7.1 Arrange numbers from small to big and vice versa.

Teaching points

1 Learners should be able to use the **inequality signs** to compare the values of directed numbers.

2 The inequality signs can be used to make a statement true.

3 Learners should be able to arrange directed numbers in ascending and descending order according to their values.

Suggested teaching approach

- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercise 8C** on pages 7–9 in the LB, or **Activity 8C** in the TG below.

Additional notes

A positive number is always *greater* than a negative number.

Use the number line to help identify which number is greater or lesser. The numbers are larger as you move to the right, and smaller as you move to the left.

Examples

Example 1

Insert < or > signs to make the following statements true:

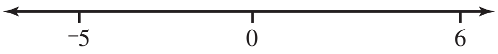
a −5 ☐ 6

b 4 ☐ −2

c −2 ☐ −4

Solution

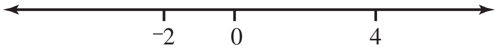
a



−5 < 6

−5 is further to the left, so it is less than 6.

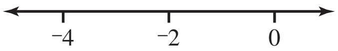
b



4 > −2

4 is further to the right, so it is greater than −2.

c



−2 > −4

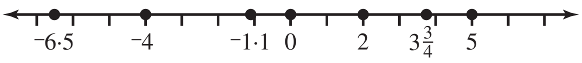
−2 is further to the right, so it is greater than −4.

Example 2

Arrange the following list of numbers in order from smallest to largest on a number line:

−4, 2, −6·5, 0, $3\frac{3}{4}$, −1·1, 5

Solution



Example 3

Determine whether each of the following statements is true or false:

a −1 > −6

b −5 > 2

Solution

a True, as −1 is further to the right, so it is greater than −6.

b False, as −5 is further to the left, so it is less than 2.

Example 4

Alaki owes $236.20 in one of the trade stores in the village.

- **a** Write this amount as a directed number.
- **b** She paid $150 off. How much does she still owe?
- **c** Write the amount she now owes as a directed number.
- **d** After paying $150, Alaki purchases a brush knife for $24 on credit from the same store. What is her balance in the store now?

Solution

- **a** Owing $236.20, written as a directed number, is $^{-}236.20$.
- **b** $236.20 – $150 = $86.20 still owing on her store credit.
- **c** $86.20 still owing on her store credit as a directed number is $^{-}86.20$.
- **d** $86.20 + $24 = $110.20 now owing on her store credit.

Activity 8C

1 Place a < or > symbol in each box to make a true statement.

- **a** $^{-}6$ ☐ $^{-}2$
- **b** 4 ☐ $^{-}1$
- **c** 0 ☐ $^{-}2$
- **d** $^{-}3$ ☐ $^{-}4$

2 Write these directed numbers in order from smallest to largest:

{$^{-}8$, 0, 2, $^{-}10$, 5, $^{-}3$, 7, $^{-}12$}

3 John has $20 in his wallet. He sees these items at a market:

- a CD ($6)
- a slice of pizza ($3)
- a sweatshirt ($15).

How much more money will he need if he wants to buy all three items?

4 Rose's bank account was overdrawn. She paid in $100. This made the balance $41 exactly. By how much had the account been overdrawn?

5 Some water at a temperature of 17°C was poured into a plastic bottle and placed in a freezer. Its temperature dropped by 25°C. It was then taken out of the freezer, and its temperature rose to 13°C. By how much did the temperature of the water rise after it was taken out of the freezer?

Answers 8C

1 **a** $^{-}6 < {}^{-}2$
  b $4 > {}^{-}1$
  c $0 > {}^{-}2$
  d $^{-}3 > {}^{-}4$

2 {$^{-}12$, $^{-}10$, $^{-}3$, 0, 2, 5, 7}

3 $4 more

4 $59

5 21°C

8D • Exploring addition

LB Page 10

Specific learning outcomes

Learners should be able to:

7.8.8.1 Add directed numbers using a number line: 'add on' for both positive and negative values.

Teaching points

1 Learners should be able to add directed numbers using a number line.

2 Learners should be able to demonstrate with diagrams how a number line is being used to add directed numbers.

Suggested teaching approach

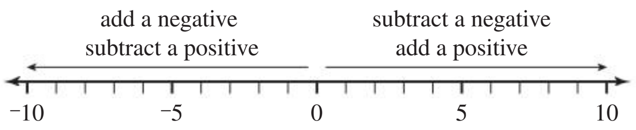
- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Learning task 8D** on page 10 in the LB, and **Activity 8D** in the TG below.

Additional notes

Adding directed numbers using a number line

Adding positive numbers is the straightforward addition you have been doing for years. To add a positive number or integer, we can imagine moving that many places to the right on the number line (or upwards on a vertical number line), in the positive direction.

Adding a negative number or integer is the opposite of adding a positive one. We move in the negative direction, to the left on the number line (or downwards on a vertical number line). We can see that this is the same movement as subtracting a positive integer.



Adding directed numbers without using a number line

When adding and subtracting numbers or integers, brackets are often placed around the second number and its sign, to separate it from the addition or subtraction sign. For example:

$^{+}5 + ({}^{+}9)$

$^{+}7 – ({}^{+}3)$

Because we can write a positive integer without the + sign in front, we can drop the positive signs in front of the numbers, remove the brackets, and simply write:

5 + 9

7 – 3.

We can see from the previous number line that subtracting a negative integer is the same as adding a positive one. This means that we could write:

8 – ($^{-}2$) as 8 + 2.

We can also see that adding a negative integer is the same as subtracting a positive one. This means we could write:

4 + ($^{-}10$) as 4 – 10.

Rules for positive and negative signs

+ (+) and − (−) can be replaced with +

− (+) and + (−) can be replaced with −

We can also say:

When the two signs are the *same*: ADD.

When the two signs are *different*: SUBTRACT.

Examples

Example 1

Complete the following questions using a number line:

a $2 + 4 =$

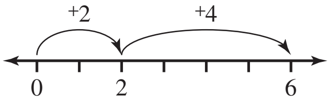
b $5 + {}^{-}4 =$

c $2 + {}^{-}7 =$

d ${}^{-}1 + {}^{-}3 =$

Solution

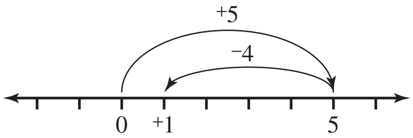
a $2 + 4 = 6$



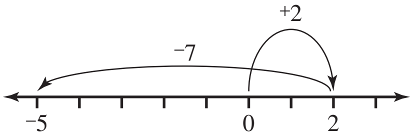
Start at zero and move to positive 2 (⁺2).

Then, facing right (because we are adding), go forward (because the number is positive) by 4.

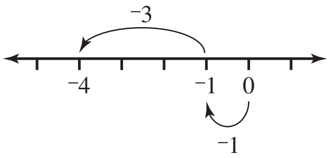
b $5 + {}^{-}4 = 1$



c $2 + {}^{-}7 = {}^{-}5$



d ${}^{-}1 + {}^{-}3 = {}^{-}4$



Activity 8D

1 In the Pacific Ocean, a submarine is stationary 400 metres below the surface of the water. A helicopter hovers overhead, 3600 metres above the surface of the water.

a The helicopter is descending at 4 metres every second (4 m/s). Describe its position after 5 minutes.

b The submarine is rising to the surface at a rate of 0·5 metres every second. Describe its position after 5 minutes.

c Which will reach the surface first?

2 Add these integers:

a ${}^{-}1 + 6$ **b** $2 + {}^{-}3$

c ${}^{-}2 + {}^{-}4$ **d** ${}^{-}6 + 5$

e ${}^{-}1 + {}^{-}10$ **f** $4 + {}^{-}7$

g ${}^{-}13 + 9$ **h** ${}^{-}35 + {}^{-}14$

i ${}^{-}20 + 28$ **j** $23 + {}^{-}15$

Answers 8D

1 **a** Helicopter's position after 5 minutes = 4 × 5 × 60 = 1200 m. Helicopter is 2400 metres above the water.

b Submarine position after 5 minutes = 0·5 × 5 × 60 = 150 m. Submarine is 250 metres below the water.

c Helicopter: 3600 ÷ 4 = 900 seconds. Submarine: 400 ÷ 0·5 = 800 seconds, so it reaches the surface first.

2 **a** 5 **b** ${}^{-}1$

c ${}^{-}6$ **d** ${}^{-}1$

e ${}^{-}11$ **f** ${}^{-}3$

g ${}^{-}4$ **h** ${}^{-}49$

i 8 **j** 8

8E • Adding directed numbers

LB Page 11

Specific learning outcomes

Learners should be able to:

7.8.8.1 Add directed numbers using a number line: 'add on' for both positive and negative values.

7.8.8.2 Use the rules *'like signs give positive (+)'* and *'unlike signs give negative (−)'* to add directed numbers.

Teaching points

1. A positive sign (+) indicates that you move to the RIGHT of the number line.
2. A negative sign (−) indicates that you move to the LEFT of the number line.
3. Learners should be able to add directed numbers without using the number line.

Suggested teaching approach

- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Learning task 8E** on page 11 in the LB, and **Activity 8E** in the TG below.

Additional notes

Adding directed numbers without using the number line

Approach 1

Here is a useful way of thinking about adding directed numbers. Show positive numbers with ticks and negative numbers with crosses:

4 = ✓✓✓✓

${}^{-}7$ = ✗✗✗✗✗✗✗

Now add them together: 4 ticks are balanced with 4 crosses. This leaves us with 3 crosses, which represents ⁻3.

$4 + {}^{-}7 = {}^{-}3$

✓✓✓✓ + ✗✗✗✗✗✗✗
✓✓✓✓ + ✗✗✗✗ + ✗✗✗
= ✗✗✗

Approach 2

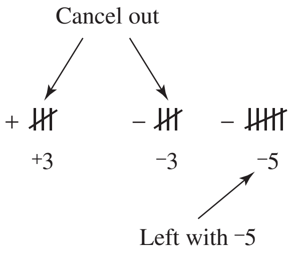
If both numbers are positive, then just add them, like adding ordinary numbers.

If both numbers are negative, then use the 'cancel out' approach.

'Cancel out'

Use the concept of cancelling to evaluate directed numbers.

Example: $3 + {}^{-}8 = {}^{-}5$



The diagram above shows that we began with positive 3 and negative 8.

'Less will cancel out from more.'

Because 3 is less than 8, *positive* 3 cancels out 3 *negatives* from ${}^{-}8$.

We are left with ${}^{-}5$.

Examples

Example 1

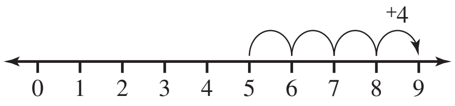
Add the following numbers:

a $5 + 4$
b $5 + {}^{-}4$
c $4 + 6$
d $4 + {}^{-}6$

Solution

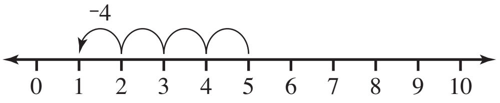
a $5 + 4 = 9$

Start at 5 and move 4 positions to the right, to arrive at 9.



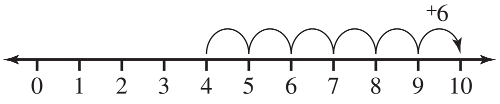
b $5 + {}^{-}4 = 1$

Start at 5 and move 4 positions to the left to arrive at 1.



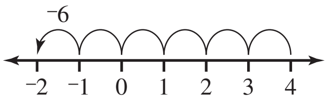
c $4 + 6 = 10$

Start at 4 and move 6 positions to the right, to arrive at 10.



d $4 + {}^{-}6 = 4 - 6 = {}^{-}2$

Start at 4 and move 6 positions to the left, to arrive at ${}^{-}2$.



Activity 8E

1 Calculate the following:

a ${}^{+}5 + ({}^{+}3)$
b ${}^{+}2 - ({}^{+}6)$
c ${}^{+}12 + ({}^{+}6)$
d ${}^{-}1 - ({}^{+}9)$
e ${}^{-}8 - ({}^{+}13)$
f ${}^{-}19 + ({}^{+}11)$
g ${}^{-}4 - ({}^{+}22)$
h ${}^{-}17 + ({}^{+}23)$
i ${}^{+}5 + ({}^{-}4)$
j ${}^{+}7 + ({}^{-}9)$
k ${}^{-}4 - ({}^{-}9)$
l ${}^{-}3 - ({}^{+}8)$
m ${}^{+}19 - ({}^{+}13)$
n $0 - ({}^{-}3)$
o ${}^{-}11 - ({}^{-}7)$
p ${}^{-}13 + ({}^{-}9)$

2 This is a magic square puzzle. Place the numbers ${}^{-}4, {}^{-}3, {}^{-}2, {}^{-}1, 1, 2, 3, 4$ in the spaces in the diagram so that the sum of the numbers is the same in each row and column, and in each of the two diagonals.

	0	

3 Place the following in descending order (largest to smallest):

a ${}^{+}4, 0, {}^{-}7, {}^{+}11, {}^{-}2$
b ${}^{-}23, 1, 0, {}^{-}9, {}^{+}7$
c ${}^{-}3, 4, 0, 11, {}^{-}15, 1$
d ${}^{-}5, 8, 19, {}^{-}43, {}^{-}2, 6$
e $14, {}^{-}72, 5, 26, {}^{-}1, {}^{-}38$
f $32, {}^{-}19, 0, 17, {}^{-}56, 4$

4 Calculate:

a $2 + 7 - 5$
b ${}^{-}3 + 10 - 5$
c ${}^{-}6 + 4 - 8$
d ${}^{-}15 + 9 + 8$
e $11 + 14 - 23$
f ${}^{-}7 - 8 - ({}^{-}9)$
g $4 + 5 - ({}^{-}5)$
h ${}^{-}6 + ({}^{-}9) - ({}^{+}9)$

Answers 8E

1 **a** 8
b ${}^{-}4$
c 18
d ${}^{-}10$
e ${}^{-}21$
f ${}^{-}8$
g ${}^{-}26$
h 6
i 1
j ${}^{-}2$
k 5
l ${}^{-}11$
m 6
n 3
o ${}^{-}4$
p ${}^{-}22$

2 More than one solution. One possible solution is:

3	${}^{-}4$	1	
${}^{-}2$	0	2	
${}^{-}1$	4	${}^{-}3$	
			0

3 **a** -7, -2, 0, +4, +11
b -23, -9, 0, 1, +7
c -15, -3, 0, 1, 4, 11
d -43, -5, -2, 6, 8, 19
e ${}^{-}72, {}^{-}38, {}^{-}1, 5, 14, 26$
f ${}^{-}56, {}^{-}19, 0, 4, 17, 32$

4 **a** 4
b 2
c ${}^{-}10$
d 2
e 2
f ${}^{-}6$
g 19
h ${}^{-}24$

8F • Exploring subtraction

LB Page 12

Specific learning outcomes

Learners should be able to:

7.8.8.1 Subtract directed numbers using a number line: ‘take away’ for both positive and negative values.

Teaching points

1. Learners should be able to subtract directed numbers using a number line.
2. Learners should be able to demonstrate with diagrams how directed numbers are subtracted using the number line.

Suggested teaching approach

- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Learning task 8F** on page 12 in the LB, or **Activity 8F** in the TG below.

Additional notes

Subtracting positive numbers is the straightforward subtraction you have been doing for years. To subtract a positive number or integer, imagine moving that many places to the left on the number line (or downwards on a vertical number line), in the negative direction.

When adding and subtracting numbers or integers, brackets are often placed around the second number and its sign, to separate it from the addition or subtraction sign. For example:

$^{+}5 + (^{+}9)$

$^{+}7 - (^{+}3)$

Because we can write a positive integer without the + sign in front, we can drop the positive signs in front of the numbers, remove the brackets, and simply write:

5 + 9

7 – 3.

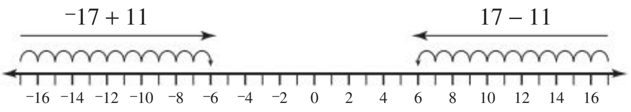
We can see from the previous number lines that subtracting a negative integer is the same as adding a positive one. This means that we could write:

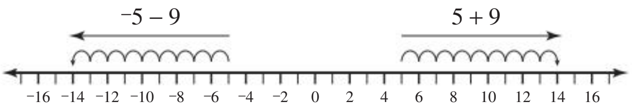
$8 - (^{-}2)$ as 8 + 2

We can also see that adding a negative integer is the same as subtracting a positive one. This means we could write:

$4 + (^{-}10)$ as 4 – 10

Examples





Activity 8F

1 Calculate the following:

a $^{-}27 + 14$

b $^{-}59 + 36$

c $^{-}87 + 62$

d $^{-}31 - 29$

e $^{-}68 - 43$

f $^{-}75 - 58$

g $^{-}47 + (^{-}62)$

h $^{-}71 - (^{-}26)$

i $^{-}96 - (^{+}31)$

2 A magic square is one in which the numbers in every row, column and diagonal add up to the same ‘magic’ total. Complete the following magic squares, by first working out the magic total.

a

$^{-}6$		$^{-}2$
	$^{-}3$	
		0

b

6			$^{-}18$
	2		8
	0	$^{-}8$	
12		$^{-}2$	$^{-}12$

Answers 8F

1 **a** $^{-}13$

b $^{-}23$

c $^{-}25$

d $^{-}60$

e $^{-}111$

f $^{-}133$

g $^{-}109$

h $^{-}45$

i $^{-}127$

2 **a**

$^{-}6$	$^{-}1$	$^{-}2$	
1	$^{-}3$	$^{-}7$	
$^{-}4$	$^{-}5$	0	
			$^{-}9$

b

6	$^{-}4$	4	$^{-}18$	
$^{-}16$	2	$^{-}6$	8	
$^{-}14$	0	$^{-}8$	10	
12	$^{-}10$	$^{-}2$	$^{-}12$	
				$^{-}12$

8G • Subtracting directed numbers

LB Page 13

Specific learning outcomes

Learners should be able to:

7.8.8.1 Subtract directed numbers using a number line: 'take away' for both positive and negative values.

7.8.8.2 Use the rules *'like signs give positive (+)'* and *'unlike signs give negative (–)'* to subtract directed numbers.

Teaching points

1 A *positive* sign (+) means you go to the RIGHT on the number line.

2 A *negative* sign (–) means you go to the LEFT on the number line.

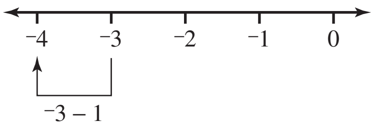
Suggested teaching approach

- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercise 8G** on page 13 in the LB, or **Activity 8G** in the TG below.

Additional notes

To subtract a positive number, move left along the number line.

Example: $^{-}3 - 1 = {}^{-}4$



To subtract directed numbers, change the sign of the second number and add it to the first number.

Examples:

$7 - {}^{-}2 = 7 + 2 = 9$

$^{-}3 - 1 = {}^{-}3 + {}^{-}1 = {}^{-}4$

Examples

1 Use a number line to evaluate:

a $8 - {}^{-}5$

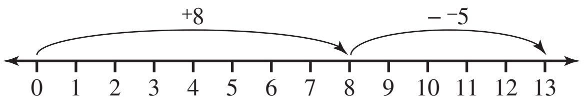
b $^{-}6 - {}^{-}4$

c $10 - 4$

Solution

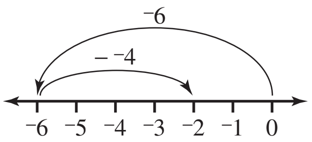
a $8 - {}^{-}5 = 13$

First start at zero and move forward to positive 8. Then, facing left (because we are subtracting), go *backwards* (because the number is negative) by 5.



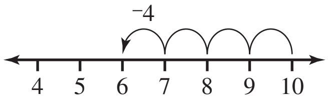
b $^{-}6 - {}^{-}4 = {}^{-}2$

First start at zero and move backwards to negative 6. Then, facing left (because we are subtracting), go *backwards* (because the number is negative) by 4.



c $10 - 4 = 6$

Start at 10 and move left by 4, to reach 6.



2 Evaluate the following:

a $4 - 7$ **b** $-3 - 2$

c $8 - -2$ **d** $5 - +8$

e $-2 + -9$

Solution

a $4 - 7 = {}^{-}3$ **b** $^{-}3 - 2 = {}^{-}5$

c $8 - {}^{-}2 = 8 + 2 = 10$ **d** $5 - {}^{+}8 = 5 - 8 = {}^{-}3$

e $^{-}2 + {}^{-}9 = {}^{-}2 - 9 = {}^{-}11$

Activity 8G

1 Subtract these directed numbers:

a $1 - {}^{-}2$ **b** $10 - 7$

c $^{-}3 - {}^{-}9$ **d** $^{-}14 - 5$

e $11 - 12$ **f** $30 - {}^{-}5$

g $0 - {}^{-}14$

2 Work out the answers to these mixed addition and subtraction problems:

a $8 - {}^{-}3$ **b** $^{-}4 + 2$

c $^{-}3 + {}^{-}12$ **d** $^{-}4 + {}^{-}1 + {}^{-}6$

e $13 - {}^{-}10 + 4$ **f** $^{-}25 - {}^{-}12 + 1$

g $14 - 12 + {}^{-}3$ **h** $^{-}1 - 2 - {}^{-}3 - {}^{-}4$

i $10 + {}^{-}4 - {}^{-}5 - 8$

Answers 8G

1 **a** 3 **b** 3 **c** 6

d $^{-}19$ **e** $^{-}1$ **f** 35

g 14

2 **a** 11 **b** $^{-}2$ **c** $^{-}15$

d $^{-}11$ **e** 27 **f** $^{-}12$

g $^{-}1$ **h** 4 **i** 3

8H • Multiplying directed numbers

LB Page 14

Specific learning outcomes

Learners should be able to:

7.8.9.1 Multiply directed numbers using the rules: 'Like signs give positive' and 'Unlike signs give negative'.

Teaching points

When multiplying directed numbers, apply the following rules:

- Like signs give positive.
- Unlike signs give negative.

Suggested teaching approach

- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercise 8H** on page 14 in the LB or **Activity 8H** in the TG below.

Additional notes

Multiplying a positive number by a positive number

If you know your tables, you are familiar with multiplying positive numbers. For example: ${}^{+}4 \times {}^{+}5 = 20$ can be written simply as $4 \times 5 = 20$.

Multiplying a positive number by a negative number

What happens when one of these numbers is negative? To help you understand this situation, imagine that you owe a friend \$5. We could write this as ${}^{-}5$. If you owed 4 friends \$5 each, you owe 4 lots of ${}^{-}5$, which we can write as ${}^{-}5 + {}^{-}5 + {}^{-}5 + {}^{-}5 = {}^{-}20$. This means that you would have \$20 less than you did before.

We can also write this as:

$4 \times {}^{-}5 = {}^{-}20$, or

${}^{-}5 \times 4 = {}^{-}20$

Multiplying a positive number by a negative number gives a negative result.

Multiplying a negative number by another negative number

What happens when both numbers being multiplied are negative? Consider the following number pattern.

$3 \times {}^{-}5 = {}^{-}15$

$2 \times {}^{-}5 = {}^{-}10$

$1 \times {}^{-}5 = {}^{-}5$

$0 \times {}^{-}5 = 0$

${}^{-}1 \times {}^{-}5 = ?$

The numbers on the right-hand side of the equals sign are increasing by 5. To continue the pattern, we need to replace the ? with ${}^{+}5$.

${}^{-}1 \times {}^{-}5 = {}^{+}5$

${}^{-}2 \times {}^{-}5 = {}^{+}10$

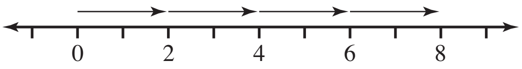
${}^{-}3 \times {}^{-}5 = {}^{+}15$

and so on.

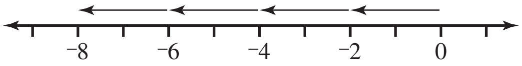
Multiplying a negative number by another negative number gives a positive result.

Using a number line:

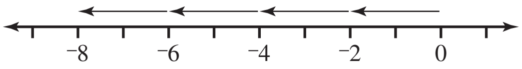
$4 \times 2 = 8$
adding 4 lots of 2



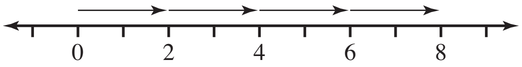
$4 \times {}^{-}2 = {}^{-}8$
adding 4 lots of ${}^{-}2$



${}^{-}4 \times 2 = {}^{-}8$
subtracting 4 lots of 2



${}^{-}4 \times {}^{-}2 = 8$
subtracting 4 lots of ${}^{-}2$
(Subtracting a negative is the same as adding a positive.)



Multiplying two numbers with like signs gives a positive answer.

Multiplying two numbers with unlike signs gives a negative answer.

This can be summarised as:

$+ \times + = +$ $+ \times - = -$

$- \times - = +$ $- \times + = -$

Multiplying two negative directed numbers gives a positive answer.

Multiplying a positive directed number by a negative one, in either order, gives a negative answer.

Examples:

${}^{-}3 \times {}^{-}4 = 12$

${}^{-}5 \times 10 = {}^{-}50$

Examples

Example 1
Evaluate:

a 3×4
b $3 \times {}^{-}4$
c ${}^{-}3 \times 4$
d ${}^{-}3 \times {}^{-}4$
e $6 \times {}^{-}3$
f ${}^{-}1 \times {}^{-}2$
g ${}^{-}5 \times 4$
h 2×7

Solution

a $3 \times 4 = 12$

b $3 \times {}^-4 = {}^-12$

c ${}^-3 \times 4 = {}^-12$

d ${}^-3 \times {}^-4 = 12$

e $6 \times {}^-3 = {}^-18$

f ${}^-1 \times {}^-2 = 2$

g ${}^-5 \times 4 = {}^-20$

h $2 \times 7 = 14$

Example 2

Calculate:

a ${}^-5 \times {}^-7$

b ${}^-6 \times {}^+9$

Solution

a Perform the multiplication as though both numbers are positive ($5 \times 7 = 35$), then determine the sign of the answer ($- \times - = +$). If the final answer is positive, you can leave out the + sign. (${}^-5 \times {}^-7 = 35$)

b Perform the multiplication as though both numbers are positive ($6 \times 9 = 54$), then determine the sign of the answer ($- \times + = -$). (${}^-6 \times {}^+9 = {}^-54$)

Example 3

Calculate: ${}^+4 \times {}^-3 \times {}^-1$

Solution

When finding the product of more than two numbers, we just extend the process already developed.

1 Multiply the first two numbers, placing the correct sign in front of the answer. (Here, $+ \times - = -$)
${}^+4 \times {}^-3 \times {}^-1$
$= {}^-12 \times {}^-1$

2 Multiply the product of the first two numbers by the third number, again ensuring that the correct sign is in front of the answer. (Here, $- \times - = +$, so we can leave the sign off the final answer.)
$= {}^-12 \times {}^-1$
$= 12$

Activity 8H

1 Work out these multiplications:

a $3 \times {}^-2$ **b** ${}^-5 \times 1$

c ${}^-12 \times {}^-2$ **d** $10 \times {}^-8$

e ${}^-11 \times {}^-3$ **f** ${}^-6 \times {}^-7$

2 Calculate:

a ${}^+6 \times {}^+5$ **b** ${}^+7 \times {}^+3$

c ${}^+8 \times {}^-5$ **d** ${}^+12 \times {}^-2$

e ${}^-2 \times {}^+4$ **f** ${}^-2 \times {}^+8$

g ${}^-6 \times {}^-5$ **h** ${}^-2 \times {}^-4$

i ${}^-12 \times 5$ **j** $7 \times {}^-20$

3 Calculate:

a ${}^-2 \times {}^-4 \times {}^-3$ **b** ${}^-1 \times 3 \times {}^-4$

c $4 \times 5 \times {}^-2$ **d** ${}^-9 \times 1 \times 2$

e ${}^-2 \times {}^-5 \times {}^-5$ **f** ${}^-5 \times {}^-2 \times {}^-2$

g ${}^-3 \times {}^-3 \times {}^-3$ **h** ${}^-2 \times {}^-2 \times {}^-2$

4 Calculate:

a $({}^-6)^2$ **b** ${}^-6^2$

c $2 \times ({}^-5)^2$ **d** ${}^-5^2 \times {}^-3$

e $({}^-2)^2 \times ({}^-2)^2$ **f** ${}^-2^2 \times ({}^-5)^2$

5 Calculate the following:

a ${}^-1 \times {}^-1$

b ${}^-1 \times {}^-1 \times {}^-1 \times {}^-1$

c ${}^-1 \times {}^-1 \times {}^-1 \times {}^-1 \times {}^-1 \times {}^-1$

d ${}^-1 \times {}^-1 \times {}^-1$

e ${}^-1 \times {}^-1 \times {}^-1 \times {}^-1 \times {}^-1$

f ${}^-1 \times {}^-1 \times {}^-1 \times {}^-1 \times {}^-1 \times {}^-1 \times {}^-1$

Answers 8H

1 **a** ${}^-6$ **b** ${}^-5$

c 24 **d** ${}^-80$

e 33 **f** 42

2 **a** 30 **b** 21

c ${}^-40$ **d** ${}^-24$

e ${}^-8$ **f** ${}^-16$

g 30 **h** 8

i ${}^-60$ **j** ${}^-140$

3 **a** ${}^-24$ **b** 12

c ${}^-40$ **d** ${}^-18$

e ${}^+50$ **f** ${}^-20$

g ${}^-27$ **h** ${}^-2$

4 **a** 36 **b** ${}^-36$

c 50 **d** 75

e 16 **f** ${}^-100$

5 **a** 1 **b** 1

c 1 **d** ${}^-1$

e ${}^-1$ **f** ${}^-1$

8I • Dividing directed numbers

LB Page 15

Specific learning outcomes

Learners should be able to:

7.8.9.1 Divide directed numbers using the rules: ‘Like signs give positive’ and ‘Unlike signs give negative’.

Teaching points

When dividing directed numbers, apply the following rules:

- Like signs give positive.
- Unlike signs give negative.

Suggested teaching approach

- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercise 8I** on page 15 in the LB, or **Activity 8I** in the TG below.

Additional notes

The table below shows the rules that must be used when dividing directed numbers.

Divide (÷)	Positive (+)	Negative (–)
Positive (+)	+	–
Negative (–)	–	+

Positive ÷ Positive = Positive

Negative ÷ Positive = Negative

Positive ÷ Negative = Negative

Negative ÷ Negative = Positive

Examples

Evaluate the following:

a 10 ÷ 5
b −10 ÷ −5
c 10 ÷ −5
d −10 ÷ 5
e 80 ÷ −10
f −48 ÷ −6
g 36 ÷ 12
h −15 ÷ 3

Solution

a 10 ÷ 5 = 2
b −10 ÷ −5 = 2
c 10 ÷ −5 = −2
d −10 ÷ 5 = −2
e 80 ÷ −10 = −8
f −48 ÷ −6 = −8
g 36 ÷ 12 = 3
h −15 ÷ 3 = −5

Activity 8I

1 Work out these divisions:

a −8 ÷ −2 **b** 10 ÷ −1
c −33 ÷ 11 **d** −40 ÷ −5
e 18 ÷ −3 **f** −54 ÷ −6
g 100 ÷ −100 **h** −100 ÷ 100
i −100 ÷ −100 **j** 32 ÷ −4

2 Calculate:

a 9 ÷ −3 **b** 6 ÷ 2
c −8 ÷ 4 **d** −30 ÷ 5
e −12 ÷ −3 **f** −18 ÷ −2
g −63 ÷ −9 **h** 45 ÷ −5
i −240 ÷ 8 **j** −600 ÷ 6

3 Calculate the following:

a $\frac{48}{-3}$ **b** $\frac{-77}{11}$
c $\frac{52}{-2}$ **d** $\frac{-93}{-3}$
e $\frac{-90}{-6}$ **f** $\frac{100}{-5}$

4 Complete the following:

a $\frac{-28}{-4}$ equals ___ **b** 162 ÷ −3 equals ___

Answers 8I

1 a 4 **b** −10
c −3 **d** 8
e −6 **f** 9
g −1 **h** −1
i 1 **j** −8

2 a −3 **b** 3
c −2 **d** −6
e 4 **f** 9
g 7 **h** −9
i −30 **j** −100

3 a −12 **b** −7
c −26 **d** 31
e 15 **f** −20

4 a 7 **b** -54

8J • Order of operations

LB Page 16

Specific learning outcomes

Learners should be able to:

7.8.10.1 Solve directed number problems applying the rule of BODMAS.

Teaching points

1 Students should understand the **BODMAS rule** and its parts or components:

B Work out the calculations inside the brackets first. If the brackets contain more than one operation, they must also follow the rules of BODMAS.

O If the question contains a fraction ‘of’ a number then this is calculated next.

D Work out the division and

M multiplication calculations, working from left to right
A Work out the addition and
S subtraction calculations, working from left to right.

2 Students need to identify the operation sign/s being used.

3 Apply the BODMAS rule to evaluate questions with a mixture of signs.

Suggested teaching approach

- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercise 8J** on page 16 in the LB, or **Activity 8J** in the TG below.

Additional notes

The BODMAS rules you have learned previously also apply to operations with directed numbers.

B – Calculations inside brackets should be worked out first.

$3 - ({}^{-}2 \times 7)$
$= 3 - {}^{-}14$
$= 3 + 14$
$= 17$

DM and AS – Do multiplying and dividing before adding and subtracting.

${}^{-}6 + 14 \div {}^{-}7$
$= {}^{-}6 + {}^{-}2$
$= {}^{-}8$

If there is just adding and subtracting in a problem, or just multiplying and dividing, work out directed number problems from left to right.

Example

Work out ${}^{-}9 + {}^{-}1 - {}^{-}6$

Solution

${}^{-}9 + {}^{-}1 - {}^{-}6$
$= ({}^{-}9 + {}^{-}1) - {}^{-}6$
$= {}^{-}10 - {}^{-}6$
$= {}^{-}10 + 6$
$= {}^{-}4$

Examples

Example 1
Evaluate:

${}^{-}7 \times 4 \div {}^{-}2 \times {}^{-}1$

Solution

As there is only multiplication and division involved, work from left to right.

${}^{-}7 \times 4 \div {}^{-}2 \times {}^{-}1$
$= {}^{-}28 \div {}^{-}2 \times {}^{-}1$
$= 14 \times {}^{-}1$
$= {}^{-}14$

Example 2
Evaluate:

${}^{-}3 \times ({}^{-}2 + {}^{-}6) - 4$

Solution

1 Evaluate brackets first. If the answer is negative, keep it inside the brackets, to avoid confusion.

${}^{-}3 \times ({}^{-}2 + {}^{-}6) - 4$
$= {}^{-}3 \times ({}^{-}8) - 4$

2 Perform multiplication and division as you move from left to right.

$= 24 - 4$

3 Perform subtraction and addition as you move from left to right.

$= 20$

Activity 8J

1 Evaluate:
  a $45 \div {}^{-}9 \times {}^{-}2$
  b ${}^{-}32 \div {}^{-}8 \times 5$
  c $4 + (6 \times {}^{-}3) - 2$
  d ${}^{-}2 + ({}^{-}64 \div {}^{-}8)$
  e $7 + (14 \div - 2) - 3$
  f $44 \div ({}^{-}12 + 1)$
  g $({}^{-}8 + 2) \times (4 - 10)$
  h $(12 \times 3) \div ({}^{-}2 - 2)$

2 Evaluate the following:
  a $19 - 7 - 15 + 14$
  b $19 - (7 - 15) + 14$
  c Explain why the presence of the brackets in **b** gives a very different answer to **a**.

Answers 8J

1 **a** 10
  b 20
  c ${}^{-}16$
  d 6
  e ${}^{-}3$
  f ${}^{-}4$
  g 36
  h ${}^{-}1$

2 **a** 11
  b 41
  c Placing brackets around 7 – 15 gives a negative value. Subtracting a negative is the same as adding.

8K • Miscellaneous directed numbers

LB Page 17

Specific learning outcomes

Learners should be able to:

7.8.11.1 Evaluate and solve different directed-number problems using the number line, BODMAS and other approaches.

Teaching points

1 Explain the BODMAS rule and its parts or components.

2 Learners need to be able to identify the operations signs that are used.

3 Learners need to be able to apply the BODMAS rule to evaluate questions.

Suggested teaching approach

- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercise 8K** on page 17 in the LB, or **Activity 8K** in the TG below

Examples

Example 1

Evaluate:

$(^-2 - 3) \times 5$

Solution

$(^-2 - 3) \times 5$
$= {^-5} \times 5$
$= {^-25}$

Example 2

Insert one of the operations +, –, ×, ÷ into the boxes below to make the number equation true:

$2 \square (^-1 \square {^-4}) \square 6 = 4$

Solution

$^-2 + (^-1 \times {^-4}) - 6 = {^-4}$

Example 3

Evaluate:

a $^-4 \times {^-8} - (96 \div {^-12})$
b $^-2 + (2 \times {^-4}) - 5$

Solution

a $^-4 \times {^-8} - (96 \div {^-12})$
$= {^-4} \times 8 - {^-8}$
$= 32 - {^-8}$
$= 32 + 8$
$= 40$

b $^-2 + (2 \times {^-4}) - 5$
$= {^-2} - 8 - 5$
$= {^-15}$

Activity 8K

1 Evaluate:

a $^-4 + 5$
b $6 - {^-3}$
c $^-4 + 1$
d $^-11 - {^-11}$

2 Evaluate:

a $^-1 - 2 - {^-3} - {^-4}$
b $10 + {^-4} - {^-5} - 8$

3 Evaluate:

a $^-4 \times {^-3} \div 2$
b $12 \div {^-3} \times {^-2}$
c $^-1 \times (^-3 + {^-8})$
d $^-10 \div {^-2} \times {^-3}$
e $(^-1 + {^-2}) \times {^-3}$
f $\frac{^-13 + 5}{^-2}$

4 These problems contain all four operations, and brackets. Use the BODMAS rule to evaluate:

a $(4 - 8) \times 3$
b $(^-2 + 1) \times {^-7}$
c $5 - {^-2} + {^-3}$
d $40 - {^-8} \times 2$
e $^-6 + 2 \times {^-4}$
f $^-60 \div {^-30} \div {^-2}$
g $20 - {^-3} + 8$
h $14 + {^-2} \times {^-5}$
i $^-4 \times (8 - {^-2})$

Answers 8K

1 **a** 1 **b** 9
c 3 **d** 0
2 **a** 4 **b** 3
3 **a** 6 **b** 8
c 11 **d** -15
e 9 **f** 4
4 **a** $^-12$ **b** 7
c 4 **d** 56
e $^-14$ **f** $^-1$
g 31 **h** 24
l $^-40$

8L • The coordinate plane

LB Pages 18–19

Specific learning outcomes

Learners should be able to:

7.8.12.1 Identify two sides of the plane and name the axes.

7.8.13.1 Find the coordinates of objects on the coordinate plane using the *x* and *y* axes.

7.8.14.1 Plot coordinate pairs on a set of *x* and *y* axes.

Teaching points

1. Learners should be able to identify the two axes of the **coordinate plane** (*x*-axis and *y*-axis).
2. Learners should be able to label both axes and give each axis a scale.
3. Learners should be able to plot **coordinates** on the plane when there are only positive coordinates and also when there are both negative and positive coordinates.

Suggested teaching approach

- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB or TG.
- Learners complete **Exercise 8L** on page 18 in the LB, or **Activity 8L** in the TG below.

Additional notes

When writing the coordinates of points, we always follow the convention:

(*x* number first, *y* number second)

This is easy to remember because the order is alphabetical:

x** before **y

horizontal *before* **v**ertical

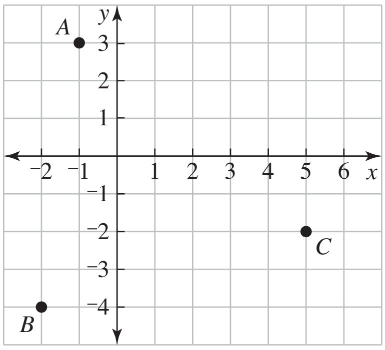
first *before* **s**econd.

Example

A is the point (−1, 3)

B is the point (−2, −4)

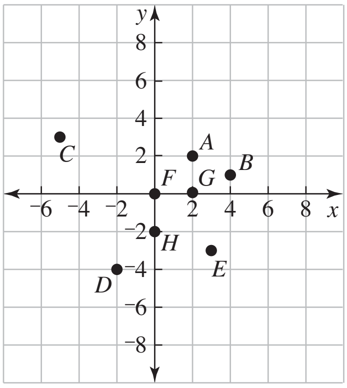
C is the point (5, −2)



Examples

Example 1

Give the coordinates of the points labelled with letters in the diagram below:



Solution

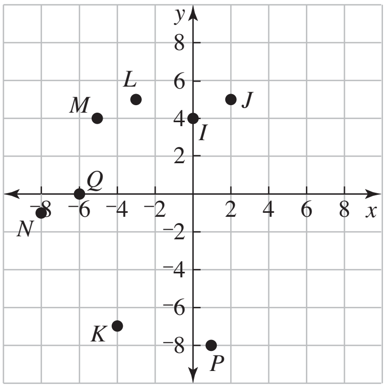
A (2, 2), *B* (4, 1), *C* (−5, 3), *D* (−2, −4),
E (3, −3), *F* (0, 0), *G* (2, 0), *H* (0, −2)

Example 2

Mark the following points on a coordinate plane with axes from −8 to 8:

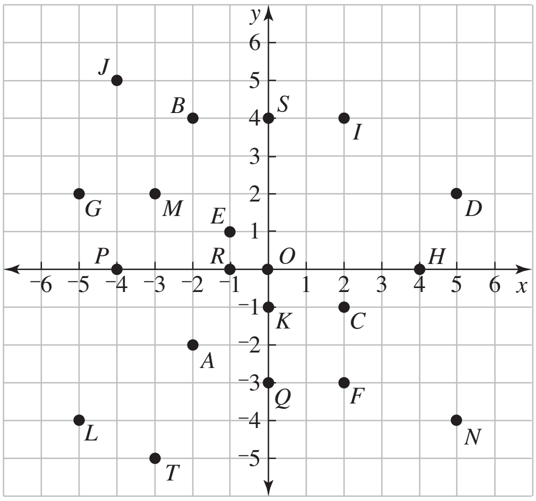
I (0, 4), *J* (2, 5), *K* (−4, −7), *L* (−3, 5), *M* (−5, 4),
N (−8, −1), *P* (1, −8), Q (−6, 0)

Solution



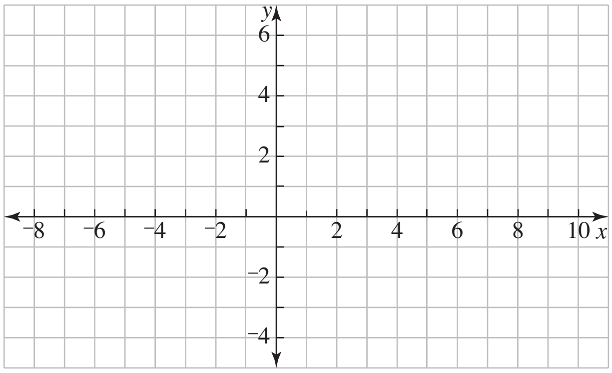
Activity 8L

1 Write down the coordinates of the points labelled *A* to *T*.



2 Plot these points and join them up in the order given. Then join the last point to the first:

(2, −3), (−1, −3), (−4, −2), (−6, −2), (−8, −4), (−7, −1), (−7, 2), (−6, 0), (−1, 2), (0, 6), (1, 2), (7, 2), (10, 1), (9, −1), (7, −1), (4, 0) (5, −2)

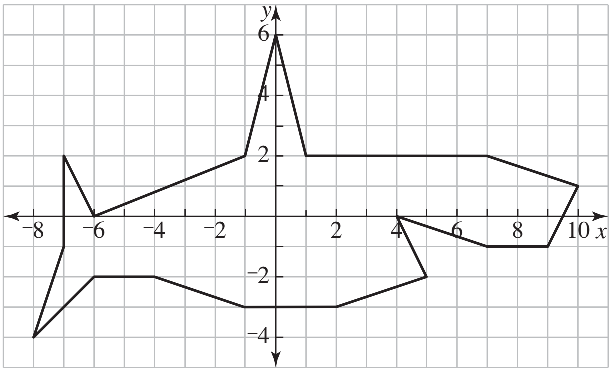


What creature is this?

Answers 8L

1 *A*(−2, −2), *B*(−2, 4), *C*(2, −1), *D*(5, 2), *E*(−1, 1), *F*(2, −3), *G*(−5, 2), *H*(4, 0), *I*(2, 4), *J*(−4, 5), *K*(0, −1), *L*(−5, −4), *M*(−3, 2), *N*(5, −4), *O*(0, 0), *P*(−4, 0), *Q*(0, −3), *R*(−1, 0), *S*(0, 4), *T*(−3, −5)

2 Shark



• Chapter Nine •

Coordinate Graphs and Location

Overview

Solomon Islands is made up of about 900 islands spread over about 1·4 million square kilometres of the western Pacific Ocean. Locals travel between the islands using traditional and local knowledge to navigate, even today. They are very good with their locations, directions and distances. They know their locations so well that they even travel at night.

The introduction of the Cartesian plane by René Descartes helped the development of a new navigation system for travelling by land and sea. Coordinate graphs are used to accurately pin-point locations, and their application in scaled maps enables people to move accurately from one location to another.

A coordinate graph is a visual method of showing the relationships between numbers on a plane that has two perpendicular lines. The vertical line is known as the *y*-axis and the horizontal line is the *x*-axis. The point where the two axes intersect is called the origin. The axes each have a scale, and the space between them forms a coordinate grid, which is used to locate points. Each point can be identified by an ordered pair of numbers – that is, a number from the *x*-axis, called an *x*-coordinate, and a number from the *y*-axis, called a *y*-coordinate. The coordinates are put together as an ordered pair, written in the form of (*x*, *y*). The origin is located at (0, 0).

In this chapter, learners will develop their skills in using maps, coordinates, compass bearings, true bearings and scales.

Contents

Chapter skills

This chapter covers the following skills:

- Drawing and interpreting diagrams in two dimensions
- Using directions in two dimensions
- Locating points on a map
- Using the Cartesian plane
- Using true bearings – a true bearing is represented by an angle measured clockwise from north
- Using compass bearings – a compass bearing gives the amount of turn east or west from the direction north or south, whichever is closer
- Applying true and compass bearings
- Using scales on maps.

Teaching plan

Lessons	Chapter sections	Class work and home work
1–2	• Intro • 9A: Directions in two dimensions	Learner's Book 2 • Exercise 9A, pages 32–33
3–5	• 9B: The coordinate number plane	Learner's Book 2 • Exercise 9B, pages 35–37
6	• 9C: Handy reflections	Learner's Book 2 • Exercise 9C. pages 38–39
7–8	• 9D: Scale diagrams and maps	Learner's Book 2 • Exercise 9D, pages 40–41
9–10	• 9E: Maps and bearings	Learner's Book 2 • Exercise 9E, pages 43–45
10	• Revision/test	Learner's Book 2 • Revision/Assessment, Exercises 9A, 9B, 9D, 9E, pages 52–53 Teacher's Guide • Chapter 9 test, page 175

General learning outcomes

Learners should:

Directions in two dimensions

7.9.1 Understand that there are two (2) dimensions (sides) to a grid, which allow us to identify and describe locations of objects. (U)

7.9.2 Use directions in the two-dimensional plane to locate the positions of objects. (U)

The coordinate number plane

7.9.3 Understand that the positions of objects can be identified and described by using lines from the two sides of the plane to find a point through ordered pairs. (U)

7.9.4 Understand that points on the number plane are described by coordinates from the *x*- and *y*-axes. (U)

Scale diagrams and maps

7.9.5 Understand that a map is a useful way of recording and keeping information about things in real life such as area, places, buildings etc. (U)

7.9.6 Know that direction north and scales must always be included in maps. (K)

7.9.7 Know how to find distances on a map and the ground, given the scale. (K)

Maps and bearings

7.9.8 Understand the importance of bearings in navigation where directions, distances and positions of locations are determined at a given time. (U)

9A • Directions in two dimensions

LB Pages 32–33

Specific learning outcomes

Learners should be able to:

7.9.1.1 Identify and label parts of the coordinate plane: *x- and y-axes, across and up*.

7.9.1.2 Draw and construct the coordinate planes and axes.

7.9.2.1 Describe and identify the positions of objects using ‘across’ and ‘up’.

Teaching points

1. The main parts of the coordinate plane are: *x*-axis, *y*-axis, origin (0, 0) and scales (on the axes).
2. Learners should be able to construct coordinate planes by marking the axes and correctly labelling them with scales.
3. The positions of objects can be found using ‘across’ and ‘up’.

Suggested teaching approach

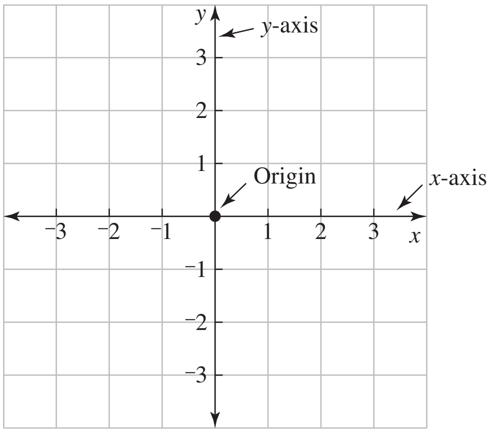
- Start the chapter section by doing the **Starter activities** provided.
- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercise 9A** on pages 32–33 in the LB, or **Activity 9A** in the TG below.

Starter activities

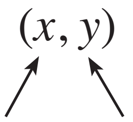
1. Arrange the class into a grid formation, with *x*- and *y*-axes.
2. Give numbers to learners who are sitting on axes.
3. Identify the origin (0, 0) – in the bottom left corner.
4. Use the *x* and *y* numbers on the axes to find the coordinates of the positions of where the other learners are sitting.
5. Ask learners to find the coordinates of the positions they are sitting on.
6. Then extend the grid to involve negative values of *x* and *y*, and repeat steps **4** and **5**.

Additional notes

A **Cartesian plane** is constructed by drawing two lines at right angles to each other, one horizontal and the other vertical. The point at which they **intersect** (cross) is called the **origin**. The horizontal line is called the ***x*-axis** and the vertical line is called the ***y*-axis**. Both **axes** (plural of *axis*) are number lines that extend infinitely in both directions. The integers on the axes are used to form a grid that allows any point to be located in reference to the origin.



The position of any point on a number plane is described by a pair of numbers called the **coordinates** of the point. Coordinates are always written in brackets as an **ordered pair** (*x, y*). Locating any point on the plane involves two moves from the origin (across, and up/down).



The ***x*-coordinate** shows the move to the left (–) or right (+) of the origin.

The ***y*-coordinate** shows the move up (+) or down (–) from the origin.

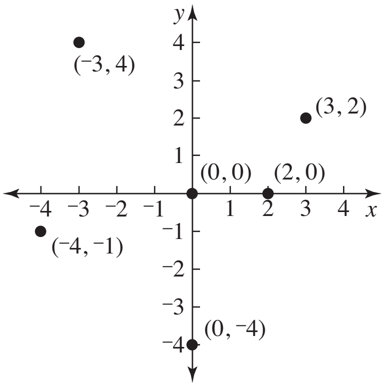
When graphing coordinate pairs of numbers:

1. Always move in the horizontal direction first, then in the vertical direction. This is a mathematical convention.
2. The name ‘ordered pair’ tells you that order is important. The *x*-coordinate is always written first, and the *y*-coordinate is written second (*x, y*).
3. The coordinates of the origin are (0, 0).

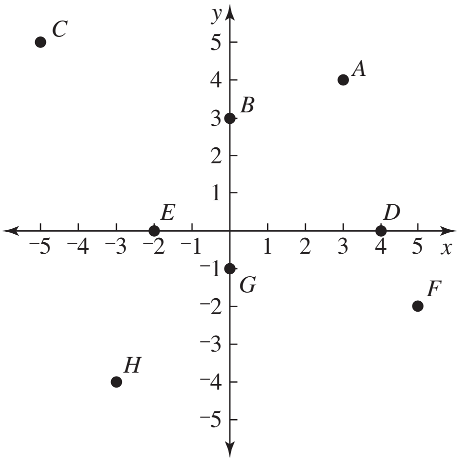
Examples

The following points and their Cartesian coordinates are shown on the Cartesian plane given below:

(3, 2), (−3, 4), (−4, −1), (0, 0), (2, 0) and (0, −4).

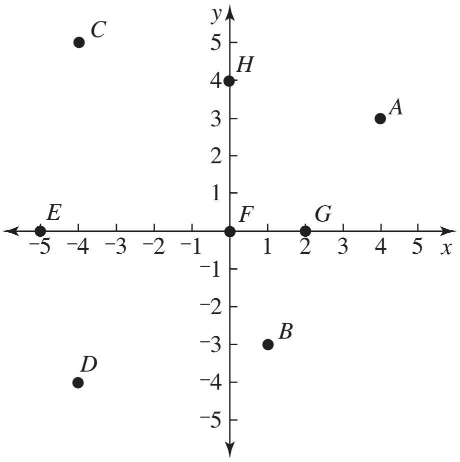


The coordinates of points *A*–*H* shown in the Cartesian plane are:
A(3, 4), *B*(0, 3), *C*(−5, 5), *D*(4, 0), *E*(−2, 0), *F*(5, −2), *G*(0, −1), *H*(−3, −4)



Activity 9A

1 Write the coordinates of each of the points *A* to *H* shown on the Cartesian plane.



2 For questions **a** to **c**, choose the correct answer (**A**, **B**, **C** or **D**).

- **a** A point is 1 unit right and 4 units up from the origin of a Cartesian plane. The coordinates of the point are:
  - **A** (4, 1)
  - **B** (−4, 1)
  - **C** (1, 4)
  - **D** (−1, 4)
- **b** A point is 5 units left and 2 units up from the origin of a number plane. The coordinates of the point are:
  - **A** (−5, 2)
  - **B** (2, −5)
  - **C** (5, −2)
  - **D** (−2, 5)
- **c** A point is 4 units down and 3 units left of the origin of a Cartesian plane. The coordinates of the point are:
  - **A** (-4, -3)
  - **B** (-3, -4)
  - **C** (3, -4)
  - **D** (-3, 4)

3 For questions **a** and **b**, choose the correct answer (**A**, **B**, **C** or **D**).

- **a** Which of the following points will give a vertical line passing through the *x*-axis when joined in a straight line to (10, −6)?
  - **A** (−6, −2)
  - **B** (4, −6)
  - **C** (10, 0)
  - **D** (0, 10)
- **b** Which of the following points will give a horizontal line passing through the *y*-axis when joined in a straight line to (8, 13)?
  - **A** (4, 2)
  - **B** (8, −3)
  - **C** (−5, 0)
  - **D** (0, 13)

4 Rule a set of axes to form a Cartesian plane on a piece of grid or graph paper. Allow for a scale from −9 to 9 on the *x*-axis and −4 to 4 along the *y*-axis.

- **a** Plot the following points and join them in the order given, to form a picture:
  (−4, −1), (−5, −1), (−5, 0), (−9, 1), (−6, 3), (−1, 2), (−4, −1), (−4, −2), (−1, −4), (0, −3), (−1, 2), (0, 3), (1, 2), (6, 3), (9, 1), (5, 0), (5, −1), (4, −1), (1, 2), (0, −3), (1, −4), (4, −2), (4, −1).
- **b** Join (3, 4) to (0, 2·5) and join (-3, 4) to (0, 2·5).

Answers 9A

1 *A*(4, 3), *B*(1, −3), *C*(−4, 5), *D*(−4, −4), *E*(−5, 0), *F*(0, 0), *G*(2, 0), *H*(0, 4)

2 **a** C

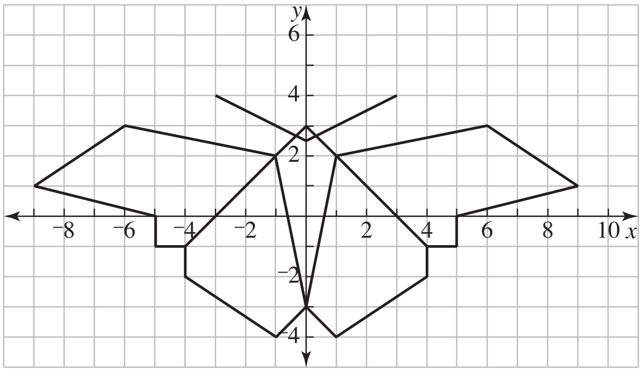
b A

c B

3 **a** C

b D

4



9B • The coordinate number plane

LB Pages 34–37

Specific learning outcomes

Learners should be able to:

7.9.3.1 Name the positions of objects on the coordinate plane using 'across' and 'up'.

7.9.4.1 Locate the positions of points on the grid by giving the coordinates using *x*- and *y*-axis values.

7.9.4.2 Plot and name coordinate pairs on the coordinate plane, using the *x*- and *y*-axis values.

Teaching points

1. The coordinates or positions of objects on the Cartesian plane can be found using 'across' and 'up'.
2. Learners should be able to find the coordinates of objects on the plane using the values on the *x*- and *y*-axes.
3. Learners should be able to plot coordinates on the plane.
4. The coordinates of objects on the plane can be named by reading their values on the *x*- and *y*-axes.

Suggested teaching approach

- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercise 9B** on pages 35–37 in the LB, or **Activity 9B** in the TG below.

Starter activities

A great way to teach the coordinate system is to take it outside.

- You need two sets of cards marked with the numbers 0 to 10, an *X*, a *Y*, a →, a ↓, and arbitrary coordinates (0, 0), (1, 2) etc.
- Move outside and draw a large set of axes with chalk on the ground.
- Give the cards to individual students to place on the ground.
- Weigh the cards down if required.

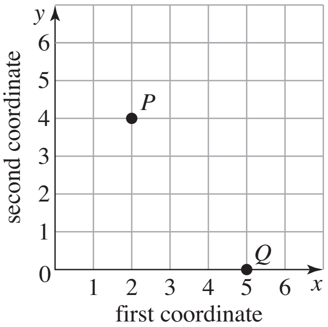
Students love moving to the coordinates, and the class gets a good grounding in the coordinate system.

Variation: Use string instead of chalk, and progress from using only the first quadrant to using all quadrants.

Additional notes

Coordinates describe the position of points on a whole-number plane.

- The horizontal scale (going across) is called the *x*-axis.
- The vertical scale (going up) is called the *y*-axis.

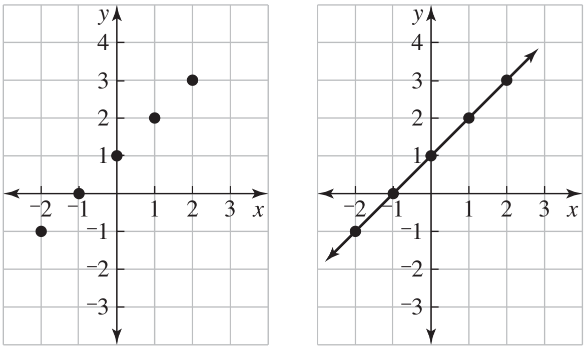


The point marked *P* is at (2, 4).

The point marked *Q* is at (5, 0).

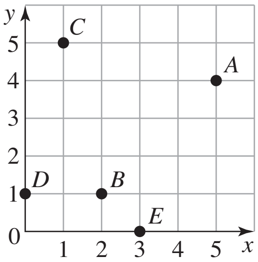
Examples

1. Plot the points (−2, −1), (−1, 0), (0, 1), (1, 2) and (2, 3) on a number plane.
2. Rule a straight line passing through all the points.



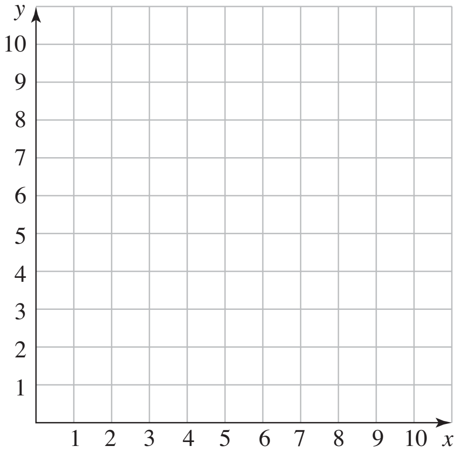
Activity 9B

1. Write down the coordinates of the points labelled *A* to *E*.



2. Plot these points on the grid.

(5, 7), (7, 4), (8, 8), (10, 8), (8, 0), (6, 0), (5, 2), (4, 0), (2, 0), (0, 8), (2, 8), (3, 4), (5, 7)



Join up all the points in the order given. What letter of the alphabet is shown?

Additional activity

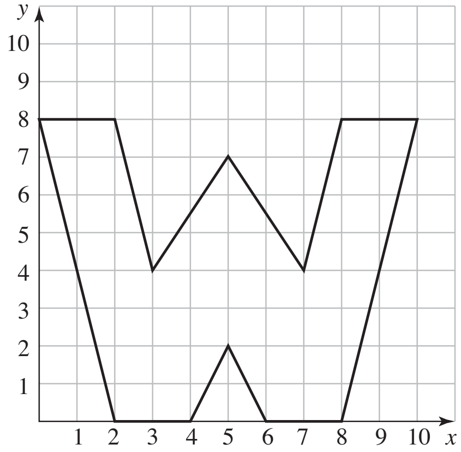
3 Divide the class into pairs to play coordinate battleships.
  - Each student draws up a first quadrant grid using the numbers 0 to 10.
  - One learner has the ships and places them on their grid without the other learner seeing. The other learner tries to sink them and records their moves. Coordinates must be marked with an X.
  - Students specify their hardware: an aircraft carrier XXXXX, battleship XXXX, a submarine XXX, a frigate XXX and a minesweeper XX. Once each pair has played, they can swap partners.

Variation: Use more ships or more quadrants.

Answers 9B

1 *A*(5,4), *B*(2, 1), *C*(1, 5), *D*(0, 1), *E*(3, 0)

2 W



3 Learner activity

9D • Scale diagrams and maps

LB Pages 40–41

Specific learning outcomes

Learners should be able to:

7.9.5.1 Identify some of the things in life that can be represented using maps: *buildings*, *land*, *area* etc.

7.9.6.1 Identify the direction of the map normally given as north, and its scales, which are normally expressed as a ratio.

7.9.7.1 Calculate the distances on the map and the ground using given scales that are expressed as ratios.

Teaching points

1 Practical things in life such as land and buildings can be represented using maps.

2 Learners should be able to identify directions and scales that are given in maps.

3 Learners should be able to use ratios to calculate distances in maps and their corresponding real distances.

Suggested teaching approach

- Start the chapter section by doing the **Starter activities** provided.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercise 9D** on pages 40–41 in the LB, or **Activity 9D** in the TG below.

Starter activities

Learners form groups of 3 or 4. Ask them to:

1 Draw a map of the school compound and its boundaries.

2 List at least six objects that they know must be shown in the map.

Examples

Example 1

If 1 cm represents 5 m, write the scale as a ratio.

Solution

Write down the scale:

1 cm represents 5 m

Make the units the same:

1 cm = 500 cm

Write down the ratio:

1:500

Example 2

Find the distance represented by 1 cm on the map if the scale is written as 10:3000.

Solution

Write down the ratio:

10:3000

10 cm represents 300 cm

1 cm represents 300 cm

The scale is 1:300

So 1 cm on the map is equivalent to an actual distance of 300 cm or 3 m.

Example 3

A map is drawn with a scale showing that 1 cm represents 120 km. If the actual distance from Honiara to KiraKira is 244 km, how far will it be on the map?

Solution

Write down the scale:

1 cm represents 120 km

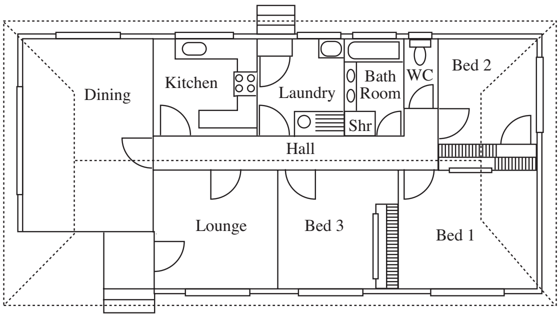
How many lots of 120 km are there in 244 km?

= 2·03

There are 2·03 lots of 1 cm. This means a distance of 2 cm on the map.

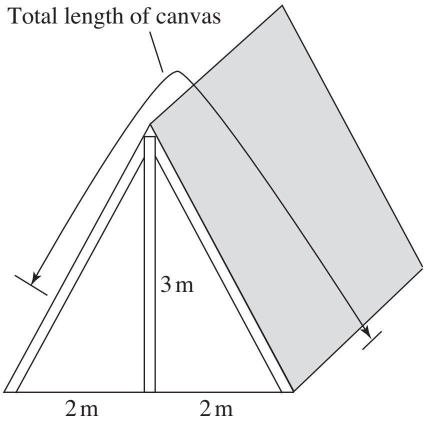
Activity 9D

1 A scale of 1:300 has been used for this house plan.



- **a** Work out the length of the hall in metres.
- **b** What is the width of the hall? Give your answer in centimetres.
- **c** What are the dimensions (length and width) of the lounge?

2 This diagram shows a pup tent. It is not drawn to scale. The length of the base is 4 metres and the height of the tent is 3 metres.



- **a** Make a scale drawing of the front of the tent (a triangle with a base of 4 cm and a height of 3 cm).
- **b** Use your drawing to estimate the total length of canvas that would be needed to cover the tent. (This is the distance from ground level on one side to ground level on the other side.)

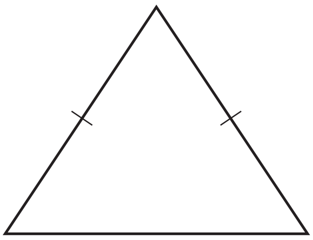
Answers 9D

1 **a** 3·8 cm = 11·4 m

b 0·5 cm = 1·5 m

c length: 1·6 cm = 4·8 m, width: 1·7 cm = 5·1 m

2 **a**



b Slope of tent ≈ 3·6 cm; Total length of canvas ≈ 7·2 m

9E • Maps and bearings

LB Pages 42–45

Specific learning outcomes

Learners should be able to:

7.9.8.1 Identify the purpose of bearings.

7.9.8.2 Identify areas where bearings are used widely by people.

7.9.8.3 Identify the two bearings that are used to give directions: *true bearings* and *compass bearings*.

7.9.8.4 Define the two bearings: *true bearings* and *compass bearings*.

7.9.9.1 Find bearings of given points using a protractor, starting from north.

7.9.9.2 Draw diagrams of given angles using protractors.

7.9.9.3 Calculate the actual distance on the ground by using the given scales on the map.

Teaching points

1. **Bearings** are used to identify the location of one object in relation to another object.
2. Bearings are a way of giving directions. They are used in navigation on land and sea.
3. Two types of bearings are measured: true bearings and compass bearings.
4. **True bearings** are the angle of a turn, measured clockwise from north. They are given in degrees, e.g. 040°.
5. **Compass bearings** give the angle of a turn, and also specify north/south and east/west, e.g. S40°E.
6. A protractor can be used to draw and find the bearings of given points.
7. Learners should be able to use scales on maps to calculate distances on the map and actual distance on the ground.

Suggested teaching approach

- Start the chapter section by doing the **Starter activities** provided.
- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercise 9E** on pages 43–45 in the LB, or **Activity 9E** in the TG below.

Starter activities

This activity will help learners develop their skills in identifying directions as N, NE, E, SE, S, SW, W and NW.

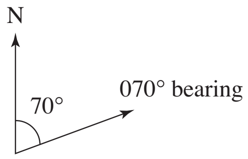
1. Take learners outside and ask them to point to the directions (N, NE, E, SE, S, SW, W and NW) when you call them out.
2. Identify various places and objects, such as buildings and houses, and ask learners to identify their direction from where you are standing.
3. Identify various places such as towns, islands, countries and so on, and ask learners to identify their direction.

Additional notes

Bearings give directions. They are used by ships and aircraft to navigate, as well as by surveyors and others. There are two possible ways of giving directions: true bearings and compass bearings.

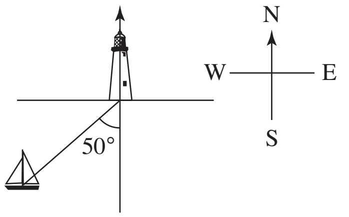
True bearings are equivalent to the angle measured clockwise from north. They are always written using three digits.

For example, this diagram shows a bearing of 070°.

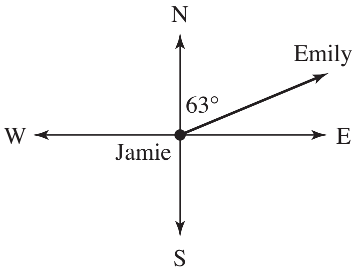


Compass bearings always begin with north (N) or south (S), whichever is closest, then give the angle, and end with E or W.

For example, the compass bearing of the yacht from the lighthouse is S50°W. This means it is 50° to the west of directly south.



Example



The *true bearing* of Emily from Jamie can be described as 063°. This is the angle measured clockwise from north.

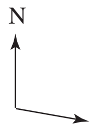
The *compass bearing* of Emily from Jamie can be described as N63°E (face north and turn 63° towards east).

Activity 9E

1 Match each true bearing with its most likely measurement from the box.

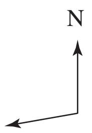
020° 100° 260° 340°

a



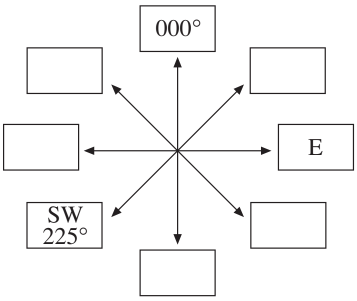
b

c



d

2 Complete this diagram to show both compass directions (e.g. SW = south-west) and true bearings.



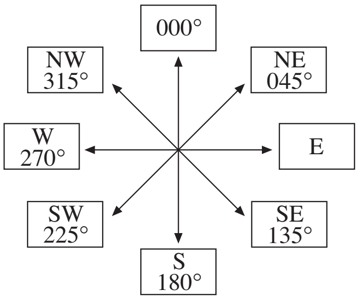
3 Complete this table to show how to convert from true bearings to compass bearings and vice versa. An example been done for you.

	True bearing	Compass bearing
Example	135°	S45°E
a	010°	
b		S10°W
c		N70°E
d	330°	
e		N5°W
f	160°	
g	250°	
h		S30°E

Answers 9E

1 **a** 100° **b** 340° **c** 260° **d** 020°

2



3

	True bearing	Compass bearing
Example	135°	S45°E
a	010°	N10°E
b	190°	S10°W
c	070°	N70°E
d	330°	N30°W
e	355°	N5°W
f	160°	S20°E
g	250°	S70°W
h	150°	S30°E

• Chapter Ten •

Fractions

Overview

In our everyday activities, whether with money, measurements or mixing a cake, we do not always work with whole numbers. Sometimes we deal with numbers that are part of a whole. These numbers are called fractions.

A fraction is part of a whole. A whole might be an object, a collection of objects or a section of a number line. If we divide a whole into parts to show a fraction, each of the parts must be equal in size. Similarly, if we divide a collection of objects into groups to show a fraction, there must be the same number of objects in each group.

A fraction represents a part of a whole or any number of equal parts. It describes how many parts of a certain size there are, such as one-half, five-eighths or three-quarters.

A common fraction has a numerator and a non-zero integer denominator. The numerator represents the number of equal parts and the denominator indicates how many of those parts make up a whole. An example is $\frac{3}{4}$, in which the numerator, 3, tells us that the fraction represents 3 equal parts, and the denominator, 4, tells us that 4 parts equal a whole.

Contents

Chapter skills

This chapter covers the following skills:

- Using the language of fractions
- Simplifying and finding equivalent fractions
- Converting improper fractions to mixed numbers and vice versa
- Adding and subtracting with like and unlike denominators
- Investigating multiplication of fractions
- Finding fractions of whole quantities
- Dividing fractions
- Finding squares and square roots of fractions
- Simplifying using the order of operations (BODMAS).

Teaching plan

Lessons	Chapter sections	Class work and home work
1	• Intro • 10A: Shaded diagrams	Learner's Book 2 • Exercise 10A, page 57
2	• 10B: Mixed numbers and improper fractions	Learner's Book 2 • Exercise 10B, page 59
3	• 10C: Adding with the same denominator	Learner's Book 2 • Exercise 10C, pages 60–61
4	• 10D: Adding with different denominators	Learner's Book 2 • Exercise 10D, pages 62–64
5	• 10E: Subtracting with the same denominator	Learner's Book 2 • Exercise 10E, pages 65–66
6	• 10F: Subtracting with different denominators	Learner's Book 2 • Exercise 10F, pages 67–68
7	• 10G: Exploring multiplication of fractions	Learner's Book 2 • Learning task 10G, page 69
8	• 10H: Multiplying fractions	Learner's Book 2 • Exercise 10H, pages 70–71
9	• 10I: Exploring division of fractions	Learner's Book 2 • Exercise 10I, page 72
10	• 10J: Dividing fractions	Learner's Book 2 • Exercise 10J, pages 73–75
11–12	• 10K: Fractions of quantities	Learner's Book 2 • Exercise 10K, pages 76–77
13–14	• 10L: Squares and square roots of fractions	Learner's Book 2 • Exercise 10L, page 79
15	• 10M: Order of operations	Learner's Book 2 • Exercise 10M, pages 80–81
15	• Revision/test	Learner's Book 2 • Revision/Assessment, Exercises 10A–10F, 10H, 10J–10M, pages 88–89 Teacher's Guide • Chapter 10 test, page 177

General learning outcomes

Learners should:

Shaded diagrams

7.10.1 Understand *fraction* as a 'part of a whole thing' that is equally divided, and expressed as FRACTION. (U)

7.10.2 Know that there are different types of fractions. (K)

7.10.3 Know how to express shaded diagrams as fractions. (K)

7.10.4 Know how to simplify fractions. (K)

Mixed numbers and improper fractions

7.10.5 Know how to change mixed numbers to improper fractions. (K)

7.10.6 Know how to convert improper fractions to mixed numbers. (K)

7.10.7 Know how to identify equivalent fractions. (K)

Add and subtract fractions

7.10.8 Know how to add and subtract fractions with the same denominator. (K)

7.10.9 Know how to add and subtract fractions with different denominators. (K)

Multiply and divide fractions

7.10.10 Know how to multiply and divide fractions. (K)

7.10.11 Apply multiplication of fractions to solve questions that deal with real-life situations. (S)

Fractions of quantities

7.10.12 Know that the word 'of' can be replaced with a multiplication '×' sign to evaluate fractions. (K)

7.10.13 Know how to find quantities of given items using fractions. (K)

Squares and square roots of fractions

7.10.14 Know how to square fractions. (K)

7.10.15 Know how to take square roots of fractions. (K)

Order of operations

7.10.16 Know how to apply the BODMAS rule to evaluate fractions with a mixture of operations. (K)

10A • Shaded diagrams

LB Pages 56–57

Specific learning outcomes

Learners should be able to:

7.10.1.1 Define *fraction*: 'part of a whole' expressed as fraction with a top number divided by a bottom number.

7.10.1.2 Name the parts of a fraction: *numerator* (top number) and *denominator* (bottom number).

7.10.2.1 Name and identify three different types of fractions: proper fraction, improper fraction and mixed number.

7.10.3.1 Find the fractions of shapes that have part/s shaded.

7.10.4.1 Simplify fractions to find their simplest form.

Teaching points

1. A **fraction** is defined as 'part of a whole'.
2. There are three types of fractions: proper fractions, improper fractions and mixed numbers.
3. The parts of a fraction are: numerator and denominator.
4. Learners should be able to find fractions of shaded shapes.

Suggested teaching approach

- Start the chapter section by doing the **Starter activities** provided.
- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercise 10A** on page 57 of the LB, or **Activity 10A** in the TG below.

Starter activities

Activity 1: Fraction – counting

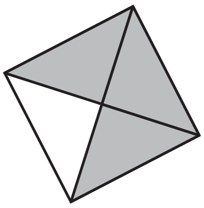
This is a version of the BUZZ activity (*Teacher's Guide* page 2). Learners are to count in fractions and call "Buzz" every time they get to a whole number, an even number or a number containing the digit 5.

Activity 2

1. Ask learners to form into groups according to their provinces.
2. Count the number of learners from each province.
3. Ask learners how many are in each group, and how many learners there are in total.
4. Stress to the learners that the total number of learners in the class is the *whole*. Each group is a part of the whole. In other words, the number in each group is a *fraction* of the whole.

Additional notes

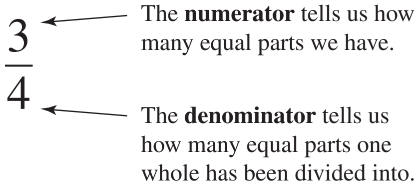
A fraction shows how part of an object compares to all of it. This diagram shows the fraction three-quarters:



We write this as $\frac{3}{4}$.

Parts of a fraction

A fraction has two parts: the numerator and the denominator. The top number is called the **numerator**. The bottom number is called the **denominator**.



Types of fractions

1. A **proper fraction** has a numerator that is less than the denominator. It has a value less than 1.

   Examples: $\frac{1}{2}$, $\frac{3}{4}$.
2. An **improper fraction** has a numerator that is greater than or equal to the denominator. It has a value greater than or equal to 1.

   Examples: $\frac{3}{2}$, $\frac{9}{9}$, $\frac{17}{6}$.
3. A **mixed number** has a whole number part and a fraction part, written separately.

   Examples: $1\frac{1}{2}$, $2\frac{5}{6}$, $34\frac{2}{7}$.

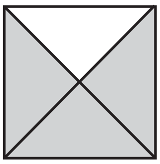
Shaded shapes

Sometimes a fraction can be expressed by using shapes and objects. The shape is divided into equal parts, and is shaded to show the desired fractions.

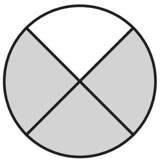
Each of the shapes below has been divided into equal parts and shaded to indicate the given fraction ($\frac{3}{4}$) of a whole.

a

b

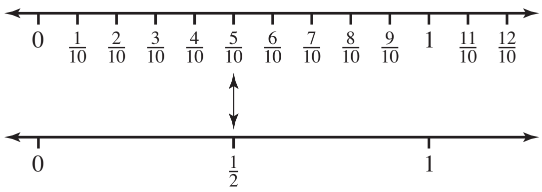


c



Using a number line to represent fractions

Fractions can be represented on a number line. For example, the top number line shown here is marked in tenths. The number line below it is marked in halves.



The number lines show that $\frac{1}{2}$ and $\frac{5}{10}$ are equivalent fractions.

You can change a fraction to a simpler **equivalent fraction** by dividing numerator and denominator by the same number, such as 2, 3, 5 and so on.

Example

Simplify the fraction $\frac{10}{12}$.

2 goes into 10 exactly 5 times, and into 12 exactly 6 times

$$\frac{10}{12} = \frac{\cancel{10}^5}{\cancel{12}^6} = \frac{5}{6}$$

Placing fractions on a number line helps us to understand their size compared to other numbers. Drawing up a number line is easier if you can make the distance between whole numbers the same as the denominator. For example, if dividing into thirds, make the distance 3 cm. Then you can mark off a third for every cm.

Examples

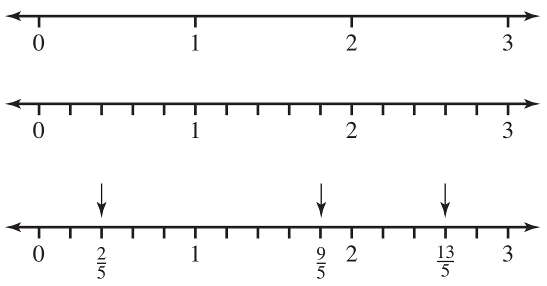
Example 1

Use a number line to show the positions of these fractions:

$\frac{2}{5}, \frac{9}{5}, \frac{13}{5}$

When constructing a number line:

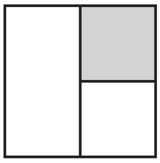
- The denominator shows how to divide up the spaces between the whole numbers (in this case, count in fifths).
- The distance between each marked division should be the same.
- For each fraction, look at the numerator and count that number of parts along from zero.
- Indicate the location of the fraction with an arrow.



Example 2

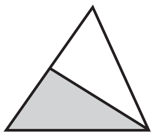
Write down the fractions for the shaded part of the shapes given below.

a



shaded = $\frac{1}{4}$

b

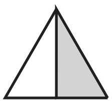


shaded = $\frac{1}{2}$

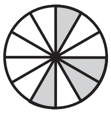
Activity 10A

1 Each of these diagrams shows a fraction. Write down the fraction that is shaded.

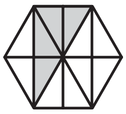
a



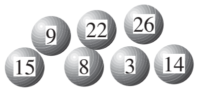
b



c



2 What fraction of these numbered balls has an even number?



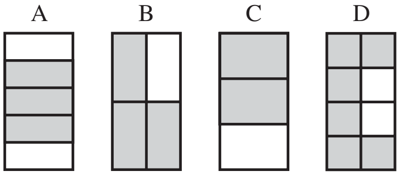
3 Seven students in a class of 28 did not do their homework. What fraction of the class is this?

4 What fraction of the words in this sentence has fewer than five letters?

5 Terri finished eighth in a cross-country race in which there were 50 runners. What fraction of the runners finished before she did?

Additional activities

6



a Which of the diagrams above show equivalent fractions?

b Write down the equivalent fractions.

7 Write these fractions in their simplest form:

a $\frac{6}{12}$ **b** $\frac{4}{10}$ **c** $\frac{14}{21}$ **d** $\frac{16}{36}$

Answers 10A

1 **a** $\frac{1}{2}$ **b** $\frac{4}{12} = \frac{1}{3}$ **c** $\frac{4}{12} = \frac{1}{3}$

2 $\frac{4}{7}$

3 $\frac{7}{28} = \frac{1}{4}$

4 $\frac{8}{13}$

5 $\frac{7}{50}$

6 **a** B and D **b** $\frac{3}{4} = \frac{6}{8}$

7 **a** $\frac{1}{2}$ **b** $\frac{2}{5}$ **c** $\frac{2}{3}$ **d** $\frac{4}{9}$

10B • Mixed numbers and improper fractions

LB Pages 58–59

Specific learning outcomes

Learners should be able to:

7.10.5.1 Change mixed numbers to improper fractions.

7.10.6.1 Change improper fractions to mixed numbers by dividing the numerator by the denominator.

7.10.7.1 Find and calculate equivalent fractions.

Teaching points

1 Learners should be able to change mixed numbers into improper fractions.

2 Learners should be able to change improper fractions to mixed numbers.

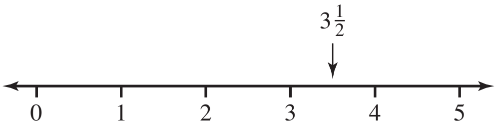
3 Learners should be able to find equivalent fractions of given fractions.

Suggested teaching approach

- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercise 10B** on page 59 of the LB, or **Activity 10B** in the TG below.

Additional notes

A **mixed number** is a combination of a whole number and a fraction smaller than one whole. For example, the number line shows where the mixed fraction $3\frac{1}{2}$ is.



To change a mixed number to an improper fraction:

1 Change the whole number part to a fraction with the same denominator as the fraction part.

2 Add the two fractions.

Example:

$3\frac{1}{2} = 3 + \frac{1}{2} = \frac{6}{2} + \frac{1}{2} = \frac{7}{2}$

To change a fraction to a mixed number:

1 Divide the denominator into the numerator.

2 The remainder (what is left over) gives the fraction part of the mixed number. For example: $\frac{21}{4} = 5\frac{1}{4}$ because when 4 is divided into 21 it goes in 5 times, with one left over:

$\begin{array}{r} 5 \\ 4\overline{)21} \end{array}$ remainder 1

Examples

Example 1

Change this mixed number to an improper fraction:

$4\frac{3}{5}$

Solution

$4\frac{3}{5}$

$= \frac{5 \times 4 + 3}{5}$

$= \frac{23}{5}$

Example 2

Change this improper fraction to a mixed number:

$\frac{48}{5}$

Solution

$\frac{48}{5} = 9\frac{3}{5}$

48 ÷ 5 = 9 with remainder 3

Example 3

Find the equivalent fractions:

$\frac{1}{4} = \frac{\square}{8} = \frac{5}{\square} = \frac{\square}{28}$

Solution

$\frac{1}{4} \times \frac{2}{2} = \frac{2}{8}, \frac{1}{4} \times \frac{5}{5} = \frac{5}{20}, \frac{1}{4} \times \frac{7}{7} = \frac{7}{28}$

Example 4

Which is larger, $\frac{4}{7}$ or $\frac{3}{10}$?

Solution

$\frac{4}{7} \times \frac{10}{10} = \frac{40}{70}$

$\frac{3}{10} \times \frac{7}{7} = \frac{21}{70}$

$\frac{40}{70}$ is larger than $\frac{21}{70}$, so $\frac{4}{7}$ is larger than $\frac{3}{10}$.

Activity 10B

1 Change the mixed numbers to improper fractions.

a $1\frac{3}{5}$ **b** $2\frac{3}{4}$ **c** $5\frac{1}{8}$ **d** $4\frac{2}{3}$

3 Change the improper fractions to mixed numbers.

a $\frac{9}{2}$ **b** $\frac{19}{5}$ **c** $\frac{20}{3}$ **d** $\frac{61}{9}$

3 A doctor has 27 minutes in which to see 4 patients. Each patient is to get equal time with the doctor. Express the time each patient gets as a mixed number.

4 Find the equivalent fractions.

a $\frac{2}{5}$ **b** $\frac{3}{8}$ **c** $\frac{1}{4}$ **d** $\frac{6}{7}$

Answers 10B

1 a $\frac{8}{5}$ **b** $\frac{11}{4}$ **c** $\frac{41}{8}$ **d** $\frac{14}{3}$

2 a $4\frac{1}{2}$ **b** $3\frac{4}{5}$ **c** $6\frac{2}{3}$ **d** $6\frac{7}{9}$

3 $6\frac{3}{4}$ minutes = 6 mins and 45 seconds

4 a $\frac{6}{15}$ **b** $\frac{6}{16}$ **c** $\frac{5}{20}$ **d** $\frac{42}{49}$

10C • Adding with the same denominator

LB Pages 60–61

Specific learning outcomes

Learners should be able to:

7.10.8.1 Add fractions with the same denominators.

Teaching points

1. When adding fractions with the same denominator, just add the numerators. The denominator stays unchanged.
2. When fractions are added, they *do not* cancel diagonally.

Suggested teaching approach

- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercise 10C** on pages 60–61 of the LB, or **Activity 10C** in the TG below.

Additional notes

To add two fractions with the same denominator, add the two numerators and leave the denominator unchanged.

Example

Add $\frac{3}{10} + \frac{1}{10}$

$\frac{3}{10} + \frac{1}{10} = \frac{3+1}{10} = \frac{4}{10} = \frac{2}{5}$

Examples

Example 1

Add these fractions:

$\frac{3}{8} + \frac{2}{8}$

Solution

$\frac{3}{8} + \frac{2}{8} = \frac{5}{8}$

Example 2

Add these fractions:

$\frac{3}{8} + \frac{7}{8}$

Solution

$\frac{3}{8} + \frac{7}{8} = \frac{10}{8}$

$= 1\frac{2}{8}$

$= 1\frac{1}{4}$

Example 3

Add these fractions:

$7\frac{5}{8} + 2\frac{7}{8}$

Solution

$7 + 2 = 9$

$\frac{5}{8} + \frac{7}{8} = \frac{12}{8}$

$7\frac{5}{8} + 2\frac{7}{8}$

$= 9\frac{12}{8}$

$= 10\frac{4}{8}$

$= 10\frac{1}{2}$

Activity 10C

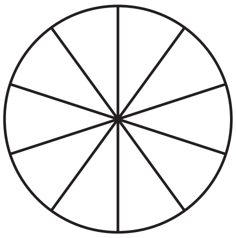
1 Helena is working out $\frac{1}{10} + \frac{7}{10}$. Her working, which is wrong, shows:

$\frac{1}{10} + \frac{7}{10} = \frac{8}{20}$

a What mistake has she made?

b Use two colours to shade this diagram to show how to find the correct answer.

c What is the correct answer in its simplest form?



Additional activity

2 Learners work in groups of 3 or 4. Each group needs black and white stones.

a Using their stones, each group is to illustrate the mixed numbers $1\frac{1}{2}$ and $2\frac{7}{8}$.

b The group then shows how these two fractions can be added.

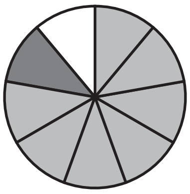
c Each group makes up three different fractions and additions/subtractions of these fractions.

d The group copies these fractions and their addition/subtraction, with the answers, to share with the teacher and the class.

Answers 10C

1 **a** The denominator should stay unchanged. Helena has added the denominators.

b



c $\frac{4}{5}$

2 Learner activity

10D • Adding with different denominators

LB Pages 62–64

Specific learning outcomes

Learners should be able to:

7.10.9.1 Add fractions with different denominators.

Teaching points

1 When adding fractions with *different* denominators, find a common denominator.

2 There are two ways to add mixed numbers:
- Add the whole numbers separately from the fractions.
- Change all the mixed numbers to improper fractions, then add these.

3 When fractions are added, they do *not* cancel diagonally.

Suggested teaching approach

- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercise 10D** on pages 62–64 in the LB, or **Activity 10D** in the TG below.

Additional notes

To add fractions with different denominators:

1 Change the fractions to equivalent fractions with the same denominator.

2 Add these fractions.

3 Simplify the result if possible.

Example

Add $\frac{3}{10} + \frac{2}{3}$

These two fractions have a common denominator of 30 (3 × 10 = 30).

$\frac{3}{10} + \frac{2}{3} = \frac{9}{30} + \frac{20}{30} = \frac{29}{30}$

Examples

Example 1

Add these fractions:

$\frac{2}{6} + \frac{5}{7}$

Solution

$\frac{2}{6} + \frac{5}{7}$

$= \frac{2}{6} \times \frac{7}{7} + \frac{5}{7} \times \frac{6}{6}$

$= \frac{14}{42} + \frac{30}{42}$

$= \frac{44}{42}$

$= 1\frac{2}{42}$

$= 1\frac{1}{21}$

Example 2

$1\frac{4}{5} + 4\frac{5}{6}$

Solution

$1\frac{4}{5} + 4\frac{5}{6}$

$= (1 + 4) + (\frac{4}{5} \times \frac{6}{6} + \frac{5}{6} \times \frac{5}{5})$

$= 5 + (\frac{24}{30} + \frac{25}{30})$

$= 5\frac{49}{30}$

$= 6\frac{19}{30}$

Activity 10D

1 Some pizzas were delivered to a party. All pizzas were cut into the same number of pieces. After the party, parts of four different pizzas were left uneaten. These fractions remained: $\frac{5}{8}, \frac{1}{8}, \frac{3}{4}, \frac{1}{2}$.

What is the most likely number of pieces each pizza was cut into?

Additional activity

2 Learners work in groups of three or four. Each group needs 60 white stones, 40 black stones and 120 seeds of Christmas tree or anything that can be counted.

a What are $\frac{5}{6}$ of the white stones, $\frac{9}{10}$ of the black stones and $\frac{35}{60}$ of the seeds of Christmas tree?

b Which fraction is the biggest?

Answers 10D

1 8

2 **a** $\frac{5}{6}$ of 60 = 50 white stones

$\frac{9}{10}$ of 40 = 36 black stones

$\frac{35}{60}$ of 120 = 70 seeds of Christmas trees

b the largest fraction is $\frac{9}{10}$

10E • Subtracting with the same denominator

LB Pages 65–66

Specific learning outcomes

Learners should be able to:

7.10.8.1 Subtract fractions with the same denominator.

Teaching points

1. When subtracting fractions with the *same* denominator, subtract the numerators. The denominator stays unchanged.
2. There are two ways to subtract mixed numbers:
   - Subtract the whole numbers separately from the fractions.
   - Change all the mixed numbers to improper fractions, then subtract these.
3. When fractions are subtracted, they do *not* cancel diagonally.

Suggested teaching approach

- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercise 10E** on pages 65–66 in the LB, or **Activity 10E** in the TG below.

Additional notes

When subtracting fractions with the same denominator, we subtract the numerators (top numbers) and leave the denominator (bottom number) unchanged. Simplify the final answer if possible.

Example

Subtract $\frac{8}{9} - \frac{5}{9}$

$$\frac{8}{9} - \frac{5}{9} = \frac{3}{9}$$
$$= \frac{1}{3}$$

Examples

Subtract these fractions:

a $\frac{5}{7} - \frac{2}{7}$

Solution

$\frac{5}{7} - \frac{2}{7} = \frac{3}{7}$

b $4\frac{3}{8} - 1\frac{7}{8}$

Solution

$3\frac{5}{8} - \frac{15}{8} = \frac{20}{8} = 2\frac{4}{8} = 2\frac{1}{2}$

Activity 10E

1 Subtract these fractions or mixed numbers. Write each answer as simply as possible.

a $\frac{3}{5} - \frac{2}{5}$ **b** $\frac{7}{8} - \frac{5}{8}$

c $\frac{13}{16} - \frac{9}{16}$ **d** $3\frac{3}{4} - 1\frac{1}{4}$

e $6\frac{1}{10} - 4\frac{7}{10}$

2 In her Will, Aunt Mary leaves three-tenths of her money to her nieces, and four-tenths of her money to her nephews. What fraction is left?

Additional activity

3 Learners discuss and answer these questions in groups.

a Do we always buy items in whole numbers?

b Where do we use fractions in everyday life?

c Each group presents their findings to the class for discussion.

Answers 10E

1 **a** $\frac{1}{5}$ **b** $\frac{2}{8} = \frac{1}{4}$

c $\frac{4}{16} = \frac{1}{4}$ **d** $2\frac{1}{2}$

e $1\frac{4}{10}$

2 $\frac{3}{10} + \frac{4}{10} = \frac{7}{10}$; three-tenths is left

3 Answers will vary

10F • Subtracting with different denominators

LB Pages 67–68

Specific learning outcomes

Learners should be able to:

7.10.9.1 Subtract fractions with different denominators.

Teaching points

1. When subtracing fractions with *different* denominators, find a common denominator.
2. There are two ways to subtract mixed numbers:
   - Subtract the whole numbers separately from the fractions.
   - Change all the mixed numbers to improper fractions, then subtract these.
3. When fractions are subtracted, they do *not* cancel diagonally.

Suggested teaching approach

- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercise 10F** on pages pages 67–68 of the LB, or **Activity 10F** in the TG below.

Additional notes

Subtracting fractions that have different denominators follows the same process as adding them. First change one or both fractions to equivalent fractions with the same denominator, then subtract.

Example

Subtract $\frac{7}{12} - \frac{3}{8}$

Use 24 as the common denominator (24 is the lowest common multiple of 12 and 8).

$$\frac{7}{12} - \frac{3}{8} = \frac{14}{24} - \frac{9}{24} = \frac{5}{24}$$

Examples

Example 1

Subtract these fractions:

$6\frac{5}{12} - 4\frac{1}{3}$

Solution

$6\frac{5}{12} - 4\frac{1}{3}$

$= (6 - 4) + (\frac{5}{12} - \frac{1}{3})$

$= 2 + (\frac{5}{12} - \frac{4}{12})$

$= 2\frac{1}{12}$

Example 2

Subtract these fractions:

$\frac{5}{8} - \frac{2}{7}$

Solution

$\frac{5}{8} - \frac{2}{7}$

$= \frac{35}{56} - \frac{16}{56}$

$= \frac{19}{56}$

Example 3

Subtract these fractions:

$6\frac{7}{12} - 3\frac{1}{3}$

Solution

$6\frac{7}{12} - 3\frac{1}{3}$

$= (6 - 3) + (\frac{7}{12} - \frac{1}{3})$

$= 3 + (\frac{7}{12} - \frac{4}{12})$

$= 3\frac{1}{4}$

Activity 10F

1 Subtract these fractions. Write each answer as simply as possible:

- **a** $\frac{7}{8} - \frac{2}{3}$
- **b** $\frac{7}{10} - \frac{2}{5}$
- **c** $\frac{11}{12} - \frac{7}{8}$
- **d** $2\frac{3}{5} - 1\frac{1}{4}$
- **e** $2\frac{1}{2} - 1\frac{7}{10}$

2 A bottle of milk is three-fifths full. A recipe requires half a bottle of milk. What fraction will be left in the bottle after the recipe is made?

3 Lee has a job delivering pamphlets. She puts aside $\frac{1}{4}$ of her pay for tax, and saves $\frac{2}{5}$. What fraction of her pay is left to spend?

Answers 10F

1 **a** $\frac{5}{24}$
- **b** $\frac{3}{10}$
- **c** $\frac{1}{24}$
- **d** $1\frac{7}{20}$
- **e** $\frac{8}{10} = \frac{4}{5}$

2 $\frac{3}{5} - \frac{1}{2} = \frac{1}{10}$; one-tenth will be left in the bottle

3 $\frac{1}{4} + \frac{2}{5} = \frac{13}{20}$; $\frac{7}{20}$ of her pay is left to spend

10G • Exploring multiplication of fractions

LB Page 69

Specific learning outcomes

Learners should be able to:

7.10.10.1 Multiply fractions: *cancel common factors, then evaluate top and bottom numbers*.

Suggested teaching approach

- Learners complete **Learning Task 10G** on page 69 of the LB, or **Activity 10G** in the TG below.

Activity 10G

Learners work in groups of 3 to 4 to do the tasks given below. When the tasks are completed, a representative from each group presents the group's findings.

Ask learners to draw, colour and cut out diagrams that can be used to explain how $\frac{2}{3} \times \frac{5}{7} = \frac{10}{21}$

Instructions to learners:

1 Draw a rectangle 3 units tall and 7 units wide.

2 Colour $\frac{2}{3}$ of the rectangle or 14 parts.

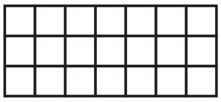
3 Shade $\frac{5}{7}$ or 10 parts of the coloured area ($\frac{5}{7} = \frac{10}{14}$).

4 The amount that is coloured and shaded is the result when two fractions are multiplied.

5 Paste this diagram into your exercise book and write a set of instructions.

Answers 10G

1



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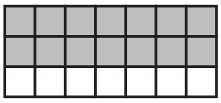

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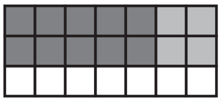


4 $\frac{2}{3} \times \frac{5}{7} = \frac{10}{21}$

10H • Multiplying fractions

LB Pages 70–71

Specific learning outcomes

Learners should be able to:

7.10.10.1 Multiply fractions: *cancel common factors, then evaluate top and bottom numbers*.

Teaching points

1 *If there are no numbers to cancel:* multiply the numerators (top numbers) and then multiply the denominators (bottom numbers).

2 *If there are numbers to cancel:* cancel them out, to simplify the fractions. Then multiply the numerators (top numbers) and multiply the denominators (bottom numbers).

Suggested teaching approach

- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercise 10H** on pages 70–71 in the LB, or **Activity 10H** in the TG below.

Additional notes

To multiply two fractions:

- multiply the two numerators (top numbers)
- multiply the two denominators (bottom numbers)
- simplify the resulting fraction if possible.

Example

Calculate $\frac{3}{8} \times \frac{2}{3}$

$\frac{3}{8} \times \frac{2}{3} = \frac{6}{24}$

$= \frac{1}{4}$ (simplifying)

Example

Work out $7 \times 6\frac{3}{5}$

Note that we can write 7 as $\frac{7}{1}$

$7 \times 6\frac{3}{5} = \frac{7}{1} \times \frac{33}{5}$

$= \frac{231}{5}$

$= 46\frac{1}{5}$

Examples

Example 1

Multiply these fractions: $\frac{3}{4} \times \frac{12}{15}$

Solution

$\frac{3}{4} \times \frac{12}{15}$

$= \frac{1}{1} \times \frac{3}{5}$

$= \frac{3}{5}$

Example 2

Multiply these fractions: $\frac{15}{30} \times \frac{11}{25}$

Solution

$\frac{15}{30} \times \frac{11}{25}$

$= \frac{1}{2} \times \frac{11}{25}$

$= \frac{11}{50}$

Activity 10H

1 Multiply these fractions and/or mixed numbers. Simplify your answer if possible.

  a $\frac{3}{5} \times \frac{2}{7}$

  b $\frac{1}{6} \times \frac{3}{4}$

  c $\frac{2}{3} \times 24$

d $\frac{3}{5} \times \frac{1}{2} \times \frac{2}{3}$

e $2 \times 1\frac{2}{3}$

f $2\frac{2}{3} \times 1\frac{1}{4}$

g $\frac{3}{8} \times 2\frac{2}{3}$

2 Mrs Jones plants three-tenths of her vegetable garden with potatoes. She only has time to weed one-third of the potato patch. What fraction of the vegetable garden does she weed?

Answers 10H

1 **a** $\frac{6}{35}$ **b** $\frac{1}{8}$

c 16

d $\frac{1}{5}$ **e** $3\frac{1}{3}$

f $\frac{10}{3} = 3\frac{1}{3}$ **g** 1

2 $\frac{1}{3}$ of $\frac{3}{10} = \frac{1}{10}$; Mrs Jones weeds one-tenth of her garden

10I • Exploring division of fractions

LB Page 72

Specific learning outcomes

There is no specific learning outcome from the syllabus.

Suggested teaching approach

Do the tasks on page 72 of the LB.

10J • Dividing fractions

LB Pages 73–75

Specific learning outcomes

Learners should be able to:

7.10.10.2 Divide fractions: change ÷ sign to × sign, then reciprocate next fraction, then cancel and evaluate top and bottom numbers.

7.10.11.1 Solve practical questions of fractions using division and multiplication.

Teaching points

1. When dividing *fractions*: 1) change the division sign to multiplication and reciprocate; 2) cancel fractions where necessary; then 3) multiply numerators and then denominators.
2. When dividing *mixed numbers*: 1) change the mixed numbers to improper fractions; 2) change the division sign to multiplication and reciprocate; 3) cancel where possible; then 4) multiply numerators and then denominators.

Suggested teaching approach

- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercise 10J** on pages 73–75 of the LB, or **Activity 10J** in the TG below.

Additional notes

To divide one fraction by another, multiply the first fraction by the *reciprocal* of the second.

To get the reciprocal of a fraction, just turn it upside down.

The reciprocal of $\frac{2}{5}$ is $\frac{5}{2}$. Whole numbers also have reciprocals.

The reciprocal of 4 is $\frac{1}{4}$, the reciprocal of $\frac{1}{3}$ is 3.

Example

Work out $\frac{2}{3} \div \frac{3}{4}$

$$\frac{2}{3} \div \frac{3}{4} = \frac{2}{3} \times \frac{4}{3}$$
$$= \frac{8}{9}$$

If the problem involves mixed numbers, change these to improper fractions first.

Example

$$1\frac{1}{4} \div 6 = \frac{5}{4} \div 6$$
$$= \frac{5}{4} \times \frac{1}{6}$$
$$= \frac{5}{24}$$

Examples

Example 1

Divide these fractions:

$\frac{3}{8} \div \frac{1}{2}$

Solution

$$\frac{3}{8} \div \frac{1}{2}$$
$$= \frac{3}{8} \times \frac{2}{1}$$
$$= \frac{6}{8}$$
$$= \frac{3}{4}$$

Example 2

Divide these fractions:

$2\frac{2}{3} \div \frac{10}{21}$

Solution

$$2\frac{2}{3} \div \frac{10}{21}$$
$$= \frac{8}{3} \div \frac{10}{21}$$
$$= \frac{8}{3} \times \frac{21}{10}$$
$$= \frac{4}{1} \times \frac{7}{5}$$
$$= \frac{28}{5}$$
$$= 5\frac{3}{5}$$

Activity 10J

1 Work out these fraction divisions. Write each answer as simply as possible:

a $\frac{1}{3} \div \frac{9}{10}$　**b** $\frac{1}{4} \div \frac{2}{5}$

c $\frac{7}{10} \div 5$　**d** $6 \div \frac{3}{4}$

2 Work out these divisions involving mixed numbers:

a $7 \div 2\frac{1}{5}$　**b** $2\frac{1}{3} \div 3$　**c** $4\frac{3}{5} \div 2\frac{1}{3}$

3 Wendy wants to share $3\frac{3}{4}$ melons among her 5 friends. Write down a mathematical calculation, and work out the answer, to explain how this could be done so that each person gets an equal share.

4 A book-binder can repair $12\frac{1}{2}$ books in $1\frac{2}{3}$ hours. Divide one of these mixed numbers by the other to work out how many books the book-binder can repair per hour.

5 There are $7\frac{1}{2}$ meat pies left in a fridge. They are to be shared equally between three people. Calculate the number of pies each person gets. Give your answer as a mixed number.

Answers 10J

1 **a** $\frac{10}{27}$　**b** $\frac{5}{8}$　**c** $\frac{7}{50}$　**d** $\frac{24}{3} = 8$

2 **a** $\frac{35}{11} = 3\frac{2}{11}$　**b** $\frac{7}{9}$　**c** $\frac{69}{35} = 1\frac{34}{35}$

3 $3\frac{3}{4} \div 5 = \frac{15}{4} \times \frac{1}{5} = \frac{3}{4}$

4 $7\frac{1}{2}$ books per hour

5 $2\frac{1}{2}$ pies per person

10K • Fractions of quantities

LB Pages 76–77

Specific learning outcomes

Learners should be able to:

7.10.12.1 Evaluate fractions that have the word ‘of’ in them.

7.10.13.1 Evaluate practical questions by taking fractions of quantities.

Teaching points

1 To evaluate fractions with the word ‘of’ in them, replace ‘of’ with a multiplication sign, then simplify where possible, then evaluate.

2 Finding ‘part of’ a given quantity in a practical situation means taking a fraction of the quantity.

Suggested teaching approach

- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercise 10K** on pages 76–77 of the LB, or **Activity 10K** in the TG below.

Additional notes

When calculating a fraction ‘of’ some quantity, we multiply. The word ‘of’ can be replaced by the × operation.

Example

Calculate $\frac{1}{3}$ of 48

$$\frac{1}{3} \times 48 = \frac{1}{3} \times \frac{48}{1}$$
$$= \frac{48}{3}$$
$$= 16$$

Examples

Example 1

Find $\frac{1}{4}$ of 16

Solution

$\frac{1}{4}$ of 16

$= \frac{1}{4} \times \frac{16}{1}$

$= 4$

Example 2

$\frac{2}{3}$ of $3\frac{3}{5}$

Solution

$\frac{2}{3}$ of $3\frac{3}{5}$

$= \frac{2}{3} \times \frac{18}{5}$

$= \frac{2}{1} \times \frac{6}{5}$

$= \frac{12}{5}$

$= 2\frac{2}{5}$

Activity 10K

1 Calculate:

a $\frac{1}{2}$ of 28

b $\frac{4}{5}$ of 35

c $\frac{3}{8}$ of 40

2 Evaluate these amounts:

a $\frac{2}{3}$ of \$30

b $\frac{7}{10}$ of 30 cm

3 It takes $4\frac{1}{2}$ hours for a dripping tap to fill an empty cup. How long will it take to fill $1\frac{2}{3}$ cups?

4 At a school social, the band expects to play for two-thirds of the time. If the social lasts for 4 hours (240 minutes), for how long will the band be playing?

5 It takes Martine a quarter of an hour to deliver newspapers to the houses in Bradman Street. Ralph thinks he could do the same job in four-fifths of this time.

a What fraction of an hour does Ralph think the job will take?

b Write down a fraction calculation that shows how long this will be, in minutes.

Answers 10K

1 **a** 14 **b** 28 **c** 15

2 **a** \$20 **b** 21 cm

3 $7\frac{1}{2}$ hours

4 160 mins = 2 hrs 40 mins

5 **a** 12 mins = $\frac{1}{5}$ of an hour **b** $\frac{4}{5}$ of 15 mins = 12 mins

10L • Squares and square roots of fractions

LB Pages 78–79

Specific learning outcomes

Learners should be able to:

7.10.14.1 Square fractions: *square numerator, then square denominator*.

7.10.14.2 Square mixed numbers by changing them to improper fractions.

7.10.15.1 Take the square root of fractions.

7.10.15.2 Take the square root of mixed numbers by changing them to improper fractions.

Teaching points

1 To *square a fraction:* square the numerator, then square the denominator.

2 To *take the square root of a fraction:* take the square root of the numerator, then the square root of the denominator.

Suggested teaching approach

- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercise 10L** on page 79 in the LB, or **Activity 10L** in the TG below.

Additional notes

To **square** a fraction, we multiply it by itself:

$$\left(\frac{2}{3}\right)^2 = \frac{2}{3} \times \frac{2}{3} = \frac{4}{9}$$

Mixed numbers should be changed into improper fractions first, then the answer should be changed back into a mixed number:

$$\left(3\frac{1}{2}\right)^2 = \left(\frac{7}{2}\right)^2 = \frac{49}{4} = 12\frac{1}{4}$$

To calculate the **square root** of a fraction, find the square root of the numerator and the square root of the denominator separately:

$$\sqrt{\frac{4}{25}} = \frac{\sqrt{4}}{\sqrt{25}} = \frac{2}{5}$$

In the same way, when working out the square root of a mixed number, change it to an improper fraction first:

$$\sqrt{2\frac{1}{4}} = \sqrt{\frac{9}{4}} = \frac{3}{2} = 1\frac{1}{2}$$

Examples

Example 1

Evaluate:

$$\left(\frac{3}{7}\right)^2$$

Solution

$$\left(\frac{3}{7}\right)^2$$
$$= \frac{3}{7} \times \frac{3}{7}$$
$$= \frac{9}{49}$$

Example 2

Evaluate:

$$\sqrt{\frac{9}{64}}$$

Solution

$$\sqrt{\frac{9}{64}}$$
$$= \frac{\sqrt{9}}{\sqrt{64}}$$
$$= \frac{3}{8}$$

Activity 10L

1 Evaluate these squares:

a $\left(\frac{5}{8}\right)^2$ **b** $\left(\frac{1}{3}\right)^2$ **c** $\left(\frac{4}{11}\right)^2$

2 Evaluate these squares. Give your answers as mixed numbers.

a $\left(2\frac{1}{2}\right)^2$ **b** $\left(1\frac{1}{3}\right)^2$ **c** $\left(2\frac{3}{8}\right)^2$

3 Evaluate this square root:

$\sqrt{\frac{25}{36}}$

4 Evaluate these square roots. Give your answers as mixed numbers:

a $\sqrt{1\frac{7}{9}}$ **b** $\sqrt{5\frac{4}{9}}$

Answers 10L

1 **a** $\frac{25}{64}$ **b** $\frac{1}{9}$ **c** $\frac{16}{121}$

2 **a** $\frac{25}{4} = 6\frac{1}{4}$ **b** $\frac{16}{9} = 1\frac{7}{9}$ **c** $\frac{361}{64} = 5\frac{41}{64}$

3 $\frac{5}{6}$

4 **a** $\frac{4}{3} = 1\frac{1}{3}$ **b** $\frac{7}{3} = 2\frac{1}{3}$

10M • Order of operations

LB Pages 80–81

Specific learning outcomes

Learners should be able to:

7.10.16.1 Evaluate and simplify fractions that involve a mixture of operations using the BODMAS Rule.

Teaching points

1 Identify the BODMAS Rule:

- **B** Work out the calculations inside the brackets first. If there is more than one operation inside the brackets, then they must also follow the rules of BODMAS.
- **O** If the question contains fractions of or powers of, then these are calculated next.
- **D** Work out the division and
- **M** multiplication calculations, working from left to right
- **A** Work out the addition and
- **S** subtraction calculations, working from left to right.

2 Learners should know how to use the BODMAS Rule when there is a mixture of operations.

3 The BODMAS Rule is applied when evaluating fractions.

Suggested teaching approach

- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercise 10M** on pages 80–81 of the LB, or **Activity 10M** in the TG below.

Additional notes

The rules we used in Chapter 1 for order of operations apply to fraction calculations as well as whole numbers.

B – Work out the part inside the brackets first.

Example

$\left(1\frac{1}{2} + 4\frac{1}{2}\right) \div 3$

$= \left(\frac{3}{2} + \frac{9}{2}\right) \div 3$

$= \frac{12}{2} \div 3$

$= 6 \div 3$

$= 2$

D, **M** – When there are no brackets in an expression, multiplication and division are done before addition and subtraction.

Work from left to right, doing × and ÷ first.

Then work from left to right again, this time doing + and –.

Example

$\frac{1}{2} + \frac{4}{5} \times \frac{3}{5}$

$= \frac{1}{2} + \frac{12}{25}$

$= \frac{25}{50} + \frac{24}{50}$

$= \frac{49}{50}$

Examples

Evaluate the following:

$\frac{2}{3} + \frac{3}{8} \div \frac{1}{2} - \frac{1}{6}$

Solution

$\frac{2}{3} + \frac{3}{8} \div \frac{1}{2} - \frac{1}{6}$

$= \frac{2}{3} + \frac{3}{8} \times \frac{2}{1} - \frac{1}{6}$

$= \frac{2}{3} + \frac{3}{4} \times \frac{1}{1} - \frac{1}{6}$

$= \frac{2}{3} + \frac{3}{4} - \frac{1}{6}$

$= \frac{8}{12} + \frac{9}{12} - \frac{2}{12}$

$= \frac{15}{12}$

$= \frac{5}{4}$

$= 1\frac{1}{4}$

Activity 10M

1 Evaluate these. Remember that 'of' means ×, so do this before + or –.

a $\frac{1}{3}$ of 12 + 5

b $\frac{1}{4}$ of 28 – $\frac{1}{2}$

c $\frac{2}{3} - \frac{1}{5} + \frac{4}{15}$

d $1\frac{1}{2} + \frac{2}{3} \times 7\frac{1}{2}$

e $4\frac{1}{2} \div \frac{3}{5} \times \frac{2}{3}$

2 $\frac{1}{6} \times \frac{3}{8} + \frac{3}{4}$

3 $\frac{2}{3} - \frac{1}{2} \times \frac{1}{4}$

4 $\frac{1}{2} \times \frac{1}{4} - \frac{1}{3} \times \frac{1}{8}$

Answers 10M

1 **a** 9

b $6\frac{1}{2}$

c $\frac{11}{15}$

d $6\frac{1}{2}$

e 5

2 $\frac{13}{16}$

3 $\frac{13}{24}$

4 $\frac{1}{12}$

• Chapter Eleven •

Time and Mass

Overview

Time is a vital factor in our lives. It determines the movements and activities of everything on our planet, and beyond. We have measuring systems for time that help us to sequence events, to compare the durations of events and the intervals between them, and to quantify rates of change, e.g. in the motions of objects. We represent time using either 12 hours or 24 hours, on analogue or digital clocks.

This chapter focuses on how the sequence and duration of events can be expressed using timelines. Schedules and timetables are used as a guide to coming events and to carry out actions in an orderly manner. Our planet is divided into time 'zones' that help people around the world to plan and coordinate their actions with each other. This chapter also discusses units of time and converting between them.

Also studied in this chapter is the concept of 'mass'. Mass is the amount of a material. This chapter discusses units for mass and the instruments used to measure mass.

Contents

Chapter skills

This chapter covers the following skills:

- Using clocks, calendars, timetables and schedules, including use of seconds and the 24-hour day
- Producing and using timelines
- Calculating time intervals when working with daylight savings, Solomon Islands and world time zones
- Expressing time using different units:
  1 minute = 60 seconds
  1 hour = 60 minutes = 3600 seconds
  1 day = 24 hours
  1 fortnight = 14 days
  1 year = 12 months
  1 year = 365 days
  1 leap year = 366 days
- Using and constructing timetables and calendars
- Expressing mass using different units:
  1 tonne = 1000 kg
  1 kg = 1000 g
  1 g = 1000 mg
- Working with questions involving mass.

Teaching plan

Lessons	Chapter sections	Class work and home work
1	• Intro • 11A: Timelines	Learner's Book 2 • Exercise 11A, pages 93–94
2–3	• 11B: Time conversions	Learner's Book 2 • Exercise 11B, pages 95–96
4	• 11C: Time differences and the calendar	Learner's Book 2 • Exercise 11C, pages 98–99
5–6	• 11D: Time differences in hours and minutes	Learner's Book 2 • Exercise 11D, pages 100–101
7	• 11E: Using timetables	Learner's Book 2 • Exercise 11E, page 103
8	• 11F: Time zones	Learner's Book 2 • Exercise 11F, page 104–105
9	• 11G: Ordering events and flow charts	Learner's Book 2 • Exercise 11G, pages 107–111
10	• 11H: Mass and conversions of units of mass	Learner's Book 2 • Exercise 11H, page 113
10	• Revision/test	Learner's Book 2 • Revision/Assessment, Exercises 11A–11F, 11H, pages 120–121 Teacher's Guide • Chapter 11 test, page 179

General learning outcomes

Learners should:

Timelines

7.11.1 Understand that events that occur in life can be expressed using lines with scales marked on them, indicating sequences of events that occur in life. (U)

7.11.2 Know how to read scales and get extra information from a timeline. (K)

Time conversions

7.11.2 Know how to do conversion between units of time. (K)

Time differences and the calendar

7.11.3 Understand that 12-month calendars are the same everywhere but have different times and days due to their locations and positions in different countries. (U)

Time differences in hours and minutes

7.11.4 Know how to read and express time in different formats: 12- and 24-hour clock, analogue and digital format. (K)

Using timetables

7.11.5 Understand that the 'table' is an appropriate format to tabulate and put time schedules in. (U)

Time zones

7.11.6 Understand that the rotation of the Earth causes daylight and nighttime at different times in different zones on Earth. (U)

Ordering events and flow charts

7.11.7 Understand that for tasks to be successfully implemented, the order in which events occur needs planning. (U)

7.11.8 Know how to arrange information in a logical order and present it in a flow chart. (K)

Mass and conversion of units of mass

7.11.9 Understand that mass is the measure of the amount of materials in an object. (U)

7.11.10 Know how to change one metric unit to another. (K)

11A • Timelines

LB Pages 92–94

Specific learning outcomes

Learners should be able to:

7.11.1.1 Define 'timeline'.

7.11.1.2 Identify different parts of a timeline.

7.11.2.1 Read and interpret information given on a timeline.

7.11.2.2 Construct timelines and identify dates, time etc. of events that occur in a given time period.

7.11.2.3 Label and place dates and events on a timeline.

Teaching points

1. A **timeline** is a way of displaying a list of events in chronological order. It is typically a long bar, labelled with the dates of events marked on points where they would have happened.
2. Learners should be able to read and interpret information given on a timeline.
3. Learners should be able to construct a timeline with dates and events labelled.

Suggested teaching approach

- Start the chapter section by doing the **Starter activities** provided.
- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercise 11A** on pages 93–94 of the LB, and **Activity 11A** in the TG below.

Starter activities

Ask the learners to list, in order of years, some of the great events that have occurred in the history of the Solomon Islands. Help them to pool their results and draw a timeline on the board.

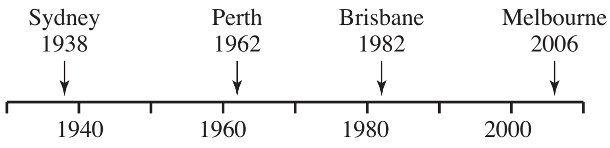
Additional notes

A **timeline** shows events in time order, with a suitable time scale.

Examples

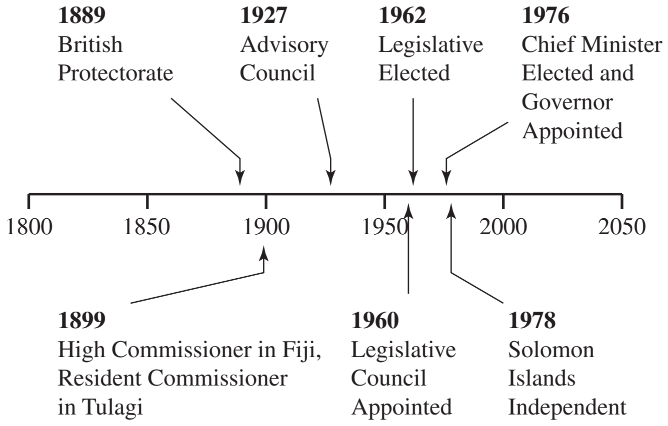
Example 1

The timeline below shows the four times that Australia has hosted the Commonwealth Games (1938, 1962, 1982, 2006).



Example 2

The timeline below shows stages in the development of the Solomon Islands as an independent nation.



Activity 11A

1 Here are some cooking times for a soup with rice, slippery cabbage, noodles and a tin of tuna.

Step 1: Boil the rice in the pot (half an hour).

Step 2: Wash and cut the slippery cabbage (10 minutes).

Step 3: Cook the cabbage (15 minutes).

Step 4: Add the noodles to the cabbage and cook (3 minutes).

Step 5: Add the tuna to the cabbage and noodles, and cook (5 minutes).

The rice and slippery cabbage soup should be ready to be served at 8:30 pm.

- **a** When should the rice be cooked?
- **b** When should the cabbage be cooked?
- **c** Create a timetable to show the times these foods are to be cooked so that they are ready to be served at 8:30 pm.

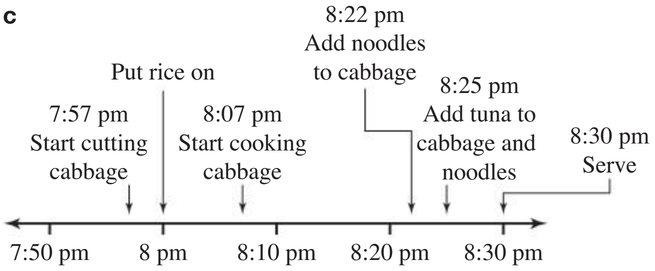
2 Use thick coloured lines or coloured blocks on this timeline to show how you spent your time last Wednesday.
Use different colours for these three activities:
sleeping, school, other activities.

Answers 11A

1 **a** 8 pm

b Start cooking cabbage at 8:07 pm.

c



2 Answers will vary

11B • Time conversions

LB Pages 95–96

Specific learning outcomes

Learners should be able to:

7.11.3.1 Identify the common units of time: *second, minute, hour, day, week, month and year*.

7.11.3.2 Convert one unit of time to another.

Teaching points

1 Learners should be able to identify the common units of time.

2 Learners should be able to convert between the units of time.

Suggested teaching approach

- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercise 11B** on pages 95–96 in the LB, or **Activity 11B** on the TG below.

Additional notes

60 seconds = 1 minute

60 minutes = 1 hour

24 hours = 1 day

7 days = 1 week

12 months = 1 year

10 years = 1 decade

100 years = 1 century

Examples

Example 1

Complete the following conversions:

a 10 minutes = ____ seconds

b 5 hours = ____ minutes

c 10 days = ____ hours

d 7 years = ____ days

e 320 seconds = ____ minutes

Solution

a $10 \times 60 = 600$ seconds

b $5 \times 60 = 300$ minutes

c $10 \times 24 = 240$ hours

d $7 \times 365 = 2555$ days (plus leap year days)

e $320 \div 60 = 5\frac{1}{3}$ minutes

Activity 11B

1 Units of time are: *seconds, minutes, hours, days, weeks, months, years, decades, centuries*.

Choose the most appropriate unit from the list above for measuring the following lengths of time:

- **a** a football game
- **b** a flight from Honiara to Brisbane
- **c** doing up your shoelaces
- **d** your father's age.

2 Convert the following to the units shown:

a 5 minutes = ____ seconds

b 35 days = ____ weeks

c 700 years = ____ centuries

d $3\frac{1}{2}$ decades = ____ years

3 How many minutes are there in $2\frac{1}{2}$ hours?

4 There are just over 52 weeks in a year. Explain how this can be worked out using the numbers 365 (there are 365 days in most years) and 7 (there are 7 days in a week).

Answers 11B

1	**a** minutes	**b** hours	**c** seconds	**d** years
2	**a** 300	**b** 5	**c** 7	**d** 35

3 150 mins

4 Divide the number of days in a year (365) by the number of days in a week (7); 365 ÷ 7 = 52·14 (2 d.p.)

11C • Time differences and the calendar

LB Pages 97–99

Specific learning outcomes

Learners should be able to:

7.11.4.1 Define what BC and AD stand for.

7.11.4.2 Find the number of years, months, days and time in a given period of time.

Teaching points

1. **BC** stands for 'before Christ'. It means the number of years before the birth of Jesus Christ. **AD** stands for 'anno domini', which is Latin for 'year of our Lord'. It means the number of years since the birth of Jesus Christ.
2. Learners should be able to find the number of years, months, days and other units of time in a given period of time.

Suggested teaching approach

- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercise 11C** on pages 98–99 in the LB, or **Activity 11C** in the TG below.

Additional notes

Length of a month

A month has 31 days, except for the following:

- April, June, September and November have 30 days.
- February has 28 days (except in a leap year, when it has 29 days).

Length of a year

Most years are 365 days long.

Every 4th year is a **leap year**, and has 366 days. The number of a leap year is divisible by 4. (The exception to this is years that are also divisible by 100. These years are only 365 days long, unless they are divisible by 400.)

Examples

Example 1

How many years are there between 65 BC and 23 BC?

Solution

65 BC and 23 BC
= 65 – 23
= 42 years

Example 2

How many years are there between 65 BC and 23 AD?

Solution

65 BC and 23 AD
= 65 + 23
= 88 years

Activity 11C

1 Suppose 18 June is a Monday. What is the day of the week on 2 July?

2 Suppose 20 October is a Friday. What is the date, and the day of the week, 25 days later?

3 Which of these years are leap years?

- **A** 2008
- **B** 1999
- **C** 2100
- **D** 2000

4 How many days are there in each of these months?

- **a** July
- **b** September
- **c** December
- **d** November
- **e** February 2007

5 Dates are often written using only digits. For example, the date 18 June 2007 can be written as 18/6/07. This means the 18th day of the 6th month in the 7th year of this century. Write these dates in full (assume they are in this century):

- **a** 12/10/04
- **b** 1/3/00
- **c** 29/2/12

Answers 11C

1 Monday

2 Tuesday, 14th November

3 and D

4 **a** 31
b 30
c 31
d 30
e 28

5 **a** 12th October 2004
b 1st March 2000
c 29th February 2012

11D • Time differences in hours and minutes

LB Pages 100–101

Specific learning outcomes

Learners should be able to:

7.11.4.2 Define what AM and PM stand for.
7.11.5.1 Identify two time systems: 12 hours and 24 hours time.
7.11.5.2 Find time using clock face and digital time.
7.11.5.3 Calculate time using 12 hours and 24 hours times.

Teaching points

1. The **12-hour clock** is a time conversion convention in which the 24 hours of the day are divided into two periods. These are called *ante meridiem* (or a.m.), which is Latin for 'before midday', and *post meridiem* (or p.m.), meaning 'after midday'. Each period consists of 12 hours.
   - am – ante meridiem
   - pm – post meridiem
2. There are two time systems: 12 hours time and 24 hours time.
3. Learners should be able to calculate time using 12 hours time and 24 hours time.
4. Learners should be able to find time using clock face (analogue) and digital time.

Suggested teaching approach

- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercise 11D** on pages 100–101 of the LB, or **Activity 11D** in the TG below.

Additional notes

The 24-hour clock uses four digits to show time:

- The first two digits represent the number of hours *after midnight*.
- The last two digits represent the number of minutes *after the hour*.

Examples

0845 means 8:45 am (or 'quarter to nine' in the morning).

2220 means 10:20 pm (or 'twenty past ten' at night).

Examples

Example 1
Give the digital time for the following:

a a quarter past 5 pm
b 23 minutes to 3 in the morning
c midnight
d 5 minutes past noon

Solution

a 5:15 pm
b 2:37 am
c 12:00 am
d 12:05 pm

Example 2
Give the clockface time for these digital times:

a 7:08 am
b 5:43 pm

Solution

a 8 minutes past 7 am
b 17 minutes to 6 pm

Example 3
Give the 24-hour clock time for these times:

a 5:23 am
b 4:17 pm
c a quarter to 6 pm
d 13 minutes past 10 am

Solution

a 0523 hours
b 4 + 12 = 16. Time is 1617 hours
c Digital time is 5:45 pm = 1745 hours
d 1013 hours

Activity 11D

1 Change these 24-hour clock times to am/pm time:

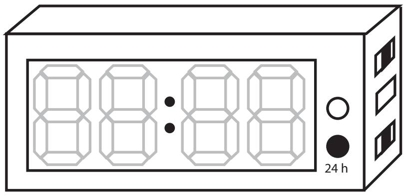
a 0915
b 1430
c 2310
d 1255

2 Write these times using the 24-hour clock:

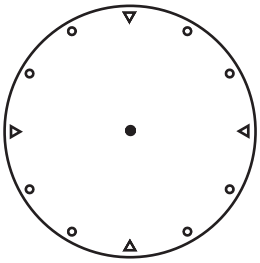
a 8:30 am
b 8:30 pm
c midday afternoon
d quarter to two in the

3 The time is 'ten to eight' at night. Show this time on both these clock displays:

a



b



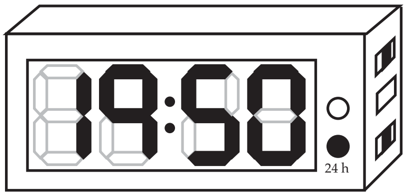
4 A video recorder is programmed to start recording at 1130 and finish at 1315. For how long will it record?

Answers 11D

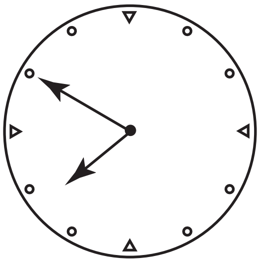
1 **a** 9:15 am **b** 2:30 pm
c 11:10 pm **d** 12:55 pm

2 **a** 0830 **b** 2030
c 1200 **d** 1345

3 **a**



b



4 1 hr 45 mins

11E • Using timetables

LB Pages 102–103

Specific learning outcomes

Learners should be able to:

7.11.6.1 Use and read time schedules given in tables that indicate when events and services are occurring.

Teaching points

1 A **timetable** is a schedule of events listed in the order in which they are expected to occur.

2 Learners should be able to read and interpret a timetable of events.

Suggested teaching approach

- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercise 11E** on page 103 of the LB, or **Activity 11E** in the TG below.

Additional notes

Travellers refer to timetables to get information about transport options. An effective timetable is set out in a way that is easy to read, and shows departure times etc. arranged in order from first to last.

Examples

The morning train timetable going from the city to Broadmeadows is shown here.

Spencer St	8:39 am	8:56 am	9:16 am	9:35 am
North Melbourne	8:42	8:59	9:19	9:38
Kensington	8:45	9:02	9:22	9:41
Newmarket	8:47	9:04	9:24	9:43
Ascot Vale	8:49	9:06	9:26	9:45
Moonee Ponds	8:51	9:08	9:28	9:47
Essendon	8:53	9:10	9:30	9:49
Glenbervie	8:55	9:12	9:32	9:51
Strathmore	8:56	9:13	9:33	9:52
Pascoe Vale	8:58	9:15	9:35	9:54
Oak Park	9:00	9:17	9:37	9:56
Glenroy	9:03	9:20	9:40	9:59
Jacana	9:05	9:22	9:42	10:01
Broadmeadows	9:08	9:25	9:45	10:04

1 Use the timetable to find the time taken to travel from:
  a Spencer St station to Oak Park
  b Essendon to Broadmeadows.

2 Which stations are closest, assuming that the train travels in a similar way between them?

3 If you needed to be at Pascoe Vale station by 9:30 am, what trains could you take from the city?

Solution

1 **a** 8:39 to 9:00, or 8:56 to 9:17, or 9:16 to 9:37, or 9:35 to 9:56 = 21 minutes
  b 8:53 to 9:08 = 15 minutes

2 Glenferrie and Strathmore. The train only takes 1 minute to travel between them.

3 The 8:39 and the 8:56 arrive at Pascoe Vale station before 9:30. The others arrive too late.

Activity 11E

1 Given in the table below is the weekly flight timetable for the twin otter plane servicing parts of the Solomon Islands.

Day	Flight No.	Destination	Depart time	Arrive time
Sun	IE352 IE352 IE353	HIR – GZO GZO – CHY CHY – HIR	0630 0830 0925	0800 0910 1120
Mon	IE320 IE320 IE321	HIR – BNY BNY – RNL RNL – HIR	0630 0740 0815	0735 0800 0915
Tue	IE302 IE302 IE303	HIR – GZO GZO – KGE KGE – HIR	0945 1145 1225	1115 1210 1345
Wed	IE354 IE355 IE355	HIR – CHY CHY – GZO GZO – HIR	0630 0840 0945	0825 0920 1115
Thu	IE358 IE358 IE359 IE359	HIR – GZO GZO – BAS BAS – GZO GZO – HIR	0630 0830 0925 1030	0800 0910 1005 1200

Key: *HIR – Honiaria, GZO – Gizo, CHY – Choiseul, BNY – Bellona, RNL – Rennell, KGE – Kagau, BAS – Ballalae*

- **a** When does flight IE355 leave Choiseul?
- **b** Mrs Makana booked to travel on flight IE359, GZO – HIR. She has been told to arrive at the airport half an hour before departure time. When should she arrive at the airport?
- **c** On Monday, flight IE321 left Rennell half an hour late. At what time would you expect it to arrive at its destination?
- **d** How long does it take to fly from Honiara to Choiseul?

2 Here is a timetable for Air New Zealand flights between Auckland and Sydney:

<table>
<tr><th colspan="4">From Auckland to Sydney</th></tr>
<tr><th>Day</th><th>Dep.</th><th>Arr.</th><th>Flight No.</th></tr>
<tr><td>D</td><td>0700</td><td>0830</td><td>NZ101</td></tr>
<tr><td>D</td><td>0900</td><td>1030</td><td>NZ103</td></tr>
<tr><td>D</td><td>1400</td><td>1530</td><td>NZ105</td></tr>
<tr><td>DX6</td><td>1800</td><td>1930</td><td>NZ107</td></tr>
<tr><th colspan="4">From Sydney to Auckland</th></tr>
<tr><th>Day</th><th>Dep.</th><th>Arr.</th><th>Flight No.</th></tr>
<tr><td>DX17</td><td>0700</td><td>1155</td><td>NZ100</td></tr>
<tr><td>1</td><td>0800</td><td>1255</td><td>NZ100</td></tr>
<tr><td>D</td><td>1000</td><td>1455</td><td>NZ102</td></tr>
<tr><td>D</td><td>1200</td><td>1655</td><td>NZ104</td></tr>
<tr><td>D</td><td>1800</td><td>2255</td><td>NZ106</td></tr>
<tr><td>7</td><td>2035</td><td>*0130</td><td>NZ108</td></tr>
<tr><td colspan="4">D = daily, 1 = Monday, 6 = Saturday, 7 = Sunday, X = except
All departure and arrival times are local.
* means the following day</td></tr>
</table>

- **a** When does flight NZ105 leave Auckland? Write your answer in am/pm time.
- **b** How many flights are there from Auckland to Sydney on Saturdays?
- **c** On what days of the week does flight NZ100 operate?
- **d** At what time, and on what day of the week, does flight NZ108 arrive in Auckland?

Answers 11E

1 **a** 8:40 am
- **b** before 10:00 am
- **c** 9:45 am
- **d** 1 hr 55 mins

2 **a** 2:00 pm
- **b** 3
- **c** Monday – Saturday
- **d** 1:30 am on Monday

11F • Time zones

LB Pages 104–105

Specific learning outcomes

Learners should be able to:

7.11.7.1 Read times and their corresponding times in different parts of the world.

Teaching points

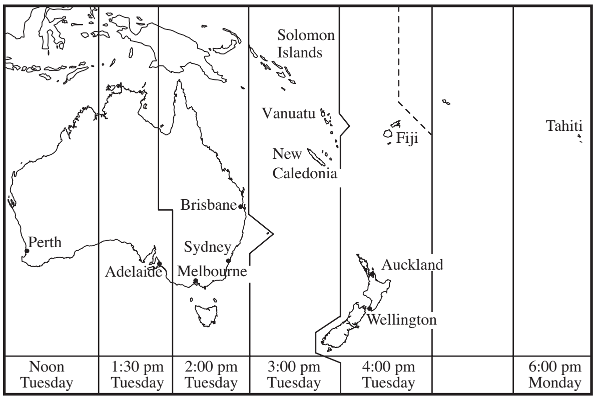
Learners should be able to read times and their corresponding times in other parts of the world.

Suggested teaching approach

- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercise 11F** on pages 104–105 of the LB, or **Activity 11F** below.

Additional notes

This map shows **time zones** in Australia's and the Solomon Island's part of the world.



For example, when it is midday in Perth, it is 2 pm in Melbourne, 3 pm in the Solomon Islands, and 6 pm (the previous day) in Tahiti.

Examples

If it is 5 pm in Honiara, Solomon Islands, what time is it (assume there is no daylight saving) in:

- **a** Fiji
- **b** Vanuatu
- **c** PNG
- **d** Perth

Solution

- **a** Fiji is 1 hour ahead of the Solomons. Therefore the time in Fiji is 6 pm.
- **b** Vanuatu is in the same time zone as the Solomons, so the time is the same, 5 pm.
- **c** PNG is 1 hour behind the Solomons, which means it is 4 pm in PNG.
- **d** Perth is 3 hours behind the Solomons, so in Perth it is 2 pm.

Activity 11F

1 Using the time zones shown in the map, calculate the answers to the following questions:

- **a** What is the time and day of the week in Gizo if the time in Perth is 10 pm on Monday?
- **b** Melbourne is 1 hour behind Solomons time. If it is midday in Honiara on Tuesday, what day and time is it in Melbourne?
- **c** If the time is 0400 in Vanuatu, what time is it in the Solomon Islands?

2 Virgin Blue flies between Honiara and Brisbane, Australia, several times a week. Here is the timetable:

From Brisbane to Honiara			
Day	**Dep.**	**Arr.**	**Flight No.**
1	1045	1345#	VB317
3	1045	1345	VB317
From Honiara to Brisbane			
Day	**Dep.**	**Arr.**	**Flight No.**
1	1600	*1900	VB318
1 = Monday, 3 = Wednesday All departure and arrival times are local (Solomons times). * means the following day. # means the previous day.			

Freda leaves Brisbane on fight VB317 on Monday morning.

a Will Freda arrive at Honiara in the morning, afternoon or evening?

b On what day will Freda arrive in Honiara?

Answers 11F

1 **a** 1 am on Tuesday **b** 11 am on Tuesday **c** 4 am

2 **a** afternoon **b** Sunday

11G • Ordering events and flow charts

LB Pages 106–111

Specific learning outcomes

Learners should be able to:

7.11.8.1 Arrange given information in order of their occurrences.

7.11.9.1 Use flowcharts to show the logical flow of information.

Teaching points

1 Learners should be able to arrange information in order of occurrence.

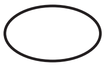
2 Learners should be able to use a flow chart to show events and information in a logical and sequential order.

Suggested teaching approach

- Read through the **Additional notes** provided.
- Model the **Example** provided in the LB.
- Learners complete **Exercise 11G** on pages 107–111 in the LB, or **Activity 11G** in the TG below.

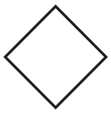
Additional notes

A **flow chart** shows events and information in a logical and sequential order. Flow charts can be used to explain the process of planning and making decisions. In simple flow charts, the following boxes are used:



Used for start or stop

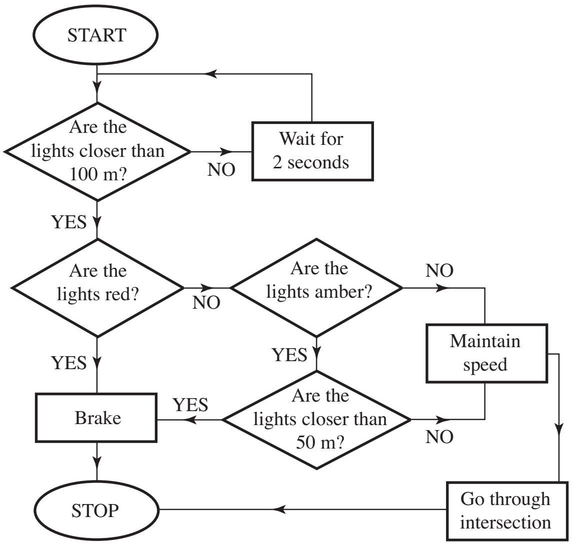
Used for instructions



Used for decisions: YES or NO

Activity 11G

1 This flow chart shows how a motorist drives as they approach traffic lights at an intersection.

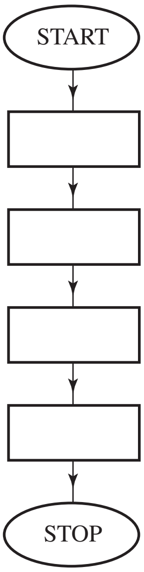


a How often does the motorist check the traffic lights?

b If the motorist checked the traffic lights every second, put a * sign alongside the box that would need to be changed.

c One particular motorist has a reputation for 'running the red'. This means that, if there is no car in front, the motorist will drive through an intersection when the lights are amber or changing to red. Put a large cross over the boxes that would be removed from the flow chart for this motorist.

2 This is a simple flow chart that has no decisions. It describes some of the steps when someone goes out one morning.



Place these steps in the correct places: put on shoes, cut toenails, tie shoelaces, put on socks.

3 Draw a simple flow chart to explain what happens to a motorist who is waiting at traffic lights, with no other cars nearby, and who checks the lights every second.

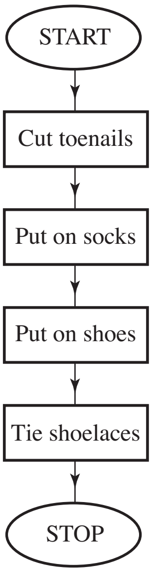
Answers 11G

1 a 2–3 times, depending on whether it is red or amber

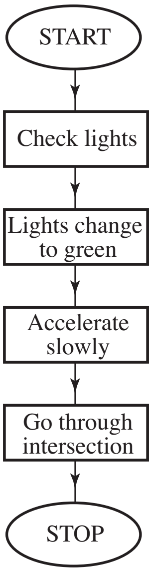
  b next to 'Wait for 2 seconds' box

  c Cross through 'Brake' box

2



3 There is more than one correct response. One possible flowchart is shown.



11H • Mass and conversion of units of mass

LB Pages 112–113

Specific learning outcomes

Learners should be able to:

7.11.10.1	Define 'mass'.
7.11.10.2	Identify units of mass and calculate the weights of various objects.
7.11.11.1	Change one unit of mass to another. 1 tonne = 1 000 kg 1 g = 1 000 mg 1 kg = 1 000 g

Teaching points

1 Learners should understand that **mass** is a measure of how heavy something is. *Mass* and *weight* are commonly considered to be the same thing. *Density* is a measure of how much mass is in a particular volume.

(In fact, scientists distinguish between *mass* (the amount of matter in an object) and *weight* (the force of gravity on an object). But for our purposes, learners do not need to know this distinction.)

2 Learners should be able to identify the units used for mass, and calculate the mass of various objects.

3 Learners should be able to convert between the units of mass.

Suggested teaching approach

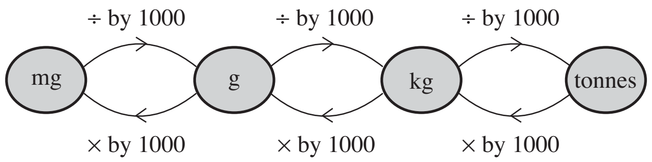
- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercise 11H** on page 113 of the LB, or **Activity 11H** in the TG below.

Additional notes

Mass and weight are measured in metric units.

Unit	Used for	Example
milligram (mg)	very accurate scientific measuring	A cup of cocoa has 5 mg of caffeine.
gram (g)	accurate measuring	A teaspoon of salt weighs 5 g.
kilogram (kg)	people, objects that can be lifted	A bag of cement weighs 20 kg.
tonne (t)	very heavy objects	A Boeing 747 weighs 380 t.

This diagram shows how to change from one unit of mass to another.



Examples

Example 1

Change 450 g to kg.

To change 450 g to kg, divide by 1000.

450 g = 0·45 kg

Example 2

Change 5·6 t to kg.

To change 5·6 t to kg, multiply by 1000.

5·6 t = 5600 kg

Activity 11H

1 Which unit of mass would be the most suitable unit to use for these objects?

a your own weight

b an eyelash

c a railway locomotive

d a teabag

e a sack of potatoes

f a Boeing 747 aircraft

g a bag of cement

h a packet of matches

2 Choose the most likely measurement for each mass from the list in the table below.

Object	Measurement
a A paper-clip	100 g
b A delivery van	175 kg
c A bar of chocolate	1 g
d A sumo wrestler	8 kg
e A tray of 24 soft-drink cans	1·8 t

3 Change these masses to grams:

a 3 kg

b 0·65 kg

c 5000 mg

d 375 mg

4 Change these masses to kilograms:

a 4 tonnes

b 0·68 tonne

c 94 000 g

d 8250 g

5 Jim is cooking some rice. He uses four 750 g packets. How much is this in kg?

6 To make a cup of coffee, you are supposed to put 8 g of coffee into the machine. How many cups of coffee can be made from 1 kg?

7 A carton holds 36 rolls of toilet paper. The carton weighs 600 g when empty. With all the toilet rolls, it weighs 1·86 kg. Calculate the weight in grams of a roll of toilet paper.

Answers 11H

1 **a** kg **b** mg

c t **d** g

e kg **f** t

g kg **h** g

2 **a** 1 g **b** 1·8 t

c 100 g **d** 175 kg

e 8 kg

3 **a** 3000 g **b** 650 g

c 5 g **d** 0·375 g

• Chapter Twelve •

Probability

Overview

Probability is the branch of mathematics that studies the possible outcomes of given events, together with the outcomes' relative likelihoods and distributions. The word 'probability' is used to mean the chance that a particular event (or set of events) will occur, expressed on a linear scale from 0 (impossibility) to 1 (certainty). It is also expressed as a percentage between 0% and 100%.
The analysis of events governed by probability is called *statistics*. This chapter focuses on how probabilities can be determined through both practice and theory. The practical approach to probability is based on experiments and data collection. The theoretical approach uses calculations to determine the probability of an event.

In studying this chapter, learners will be introduced to the terminology of probability. They will learn how to use a probablilty scale, and do some calculations to predict the likelihood of particular outcomes. They will also carry out some practical experiments with spinners to observe outcomes and see probability in action.

Contents

Chapter skills

This chapter covers the following skills:

- Using the language of chance in everyday situations
- Comparing probabilities using language
- Using language to estimate a probability by using the results of simple experiments
- Finding the probability of a simple event
- Predicting and testing probabilities using spinners
- Measuring probabilities using percentages, decimals or fractions
- Calculating theoretical probabilities using the rule:

$$\text{probability of an event} = \frac{\text{number of favourable outcomes}}{\text{total number of outcomes}}$$

Teaching plan

Lessons	Chapter sections	Class work and home work
1–2	• Intro • 12A: The language of chance	Learner's Book 2 • Exercise 12A, pages 124–125
3–5	• 12B: Theoretical probability	Learner's Book 2 • Exercise 12B, pages 126–127
6	• 12C: Exploring simple experiments	Learner's Book 2 • Learning task 12C, pages 128–129
7	• 12D: Exploring spinners	Learner's Book 2 • Learning task 12D, page 130
8	• 12E: Exploring games of chance	Learner's Book 2 • Learning task 12E, page 131
9	• 12F: Exploring card games	Learner's Book 2 • Learning task 12F, pages 132–133
10	• 12G: Spinners	Learner's Book 2 • Exercise 12G, pages 134–135
11–15	• 12H: Using statistics to find probabilities	Learner's Book 2 • Exercise 12H, pages 136–137
15	• Revision/test	Learner's Book 2 • Revision/Assessment, Exercises 12A, 12B, 12G, 12H, pages 144–145 Teacher's Guide • Chapter 12 test, page 181

General learning outcomes

Learners should:

The language of chance

7.12.1 Understand that the language of chance in everyday situations represents the likelihood of an event occurring. (U)

7.12.2 Know how to use a 'probability scale' to indicate the positions of the likelihood that an event would occur. (K)

7.12.3 Understand that probability can be expressed in many different ways: words, percentages, fractions and decimals. (U)

Theoretical probability

7.12.4 Understand that in 'theoretical probability' all possible outcomes are considered with equal chances, and therefore outcomes can be calculated. (U)

7.12.5 Know how to estimate the probability of an event in a range of possible outcomes. (K)

Exploring simple experiments

7.12.6 Know how to explore more probabilities of events using (K)

- simple experiments
- spinners
- games of chance
- card games.

Using statistics to find probabilities

7.12.7 Understand that when attempting to estimate the chance of an event occurring, we look to past experiences. (U)

7.12.8 Know how to read and use existing data to predict the chance of an event occurring. (K)

12A • The language of chance

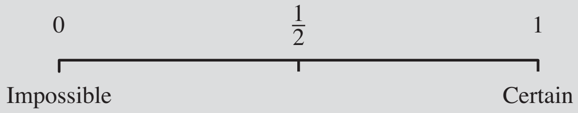
LB Pages 124–125

Specific learning outcomes

Learners should be able to:

7.12.1.1 Identify and define the terms that are used to express probabilities used in everyday situations: ‘unlikely’, ‘definitely’, ‘even chance’, ‘probably’, ‘impossible’, ‘certain’.

7.12.2.1 Use the ‘probability scale’ or number line to represent the occurrence of events.



7.12.3.1 Express the probability of events occurring, knowing the total possible outcomes in words, percentages, fractions and decimals.

Teaching points

1 **Probability** is the branch of mathematics that studies the **possible** outcomes of given events, together with the relative likelihoods and distributions of the **outcomes**. In common usage, the word ‘probability’ is used to mean the **chance** that a particular **event** (or set of events) will occur, expressed on a linear scale from 0 (impossibility) to 1 (certainty). It can also be expressed as a percentage between 0% and 100%.

2 The analysis of events governed by probability is called **statistics**.

3 Learners should understand and be able to define the following terms, which are used to express probability in everyday situations: **unlikely**, *definitely*, *even chance*, **likely**, *probably*, **impossible**, **certain**.

3 Learners should be able to use a scale or number line to determine the chance of an event occurring.

4 Learners should be able to express probabilities in words, percentages, fractions and decimals.

Suggested teaching approach

- Start the chapter section by doing the **Starter activities** provided.
- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercise 12A** on pages 124–125 of the LB, or **Activity 12A** in the TG below.

Starter activities

‘Scissors, paper, rock’ game

Start this chapter by playing the game: ‘Scissors, paper, rock’. This a game of ‘chance’, with three possible outcomes on each try:

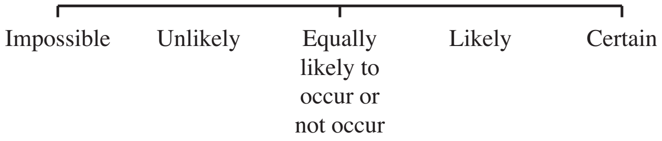
Scissors cut paper.

Paper wraps rock.

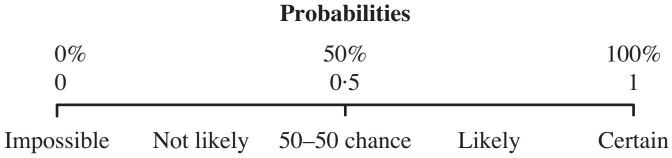
Rock crushes scissors.

Additional notes

The **probability** of an event means how likely it is to occur. The scale below shows how we can describe the probability of an event.



The easiest way to think of probability is as a number line: the closer you get to 0, the less likely an event is to occur; and the closer you get to 1, the more likely the event is to occur.



Probability can be written as a fraction, as a decimal from 0 to 1, or as a percentage from 0% to 100%.

- An event that has no chance of happening (impossible) has a probability of 0 or 0%.
- An event that is certain to happen has a probability of 1 or 100%.
- An event that has a 50–50 chance of happening has a probability of 0·5 or 50%.

We often use **Pr** as an abbreviation for probability. The event is then written in brackets. For example, if we were spinning a spinner that had different-coloured sections, *Pr(white)* would be written to stand for the probability of the pointer landing in a white section.

Finding probability

To find the probability of an event occurring (also known as an outcome), we do the following calculation:

$$\text{Pr(event)} = \frac{\text{number of favourable outcomes}}{\text{total number of outcomes}}$$

Frequency and relative frequency

The **frequency** tells us how often an event has occurred in the past. The **relative frequency** is a fraction made by putting the frequency of an event over the total number of events.

Examples

Timo works at Henderson International Airport. He has data for 200 consecutive flights – whether they were early, on time or late. This table shows the frequency and relative frequency for these.

Arrival	Frequency	Relative frequency
Early	3	$\frac{3}{200}$ or 1·5%
On time	139	$\frac{130}{200}$ or 69·5%
Late	58	$\frac{58}{200}$ or 29%

He could use this information to predict how likely a flight is to be:

- early – very unlikely
- on time – likely
- late – unlikely.

Activity 12A

1 Describe how likely the events listed below are. Choose from this list: *impossible, very unlikely, unlikely, equally likely to occur or not occur, likely, very likely, certain.*
   - **a** A coin lands with heads showing up.
   - **b** A window breaks when a stone is thrown at it.
   - **c** You buy a raffle ticket at the Tenau Secondary School bazaar and win first prize.
   - **d** You throw a brick into the sea and it floats.
   - **e** There will be people in front of you when you next buy tickets at the movies.

2 Mary puts on a blindfold, and throws a dart at a dartboard a number of times. She hits the board 9 times altogether.

   Complete the sentences below. Choose from: *likely*, *unlikely*, *almost certain*, *very unlikely*.
   - **a** If Mary has thrown the dart 50 times, her next throw is ________ to hit the board.
   - **b** If Mary has thrown the dart 15 times, her next throw is ________ to hit the board.
   - **c** If Mary has thrown the dart 100 times, her next throw is ________ to hit the board.
   - **d** If Mary has thrown the dart 9 times, her next throw is ________ to hit the board.

Additional activity

3 Create an imaginary number line across the front of the classroom, numbered from 0 to 1 or 0% to 100%. Give learners cards with the following labels: *certain*, *impossible*, *possible*, *50–50*, *maybe* and *likely*. Ask them to go and stand on the correct position on the number line.

   Discuss the meanings of the words given above with the class, so that everyone has a common understanding of their meaning.

Answers 12A

1 **a** equally likely to occur or not occur
   - **b** very likely
   - **c** unlikely or very unlikely
   - **d** impossible
   - **e** very likely

2 **a** likely
   - **b** likely
   - **c** likely
   - **d** likely

3 Learner activity

12B • Theoretical probability

LB Pages 126–127

Specific learning outcomes

Learners should be able to:

7.12.4.1 Find the probability of events occurring, expressed as fractions in their lowest form.

7.12.5.1 Calculate theoretical probabilities using the given formula $PE = \frac{\text{number of favourable outcomes}}{\text{total number of outcomes}}$

- Event is certain to occur = 1
- Event is certain not to occur = 0

Teaching points

1 Learners should be able to find the probability of events occurring, and simplify this fraction to its lowest form.

2 Probability is calculated using the formula:

$$PE = \frac{\text{number of favourable outcomes}}{\text{total number of outcomes}}$$

A *favourable outcome* is also known as a *success*.

Suggested teaching approach

- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercise 12B** on pages 126–127 of the LB, or **Activity 12B** in the TG below.

Examples

Example 1

What is the probability of getting a 3 when you throw a fair six-sided **die**?

Solution

1 List all possible outcomes, and count them.

The possible outcomes are:

1, 2, 3, 4, 5 and 6

There are 6 possible outcomes.

2 Identify the successes and count them.

There is only one success: 3

3 Find the probability using the rule:

$$\Pr(\text{event}) = \frac{\text{number of successes}}{\text{total number of outcomes}}$$

The probability of throwing a three = $\frac{1}{6}$

Example 2
What is the probability of getting a number divisible by 2 when throwing a fair 6-sided die?

Solution

1 List the possible outcomes, and count them.

The possible outcomes are:

1, 2, 3, 4, 5 and 6.

There are 6 possible outcomes.

2 Identify the successes and count them.

The successes are: 2, 4 and 6.

There are three successes.

3 Find the probability using the rule:

$$\Pr(\text{event}) = \frac{\text{number of successes}}{\text{total number of outcomes}}$$

The probability of throwing a number divisible by $2 = \frac{3}{6}$ or $\frac{1}{2}$.

Example 3
Find the probability of rolling an odd number with a normal die.

Solution

1 List the possible outcomes, and count them.

Possible outcomes: 1, 2, 3, 4, 5, 6.

There are 6 possible outcomes.

2 Identify the favourable outcomes and count them.

Favourable outcomes are: 1, 3 and 5.

There are three favourable outcomes.

3 Find the probability using the rule:

$$\Pr(\text{event}) = \frac{\text{number of favourable outcomes}}{\text{total number of outcomes}}$$

$$\Pr(\text{odd number}) = \frac{3}{6}$$

Simplify the fraction if possible.

$$\frac{3}{6} = \frac{1}{2}$$

Activity 12B

1 Using your class, establish the probability of a student chosen at random:

- **a** having white hair
- **b** being from Malaita Province
- **c** being from Temotu Province
- **d** having a birthday in April
- **e** being from the island of Ulawa.

2 If one letter is chosen at random from the letters of the word *m a t h s*, what is the probability that it is:

- **a** the letter a?
- **b** the letter z?

3 An egg container holds 12 eggs. Three of them have been hard-boiled. If one of the eggs is chosen at random, what is the probability that it is hard-boiled?

4 The Accident and Emergency Ward at Central Hospital has 5 female nurses and 12 male nurses. The General Ward has 10 female nurses and 6 male nurses.

- **a** If a nurse is picked randomly from the hospital staff, what is the probability that a male will be picked?
- **b** Aunty Rita prefers a female nurse. Which of the two wards would she prefer to call? Explain why.

5 This rhyme helps you to remember how many days are in each month of the year:

"Thirty days hath September, April, June and November.
All the rest have 31, excepting February alone,
which has 28 days clear and 29 in each leap year."

If a month is chosen at random, what is the probability that it has:

- **a** 30 days?
- **b** 31 days?

6 Give an example of a situation in which an event has a probability of:

- **a** $\frac{3}{6}$
- **b** $\frac{2}{5}$

Answers 12B

1 Answers will vary

2 **a** $\frac{1}{5}$

b 0

3 $\frac{3}{12} = \frac{1}{4}$

4 **a** Pr(male nurse) = $\frac{18}{33}$

b General ward, as the percentage of female nurses is greater, therefore it is more likely to be tended to by a female nurse.

5 **a** $\frac{4}{12} = \frac{1}{3}$

b $\frac{7}{12}$

6 Answers will vary

12G • Spinners

LB Pages 134–135

Specific learning outcomes

Learners should be able to:

7.12.6.1 Calculate the probabilities of events: simple experiments, card games, spinners etc.

Teaching points

Learners should be able to calculate probabilities of events using spinners.

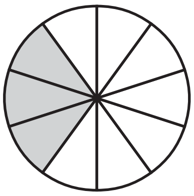
Suggested teaching approach

- Read through the **Additional notes** provided.
- Learners complete **Exercise 12G** on pages 134–135 of the LB, or **Activity 12G** in the TG below.

Additional notes

Spinners can be used to give equally likely outcomes in board games and game shows. They are more versatile than dice, because dice only have 6 possible outcomes.

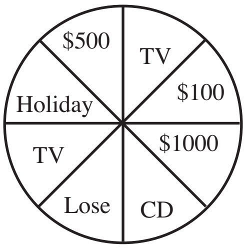
This spinner has 10 segments. Each segment is equally likely.



The probability that the pointer will stop on a shaded segment is $\frac{3}{10} = 0{\cdot}3$.

Activity 12G

1 This spinner is used on a game show:

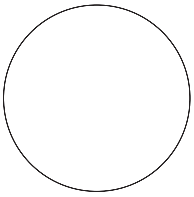


a What is the probability of winning a TV?

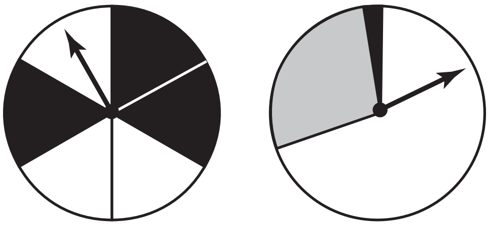
b What is the probability of winning a cash prize?

c What is the probability of losing?

2 Design a spinner in which the probability of winning a prize is $\frac{1}{3}$ and losing is $\frac{2}{3}$.



3 The diagram below shows two discs, each of which has a spinner that can stop anywhere on the disc.



Spinner 1 Spinner 2

a Which spinner is equally likely to stop on a black or a white sector?

b Complete these sentences.

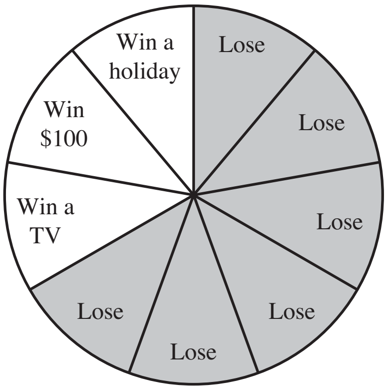
- **i** It is likely that spinner ___ will stop on a ______ sector.
- **ii** It is very unlikely that spinner ___ will stop on a ______ sector.

c Describe an event that is unlikely to happen with one of these spinners.

Answers 12G

1 a $\frac{2}{8} = \frac{1}{4}$ **b** $\frac{3}{8}$ **c** $\frac{1}{8}$

2 Sample answer:



3 a Spinner 1

b **i** It is likely Spinner 2 will stop on a white sector

ii It is very unlikely that Spinner 2 will stop on a black sector

4 Sample answer: Spinner 2 is unlikely to stop on a grey sector

12H • Using statistics to find probabilities

LB Pages 136–137

Specific learning outcomes

Learners should be able to:

7.12.7.1 Predict the chance of an event occurring using past events.

7.12.8.1 Calculate the probability of an event occurring using collected data.

Teaching points

Learners should be able to predict the probability (chance) of an event occurring, by using collected data on past events.

Suggested teaching approach

- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercise 12H** on pages 136–137 of the LB, or **Activity 12H** in the TG below.

Additional notes

In some cases, statistics from the past can be used to **predict** the chance of future events. The probability of an event occurring in the future can be calculated, based on its occurrence in the past.

The probability of an event occurring in the future is based on its relative frequency. Frequency is how often the event has actually occurred in the past. **Relative frequency** is a fraction made up of the frequency on top, and the total number of all past outcomes on the bottom. This fraction gives the probability of the event happening in the future.

Probability of the event happening

$$= \frac{\text{number of times the event has happened}}{\text{total number of all events that have happened}}$$

Examples

Example 1

During the Oceania Football Championship in Honiara, Benjamin Totori scored a goal in 4 games of the 5 games held so far. Predict the chance that he will score a goal in the next game.

Solution

Relative frequency = $\frac{4}{5}$

Probability = $\frac{4}{5}$

= 0·8

= 80%

Example 2

A farmer at Tamboko village, west Guadalcanal, collected 10 eggs and found that 2 of them were bad. If he chose another egg, what is the chance that he would get another bad one?

Solution

Because 2 of the first 10 eggs were bad, it seems that $\frac{2}{10}$ or $\frac{1}{5}$ of the farmer's eggs might be bad. So if the first 10 eggs were truly representative of all the farmer's eggs, then the chance of picking another bad one is $\frac{1}{5}$, or 1 out of 5.

Activity 12H

1 Makalisi works at the Telekom answering centre. He answers an average of 100 calls per hour. This table shows what happened with 100 calls put through to Makalisi's phone.

Result of call	Frequency	Relative frequency
Answered	61	$\frac{61}{100} = 0{\cdot}61$
Not answered	22	
Recorded message	11	
Out of order	1	
Engaged	5	

a Complete the Relative frequency column.

b Match the results below with one of these descriptions: *unlikely, very unlikely, likely.*

i The call will be answered.

ii Makalisi's phone will be out of order.

iii Makalisi's phone will be engaged.

2 A large drama club has four different types of membership: adult, child, senior citizen and life member.

Fifty membership records are chosen at random to take a survey. Here are the results:

Type of membership	Number in survey
Adult	25
Child	7
Senior citizen	18
Life member	1

a The relative frequency of child memberships in this survey is 14%. Write down a calculation to show how this is worked out.

b What is the relative frequency of senior citizen memberships:

i as a fraction?

ii as a percentage?

c Which type of membership is equally likely to appear or not appear in this survey?

d Which type of membership is very unlikely to appear in the survey?

3 A computer dealer keeps records of repairs needed on both old and new models of computers.

	Type of computer	
	Old	New
Needed repair	75	16
Did not need repair	425	24
Total	500	40

a Is it likely or unlikely that a computer sold by this dealer will need repair?

b Calculate the relative frequencies of computers needing repair, for both the old and new models.

c Use your answer to part **b** to explain which type seems the most reliable.

Answers 12H

1 a

Result of call	Frequency	Relative frequency
Answered	61	$\frac{61}{100} = 0{\cdot}61$
Not answered	22	0.22
Recorded message	11	0.11
Out of order	1	0.01
Engaged	5	0.05

b i likely

ii very unlikely

iii unlikely

2 a $\frac{7}{50} = 0{\cdot}14 = 14\%$

b i $\frac{18}{50} = \frac{9}{25}$

ii 36%

c adult

d life membership

3 a unlikely

b Pr (old needing repairs) = 0·15 ;
Pr (new needing repairs) = 0·4

c The old computers are more reliable as a smaller percentage of old computers sold required repairs (15% compared to 40%).

• Chapter Thirteen •

Polygons

Overview

In the Solomon Islands, shapes are all around us. Some of the shapes discussed in this chapter are naturally made, and some are made by people, including the many shapes in our painting, arts and crafts, and other activities. Shapes can be two-dimensional (flat) or three-dimensional. A flat or two-dimensional shape is one that is drawn on paper or a flat surface, and is known as a plane shape. Plane shapes whose sides are all straight lines are called polygons.

The word *polygon* is made up of two Greek words: *poly*, meaning 'many', and *gon*, meaning 'angle'. Thus, a polygon is a 'many-angled' shape. The number of sides gives the name of the polygon. If all the sides of a polygon are of equal length, then all its angles are equal, and it is called a regular polygon. If its sides are not all equal, it is called an irregular polygon.

Many shapes are looked in this chapter, with the focus mainly on triangles. Learners will explore the side and angle properties of triangles, exterior angles, and calculating the third angle in a triangle. They will also study quadrilaterals, along with some other polygons, both regular and irregular.

Contents

Chapter skills

This chapter covers the following skills:

- Identifying a polygon
- Defining 'polygon' – a flat, enclosed figure with straight sides
- Naming triangles according to their side or angle properties
- Finding the angle sum of a triangle (angle sum ∆ = 180°)
- Identifying the interior and exterior angle properties of a triangle
- Identifying special quadrilaterals and their properties
- Finding the angle sum of a quadrilateral (angle sum □ = 360°)
- Identifying the relationship between the number of sides of regular and irregular polygons (3-, 4-, 5-, 6-sided) and the sum of their interior angles
- Recognising angle relationships in parallel lines
- Using angle relationships to work out angle size.

Teaching plan

Lessons	Chapter sections	Class work and home work
1–2	• Intro • 13A: Triangles: Side properties	Learner's Book 2 • Exercise 13A, pages 149–150
3–4	• 13B: Triangles: Angle properties	Learner's Book 2 • Exercise 13B, pages 151–152
5–6	• 13C: Finding the third angle in a triangle	Learner's Book 2 • Exercise 13C, pages 153–154
7–8	• 13D: Exterior angle properties of triangles	Learner's Book 2 • Exercise 13D, page 155
9	• 13E: Quadrilaterals	Learner's Book 2 • Exercise 13E, pages 156–157
10	• 13F: Angle sum of a quadrilateral	Learner's Book 2 • Exercise 13F, pages 158–160
11	• 13G: Polygons	Learner's Book 2 • Exercise 13G, page 162
12–13	• 13H: Angle sum of polygons	Learner's Book 2 • Exercise 13H, pages 164
14	• 13I: Exploring polygon constructions	Learner's Book 2 • Learning task 13I, pages 166–167
15	• 13J: Exploring geometric designs	Learner's Book 2 • Learning task 13J, pages 168–169
15	• Revision/test	Learner's Book 2 • Revision/Assessment, Exercises 13A–13H, pages 176–177 Teacher's Guide • Chapter 13 test, page 168

General learning outcomes

Learners should:

Triangles: Side properties

7.13.1 Recognise the side properties of any given triangles and the symbols used to identify some of their properties. (S)

7.13.2 Know how to find the names of given triangles by using measuring instruments to measure the sides of given triangles. (K)

Triangles: Angle properties

7.13.3 Know that triangles are named according to their angle properties. (K)

Finding the third angle in a triangle

7.13.4 Know that the total sum of the three interior angles in a triangle is 180° (degrees). (K)

7.13.5 Know how to find the third missing angle in a triangle. (K)

Exterior angle properties of triangles

7.13.6 Know that each of the three interior angles in a triangle has a supplementary exterior angle which adds to 180°. (K)

7.13.7 Know how to find the exterior angle of a triangle by using the exterior angle properties. (K)

Quadrilaterals

7.13.8 Know that a quadrilateral is a plane shape or figure with four sides. (K)

Angle sum of a quadrilateral

7.13.9 Understand that the angle sum of any quadrilateral is 360°. (U)

Polygons

7.13.10 Understand that a flat plane figure enclosed by straight lines is a polygon. (U)

Angle sum of polygons

7.13.11 Understand that any regular polygon can be split into triangles to find the total sum of interior angles. (U)

7.13.12 Know the relationships between the sides of a polygon and the sum of the interior angles. (K)

Exploring polygon constructions

7.13.13 Know how to construct triangles and quadrilaterals using a protractor. (K)

7.13.14 Know how to construct regular polygons in a circle using a ruler and a protractor. (K)

Exploring geometric designs

7.13.15 Understand that polygon shapes can be used to create very good and attractive patterns and designs. (U)

13A • Triangles: Side properties

LB Pages 148–150

Specific learning outcomes

Learners should be able to:

7.13.1.1 Identify the different properties of given triangles and the marks or symbols that identify some of their properties.

7.13.1.2 Measure the dimensions (sides) of different triangles and name them according to their side properties: *scalene, isosceles and equilateral*.

Teaching points

1. Solomon Islands arts and its natural environment have many examples of polygons.
2. The ‘dashes’ on the sides of triangles indicate whether the sides are the same length as each other: matching dashes mean matching side lengths.
3. Learners should be able to identify the side properties of any given triangle: sides all different lengths (**scalene**), two sides of matching length (**isosceles**), or all three sides the same length (**equilateral**).

Suggested teaching approach

- Start the chapter section by doing the **Starter activities** provided.
- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercise 13A** on pages 149–150 in the LB, or **Activity 13A** in the TG below.

Starter activities

Activity 1: Solomon Islands arts

1. Ask learners to group into their provinces or villages.
2. Learners are to draw examples of different arts or customs from their province or village.
3. Learners identify the different polygons or shapes that can be identified in those drawings.

Activity 2: Triangles around us

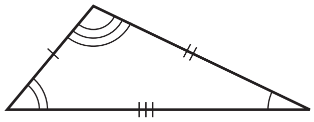
1. Ask learners to look around the classroom and out in the yard, and identify any objects, whether natural or made by humans, that are triangular in shape.
2. Later, when learners are familiar with the properties and types of triangles, they could return to this activity and see if they can name the triangles they identified, based on their properties.

Additional notes

A **triangle** is the simplest polygon: it has three straight sides and three angles.

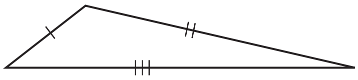
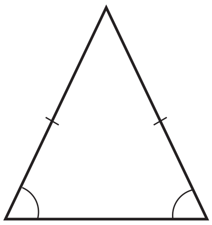
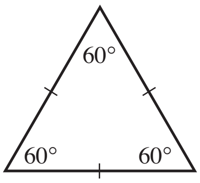
What the marks mean

The sides and the angles of a triangle can be marked in a particular way, to indicate whether the side lengths or the angles match each other in size. In the diagram below, each side of the triangle has a different dash (|, || or |||). This means that the three sides are all of different lengths. The angles inside the triangle all have different marks. This means that the three angles are all different in size.



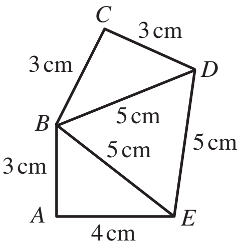
Types of triangle

Triangles can be classified according to their **side properties**. There are three main types, shown in the table below.

Scalene triangle No equal sides and no equal angles.	
Isosceles triangle Two equal sides and two equal base angles, which are opposite the two equal sides.	
Equilateral triangle Three equal sides and three equal angles of 60° each.	

Activity 13A

1 Write down what kind of triangles these are. Choose from: isosceles, equilateral, scalene.
   - a ΔABE
   - b ΔBED
   - c ΔBCD



2 Complete these sentences:
   - a A triangle with all three sides of different lengths is called __________ .
   - b A triangle that has two sides the same length and the third side a different length is called __________ .

3 Rachel measured the lengths of the three sides of some triangles and came up with the results listed below. Alongside each set of measurements, write down what kind of triangle it is: isosceles, equilateral or scalene.
   - a 7 cm, 4 cm, 7 cm
   - b 23 cm, 23 cm, 23 cm
   - c 5 cm, 7 cm, 6 cm
   - d 4 cm, 4 cm, 7 cm

4 a Draw two equilateral triangles (*ABC*) and (*BCD*) that share one side (*BC*) in common.
   - b How many sides of the quadrilateral *ABDC* are the same length?
   - c "*ABDC* is a square." True or false?

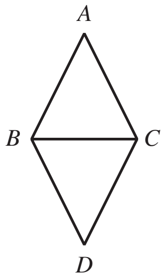
Answers 13A

1 a scalene
   - b equilateral
   - c isosceles

2 a scalene
   - b isosceles

3 a isosceles
   - b equilateral
   - c scalene
   - d isosceles

4 a Sample answer:



   - b 4
   - c false. The angles of this shape are 60°and 120°. It is a rhombus.

13B • Triangles: Angle properties

LB Pages 151–152

Specific learning outcomes

Learners should be able to:

7.13.3.1 Name triangles according to their angle properties.

7.13.3.2 Measure the angles of given triangles and name them according to their angle properties: *acute, obtuse and right-angled triangles*.

Teaching points

1 Learners should be aware that a triangle has three sides and three angles.

2 Learners should be aware that triangles are named according to their angle properties: acute-angled, right-angled and obtuse-angled.

Suggested teaching approach

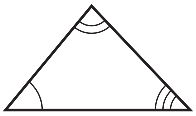
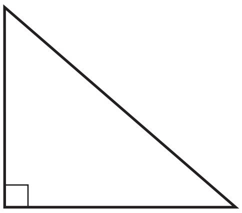
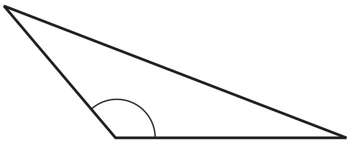
- Read through the **Additional notes** provided.
- Model the **Example** provided in the LB.
- Learners complete **Exercise 13B** on pages 151–152 of the LB, or **Activity 13B** in the TG below.

Additional notes

In the previous section, learners saw that triangles can be classified according to their side properties. In this section, they learn that triangles are also classified according to their angles.

When using angles to classify a triangle, it is the biggest angle that determines the name of the triangle.

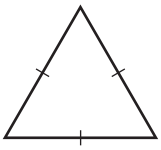
Triangles are classified according to their angles as shown in the table below.

Acute-angled triangle All three angles are acute (less than 90°).	
Right-angled triangle One angle is a right angle (equal to 90°).	
Obtuse-angled triangle One angle is obtuse (greater than 90° but less than 180°).	

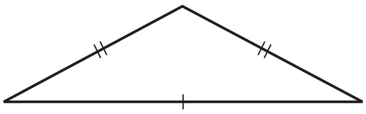
Activity 13B

1 Give each of the following triangles its angle name.

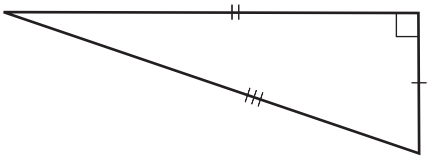
a



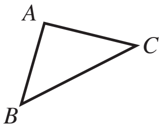
b

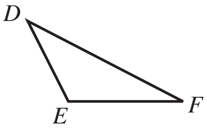


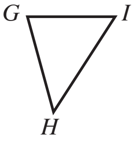
c



2 Use your protractor to measure the size of each angle in these triangles:







Use your results to complete this table:

Size of angle			Type of triangle
$\angle A =$	$\angle B =$	$\angle C =$	
$\angle D =$	$\angle E =$	$\angle F =$	
$\angle G =$	$\angle H =$	$\angle I =$	

3 Which of the following kinds of triangle are possible? If it is possible, draw an example.

a a right-angled isosceles triangle

b an obtuse equilateral triangle

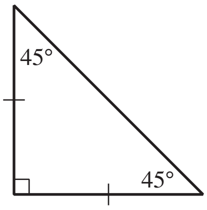
Answers 13B

1 **a** acute-angled **b** obtuse-angled **c** right-angled

2

Size of angle			Type of triangle
$\angle A = 90°$	$\angle B = 50°$	$\angle C = 40°$	right-angled
$\angle D = 35°$	$\angle E = 115°$	$\angle F = 30°$	obtuse-angled
$\angle G = 75°$	$\angle H = 50°$	$\angle I = 58°$	acute-angled

3 **a** yes **b** no



13C • Finding the third angle in a triangle

LB Pages 153–154

Specific learning outcomes

Learners should be able to:

7.13.4.1 Identify the three interior angles of any given triangle.

7.13.5.1 Calculate the third missing interior angle, given the other two angles.

Teaching points

1 A triangle always has three angles.

2 The three angles in a triangle always add to 180°. This property can be used to calculate an unknown third angle.

Suggested teaching approach

- Start the chapter section by doing the **Starter activities** provided.
- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercise 13C** on pages 153–154 in the LB, or **Activity 13C** in the TG below.

Starter activity

1 Draw some triangles, one on each sheet of paper. Mark all three angles for each triangle.

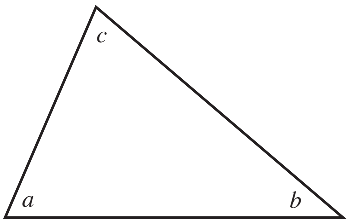
2 Share the shapes among the learners.

3 Tell learners to tear their triangle into three angles, then join their three shapes together (side by side). The shapes will form a straight-line angle.

Additional notes

In any triangle, **the three angles add up to 180°**. This property can be used to help find the size of the unknown angle.

$a° + b° + c° = 180°$

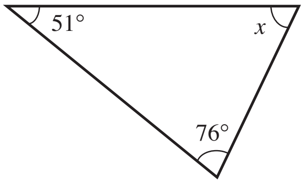


Examples

Example 1

Work out the size of the angle marked *x*.

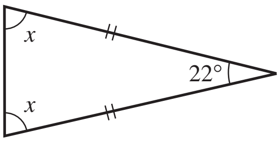
$$\begin{aligned} x° + 51° + 76° &= 180° \\ x° + 127° &= 180° \\ x° &= 180° - 127° \\ &= 53° \end{aligned}$$



Example 2

Work out the size of the angles marked *x*°. (*Note:* the *x* stands for the same amount for both angles.)

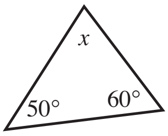
$$\begin{aligned} x° + x° + 22° &= 180° \\ 2x° + 22° &= 180° \\ 2x° &= 180° - 22° \\ &= 158° \\ x° &= \frac{158\Upsilon}{2} \\ &= 79° \end{aligned}$$



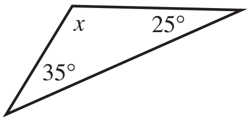
Activity 13C

1 Work out the size of the marked angles.

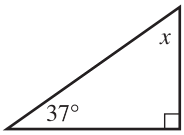
a



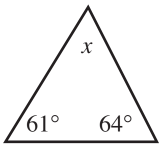
b



c



d



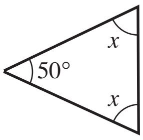
2 Here are two of the angles in some triangles. Complete each set by stating the third angle:

a {10°, 60°, ___}

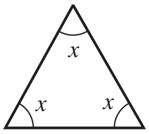
b {102°, 69°, ___}

3 Work out the size of the marked angle(s) in each triangle:

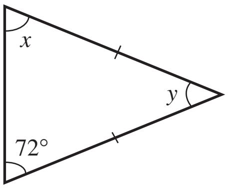
a

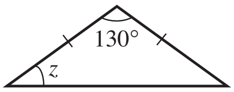


b



4 Calculate the size of the angles marked *x*, *y* and *z*:





Answers 13C

1 **a** 70° **b** 120°

c 53° **d** 55°

2 **a** 110° **b** 9°

3 **a** 65° **b** 60°

4 $x = 72°$ (base angles of isosceles triangles are equal), $y = 36°$, $z = 25°$

13D • Exterior angle properties of triangles

LB Page 155

Specific learning outcomes

Learners should be able to:

7.13.6.1 Identify the supplementary exterior angles of the three interior angles of any given triangle.

7.13.7.1 Use the given formula to find the exterior angle. *Exterior angle = sum of the two interior opposite angles.*

Teaching points

1. An **exterior angle** is an angle outside the triangle.
2. The three angles inside the triangle are *not* included in the exterior angle.
3. One interior angle and the exterior angle next to it add together to equal 180°.
4. The two interior opposite angles add together to equal the exterior angle.

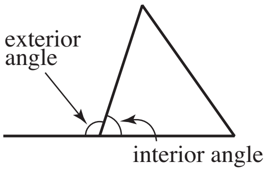
Suggested teaching approach

- Read through the **Additional notes** provided, for additional help.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercise 13D** on page 155 in the LB, or **Activity 13D** in the TG below.

Additional notes

Identifying the exterior angle

When one of the sides of a triangle is extended, it forms an **exterior angle**. The exterior angle and the interior angle next to it add up to 180°.

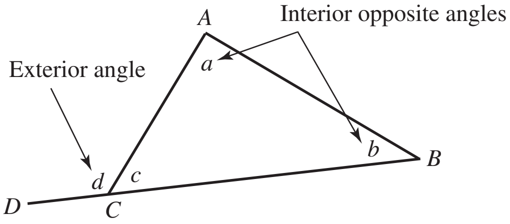


Calculating the exterior angle

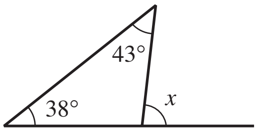
The exterior angle is equal to the sum of the two interior opposite angles.

Exterior angle = Sum of the two interior angles

In the diagram below, *d* is the exterior angle. It is equal to the sum of angles *a* and *b*.



In the diagram below, *x* is the exterior angle. It is equal to the sum of the interior angles: $x = 43° + 38° = 81°$



Examples

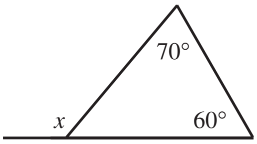
Example 1

Calculate the value of *x*.

Solution

The exterior angle, *x*, is equal to the sum of the two interior opposite angles. Substitute the known angles into the rule and calculate the exterior angle.

$x = 60° + 70°$
$= 130°$



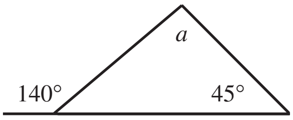
Example 2

Calculate the value of *a*.

Solution

The exterior angle is equal to the sum of the two interior opposite angles. Substitute the known angles into the rule and calculate the unknown angle.

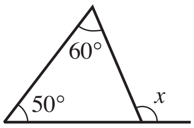
$140° = a + 45°$
$a = 140° - 45°$
$= 95°$



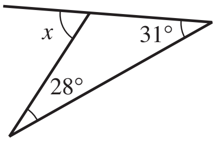
Activity 13D

1 Calculate the size of the angle marked *x*° in each triangle:

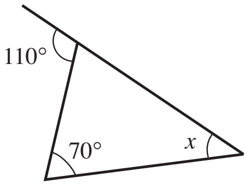
a



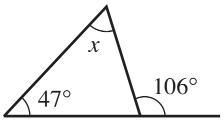
b



c

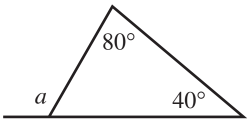


d

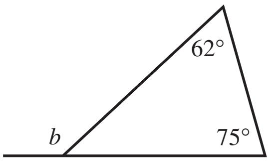


2 Calculate the value of the pronumeral in each of the following:

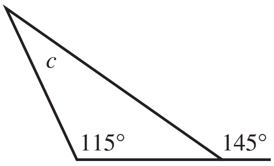
a



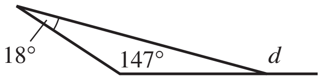
b



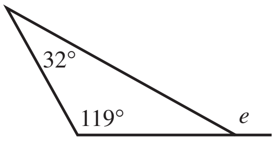
c



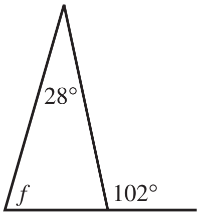
d



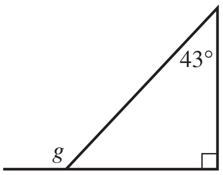
e



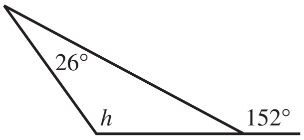
f



g



h



Answers 13D

1 **a** 110° **b** 59°
c 40° **d** 59°
2 **a** 120° **b** 137°
c 30° **d** 165°
e 151° **f** 74°
g 133° **h** 126°

13E • Quadrilaterals

LB Pages 156–157

Specific learning outcomes

Learners should be able to:

7.13.8.1 Identify and name different types of quadrilaterals according to their properties.

Teaching points

1 A **quadrilateral** is a plane shape with four straight sides. It has four sides and four interior angles.
2 The four interior angles of a quadrilateral add to 360°.
3 There are different types of quadrilaterals, but all have four sides and four angles.

Suggested teaching approach

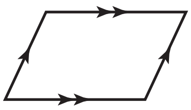
- Start the chapter section by doing the **Starter activities** provided.
- Read through the **Additional notes** provided.
- Model the **Example** provided in the LB.
- Learners complete **Exercise 13E** on pages 156–157 in the LB, or **Activity 13E** in the TG below.

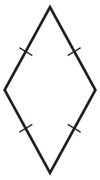
Starter activity

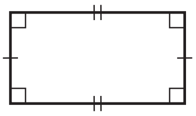
1 Ask the learners to look around the classroom and school yard to observe any objects, plants and so on that have quadrilateral shapes.
2 Ask them to draw the quadrilateral shapes they have discovered.
3 Ask some learners to present the drawings to the class and explain why they consider these things to be quadrilateral.
Note: Make sure the shapes the learners have drawn have all the properties of a quadrilateral (four straight sides).

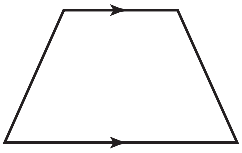
Additional notes

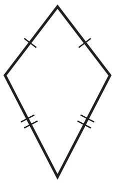
A **quadrilateral** is a figure with four sides. The shapes below are all quadrilaterals.

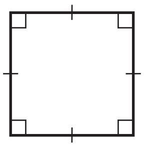

parallelogram


rhombus


rectangle


trapezium


kite


square

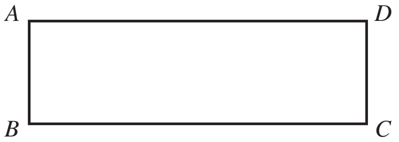
Names and properties of quadrilaterals

The different types of quadrilateral are listed in the table, with the properties of each type.

Name of shape	Properties/description
Kite	Two pairs of equal adjacent sides (sides next to each other) and one pair of equal opposite angles.
Trapezium	Only one pair of parallel sides.
Parallelogram	Two pairs of parallel sides. Opposite sides and angles are equal.
Rectangle	Two pairs of opposite sides equal, and all internal angles are right angles (90°).
Rhombus	All four sides equal; opposite angles are equal. (This can be thought of as a parallelogram with all sides equal or a 'pushed over' square.)
Square	All sides equal and all internal angles are right angles (90°).

Quadrilaterals are usually named using their four vertices (corners).

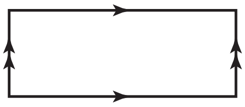
This diagram shows rectangle *ABCD*:



Here is a list of the properties of a rectangle:

- Opposite sides are the same length.
- Opposite sides are parallel.
- All four angles are the same size (90°).

Parallel side pairs are indicated by marking the side with the same number of arrows in the same direction, as shown.

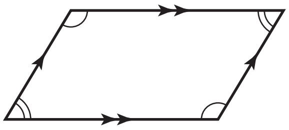


Angle sum of a quadrilateral

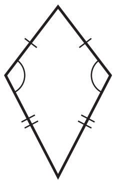
The sum of the angles in a quadrilateral is 360°.

Angle properties of special quadrilaterals

The diagonally opposite angles of a parallelogram are equal.



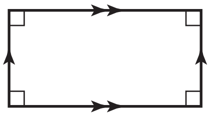
The two interior opposite angles of a kite where the unequal sides meet are equal.



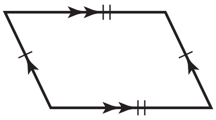
Activity 13E

1 Give the most accurate name for each shape below.

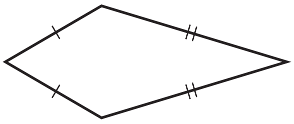
a



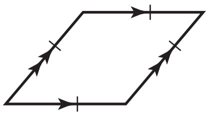
b



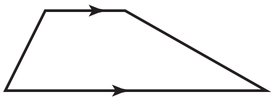
c



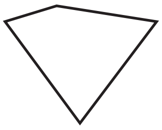
d



e

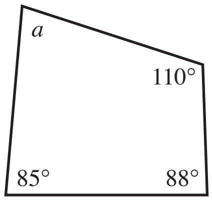


f

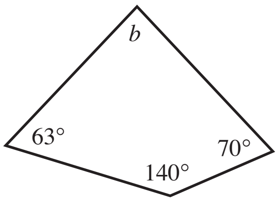


2 Find the size of the unknown angle represented by a letter in each of the following quadrilaterals.

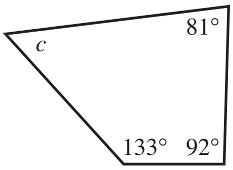
a



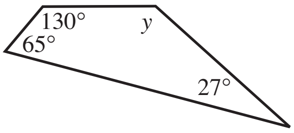
b



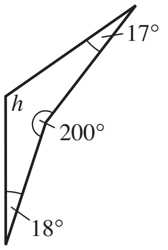
c



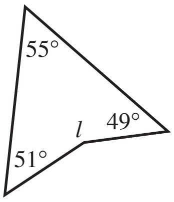
d



e



f



Answers 13E

1 **a** rectangle **b** parallelogram

c kite **d** rhombus

e trapezium **f** irregular quadrilateral

2 **a** 77° **b** 87°

c 54° **d** 138°

e 125° **f** 205°

13F • Angle sum of a quadrilateral

LB Pages 158–160

Specific learning outcomes

Learners should be able to:

7.13.9.1 Find the angles of quadrilaterals by using the protractor to measure them.

7.13.9.2 Calculate the angle sum of different quadrilaterals and missing angles.

Teaching points

1. Learners should know how to use a protractor to measure different angles in a quadrilateral.
2. Learners should be able to use their knowledge of the properties of a quadrilateral to find the four angles.
3. Learners should be able to use their knowledge of the properties of a quadrilateral to find unknown angles.

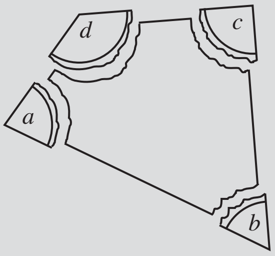
Suggested teaching approach

- Start the chapter section by doing the **Starter activities** provided.
- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercise 13F** on pages 158–160 in the LB, or **Activity 13F** in the TG below.

Starter activity

Learners should follow these steps and answer the questions as they go:

1. On a sheet of paper, use a ruler to draw a quadrilateral.
2. Measure each angle.
3. Add these angles together. *Did you get 360°?*
4. Draw another quadrilateral and cut it out carefully.
5. Tear off the angles as shown in the diagram below.
6. Place all the vertices together with arms touching. *Did they form a revolution?*
7. Paste the angles together on your first page.
8. Draw another quadrilateral and divide it into two triangles.
9. Calculate the angle sum of the quadrilateral.



Additional notes

The interior angles of any quadrilateral add to 360°.

Example

Find the sum of the interior angles of the shape below:

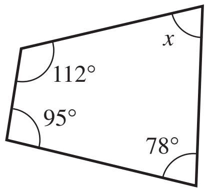
Solution

$x° + 78° + 95° + 112° = 360°$

$x° + 285° = 360°$

$x° = 360° - 285°$

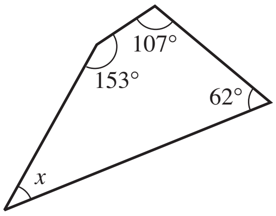
$= 75°$



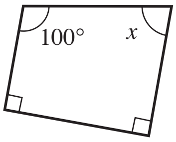
Activity 13F

1. Calculate the size of the unknown marked angle in each of these quadrilaterals.

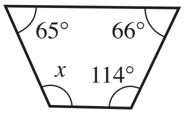
a



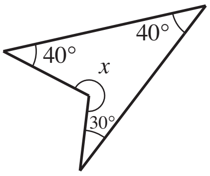
b



c

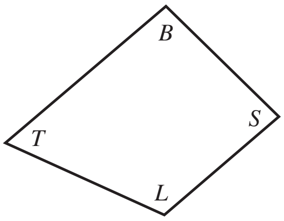


d

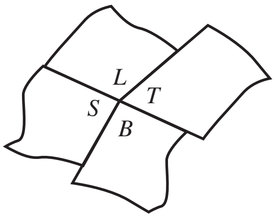


Additional activity

2. Ask each learner to do the following steps:
   - Draw a quadrilateral on a piece of paper, then cut the shape out using scissors.
   - Label each internal angle of the quadrilateral ∠*B*, ∠*S*, ∠*L* and ∠*T*.



   - Fold or tear the corners and place them adjacent to one another.



We see that they combine to form a perigon, or full circle. Because there are 360° in a full circle, we see that the sum of the interior angles in any quadrilateral is 360°.

Ask students to paste this into their exercise books.

Answers 13F

1. **a** $x = 38°$
   b $x = 80°$
   c $x = 115°$
   d $x = 250°$
2. Learner activity

13G • Polygons

LB Pages 161–162

Specific learning outcomes

Learners should be able to:

7.13.10.1 Define the term 'polygon'.

7.13.10.2 Identify and name different polygons from pictures and shapes: *triangle, quadrilateral, pentagon, hexagon, heptagon, octagon, nonagon, decagon and dodecagon*.

Teaching points

1 A **polygon** is a flat, enclosed figure with straight sides.

2 Polygons are named according to the number of sides they have, up to a 12-sided shape (dodecagon).

Suggested teaching approach

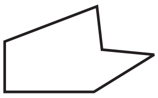
- Start the chapter section by doing the **Starter activities** provided.
- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercise 13G** on page 162 in the LB, or **Activity 13G** in the TG below.

Starter activities

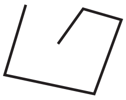
Start this section by starting the names, with learners, of all the the polygon shapes, from 3-sided to 12-sided shapes.

Additional notes

Polygon is a general name for a figure with many sides.
The figure must be flat, enclosed and have straight sides.

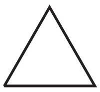
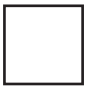
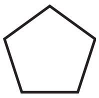


A polygon



Not a polygon

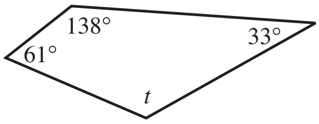
A **regular polygon** has sides that are equal in length, and all angles the same size. Some regular polygons are shown in the table:

3 sides	4 sides	5 sides
 equilateral triangle	 square	 regular pentagon

Other polygons with special names are: hexagon (6 sides), octagon (8 sides), decagon (10 sides) and dodecagon (12 sides).

Examples

Find the missing angle:



Solution

The shape is a quadrilateral.

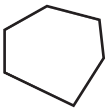
The interior angles of a quadrilateral add to 360°.

$t = 360° - (61° + 138° + 33°)$
$= 360° - 232°$
$= 128°$

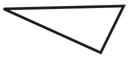
Activity 13G

1 Name each of the polygons below. Choose from this list: *triangle, quadrilateral, pentagon, hexagon, octagon, decagon.*

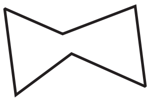
a



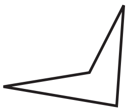
b



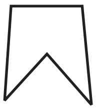
c



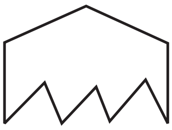
d



e



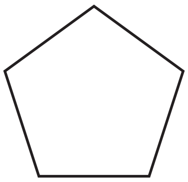
f



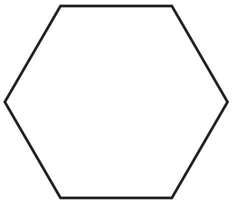
2 Divide each shape below into triangles to determine the sum of the interior angles.

a

b



c



3 Look at the interior angles calculated in Question 2. Explain your findings, describing any pattern that may exist.

Answers 13G

1 **a** hexagon **b** triangle **c** hexagon
d quadrilateral **e** pentagon **f** decagon

2 **a** 360° **b** 540° **c** 720°

13H • Angle sum of polygons

LB Pages 163–165

Specific learning outcomes

Learners should be able to:

7.13.11.1 Use total degrees in a triangle = 180° to calculate the total interior angles in any quadrilateral.

7.13.11.2 Divide polygon shapes into triangles to find the total sum of interior angles.

7.13.11.3 Calculate the angle sum of any given polygon using the formula:
Angle sum = (n – 2) × 180°
where n = number of sides of a polygon.

Teaching points

1. The **angle sum** is the total of all interior angles in a polygon, from three-sided to any number of sides.
2. The angle sum of any polygon can be calculated using *triangle properties*: the angle sum of a triangle equals 180°.
3. Quadrilaterals and other polygons can be split into triangles.
4. To find the angle sum (total sum of the interior angles) of a given quadrilateral or other polygon, find the number of triangles in the polygon, then multiply the number of triangles by 180°.
5. Another way to calculate the angle sum of any given polygon is to use the formula:
   Angle sum = (n – 2) × 180°
   where n = number of sides of the polygon.

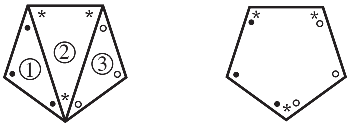
Suggested teaching approach

- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercise 13H** on pages 164–165 in the LB, or **Activity 13H** in the TG below.

Additional notes

A polygon can be divided into triangles. There are always two fewer triangles than there are sides. The triangles all share a common point.

For a pentagon, the diagram looks like this:



The angles in each triangle add to 180°. There are 3 triangles, and so the angles in the pentagon must add to 180° + 180° + 180° = 540°.

In general, if the polygon has n sides, the sum of the interior angles is:

$(n - 2) \times 180°$.

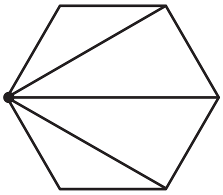
Examples

Example 1

Find the sum of the angles in a hexagon (6 sides).

Solution

Divide the hexagon into triangles.



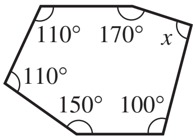
There are 4 triangles.

Sum of the angles = 4 × 180
= 720°

Note: When a polygon has many sides, it is not always practical to draw the shape and divide it into triangles. It can be useful to know the relationship between the number of sides and the number of triangles.

Example 2

Calculate the size of the angle marked x.



Solution

The diagram shows a hexagon (6 sides).

The angle sum is:

$(6 - 2) \times 180° = 4 \times 180°$
$= 720°$

$x + (170° + 100° + 110° + 150° + 110°) = 720°$
$x + 640° = 720°$
$x = 720° - 640°$
$= 80°$

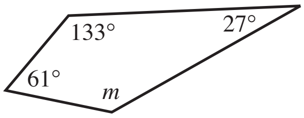
There are 6 sides, and 6 – 2 = 4 triangles

Sum of the angles = (6 – 2) × 180
= 720°

In an n-sided polygon there are $n - 2$ triangles.
So the angle sum of any polygon is $(n - 2) \times 180°$.

Example 3

Find the missing angle:



Solution

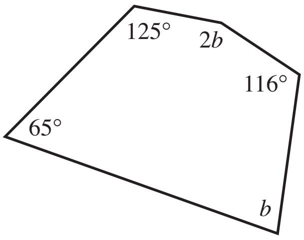
The shape is a quadrilateral.

There are 360° in a quadrilateral.

$m = 360° - (61° + 133° + 27°)$
$= 360° - 221°$
$= 139°$

Example 4

Find the missing angle:



Solution

The shape is a pentagon.

The angle sum of a pentagon = 540°.

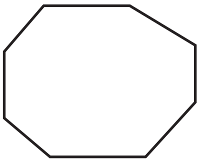
$b + 65° + 125° + 2b + 116° = 540°$

$3b = 540° - (65° + 125° + 116°)$
$= 540° - 306°$
$= 234°$
$b = 78°$

Activity 13H

1 The diagram shows an octagon.

a Add lines to the diagram to show how to divide it into triangles. The triangles should share a common point and not overlap.



b How many triangles are there?

2 Use the formula $(n - 2) \times 180°$ to calculate the sum of the interior angles of these shapes:

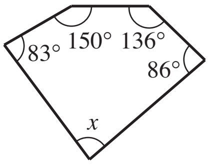
a a quadrilateral

b an octagon

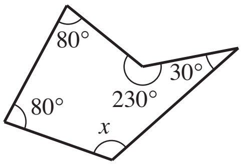
c a polygon with 20 sides.

3 Calculate the value of angle $x°$ in each polygon:

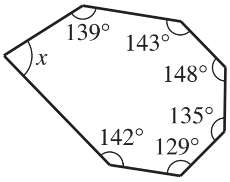
a



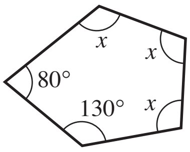
b



c

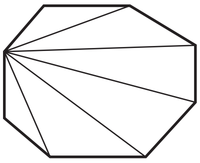


4 Write down an equation for the sum of the interior angles in this polygon, then solve it to calculate the value of $x°$.



Answers 13H

1



b 6 triangles

2 **a** 360°

b 1080°

c 3240°

3 **a** 85°

b 120°

c 64°

4 $x + x + x + 80° + 130° = 540°$
$3x + 210° = 540°$
$3x = 330°$
$x = 110°$

• Chapter Fourteen •

Area and Volume

Overview

Area is the amount of two-dimensional space inside a shape, measured in square units. Volume is the amount of space contained within a three-dimensional object, measured in cubic units.

The topic of 'Area' is partly covered in Year 5 but not in Year 6. Volume is briefly covered in both academic years. Therefore, area and volume must both be covered thoroughly in Year 7. Learners must be taught well, so that they have confidence in estimating and computing the area and the volume of various shapes and objects, both regular and irregular.

In this chapter, learners will use metric units to estimate area, volume and capacity of shapes, prisms and solids. They will use grids and mensuration formulas to calculate the area of polygons, prisms and solids.

Contents

Chapter skills

This chapter covers the following skills:

- Finding and comparing areas
- Using grids to find area
- Calculating the area of triangles and quadrilaterals

  Area rules

  Rectangle: length × width

  Parallelogram: base × height

  Triangle: $\frac{1}{2}$ × base × height
- Calculating the volumes of prisms

  Volume rules

  Rectangular prism: length × width × height

  General prism: area base × height

Teaching plan

Lessons	Chapter sections	Class work and home work
1	• Intro • 14A: Finding and comparing areas	Learner's Book 2 • Exercise 14A, page 181
2	• 14B: Using grid to find areas	Learner's Book 2 • Exercise 14B, pages 182–183
3	• 14C: Exploring areas of faces	Learner's Book 2 • Learning task 14C, page 184
4	• 14D: Area of rectangles	Learner's Book 2 • Exercise 14D, pages 185–187
5	• 14E: Area of parallelograms	Learner's Book 2 • Exercise 14E, pages 188–189
6–7	• 14F: Area of triangles	Learner's Book 2 • Exercise 14F, pages 190–192
8–9	• 14G: Volume as a measure of space	Learner's Book 2 • Exercise 14G, page 194
10	• 14H: Exploring volume	Learner's Book 2 • Learning task 14H, page 195
11–12	• 14I: Volume of rectangular prisms	Learner's Book 2 • Exercise 14I, pages 196–197
13–15	• 14J: Volume of prisms	Learner's Book 2 • Exercise 14J, pages 198–199
15	• Revision/test	Learner's Book 2 • Revision/Assessment, Exercises 14A, 14B, 14D–14J, pages 206–209 Teacher's Guide • Chapter 14 test, page 185

General learning outcomes

Learners should:

Finding and comparing areas

7.14.1 Understand that area is the two-dimensional space inside a shape. (U)

7.14.2 Understand that a grid can be used to estimate and determine the area of any given shape by placing the grid onto the shapes. (U)

Using grids to find areas

7.14.3 Know how to use a unit square grid to estimate and determine the areas of regular and irregular shapes. (K)

Areas of polygon shapes

7.14.4 Know how to calculate the area of various polygons. (K)

Volume as a measure of space

7.14.5 Understand that volume is the amount of space contained in a three-dimensional shape. (U)

7.14.6 Know that the volume of a three-dimensional shape is determined by cutting up the shape into equal cubes. (K)

Exploring volume

7.14.7 Know how to derive a rule or formula to calculate volume of rectangular prisms using cubic blocks. (K)

Volume of rectangular prisms

7.14.8 Know how to calculate the volume of various prisms and composite shapes using formulas. (U)

Volume of prisms

7.14.9 Know how to find the volumes of various shapes and prisms. (U)

14A • Finding and comparing areas

LB Pages 180–181

Specific learning outcomes

Learners should be able to:

7.14.1.1 Define 'area'.

7.14.2.1 Determine areas of shapes by using a grid.

7.14.2.2 Use a square grid to determine the area of various regular shapes.

Teaching points

1. **Area** is the amount of surface that a two-dimensional shape covers, or the amount of space inside the shape. It is measured in square units (e.g. mm^2, cm^2, m^2 etc).
2. Learners should be aware that area is determined by counting the number of squares that would fit exactly inside the shape.
3. Learners should be aware that they can find the area of straight-sided shapes by counting the number of square centimetres inside the shape on centimetre-dot paper.
4. In finding the area of a rectangle, multiplying length by width is a shortcut for counting the number of squares.

   Area of a rectangle = length × width

Suggested teaching approach

- Start the chapter section by doing the **Starter activities** provided.
- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercise 14A** on page 181 in the LB, or **Activity 14A** in the TG below.

Starter activities

Activity 1: Counting squares

1. Provide learners with sets of different squared papers.
2. Group learners into 2, 3 or 4.
3. Instruct learners to use the squared papers to cover the tops of their desks.
4. Ask learners to count how many squared papers were needed to cover the tops of their desks.

Activity 2: Area of a foot or a hand

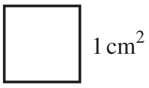
Learners will use 1-centimetre dot paper to estimate the area of their foot or hand.

1. Ask learners to trace around their foot or hand onto a piece of 1-centimetre dot paper, then cut out the shape.
2. Learners then count the squares and write the area in square centimetres in the middle of the shape.
3. Learners display their shapes on the classroom wall.

Additional notes

Area is measured in **square units**, such as m^2 or cm^2.

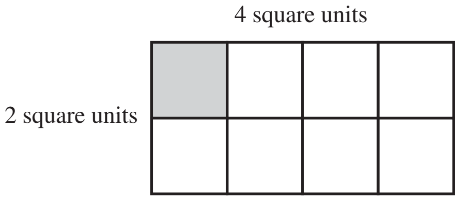
The area of this square is exactly 1 cm^2.



Area of a rectangle

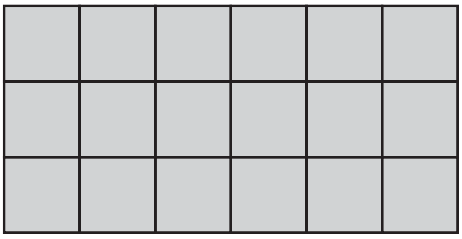
To find the amount of space inside a figure, we use a square to represent 1 unit, and we say that the area is measured in square units.

For example, to find the area of the rectangle shown below, we have drawn squares of equal sizes inside it.



One square represents 1 square unit. The rectangle has 8 squares, so the area of this rectangle is 8 square units.

Consider this rectangle, of length 6 cm and width 3 cm.



The rectangle contains 3 rows of 6 squares. Its area is equal to $3\,cm \times 6\,cm = 18\,cm^2$.

The area (A) of a rectangle is equal to its length (l) multiplied by its width (w).

$A = l \times w$

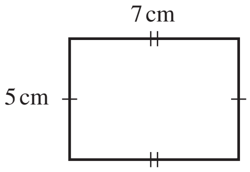
This formula can also be written as $A = lw$.

The length and width of a square are equal, so the area of a square can be found using the formula $A = l \times l$, or $A = l^2$.

Examples

Example 1

Calculate the area of the shape:



Solution

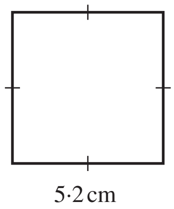
1. Write the formula for the area of a rectangle.

   $A = lw$
2. Identify l and w, and substitue their values into the formula.

   $A = 7 \times 5$
3. Evaluate, writing the answer with the correct units.

   $A = 35\,cm^2$

Example 2
Calculate the area of the shape:



Solution

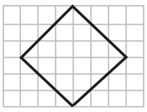
1 Write the formula for the area of a square.
$A = l^2$

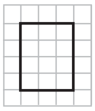
2 Identify l and substitute its value into the formula.
$A = 5{\cdot}2 \times 5{\cdot}2$

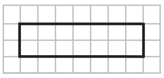
3 Evaluate, writing the answer with the correct units.
$A = 27{\cdot}04\,\text{cm}^2$

Activity 14A

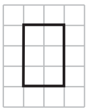
1 Write down the letters of these three shapes so that the shapes are in order from smallest area to largest area:

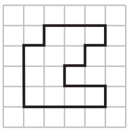
A


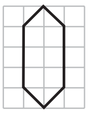
B


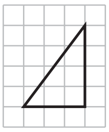
C


2 Work out the area of these shapes by counting squares and parts of squares (each square represents 1 cm^2):

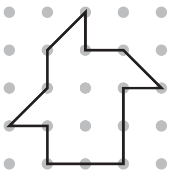
a


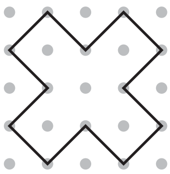
b


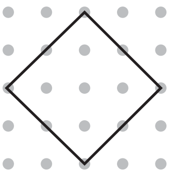
c


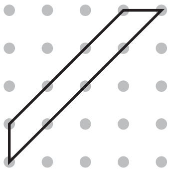
d


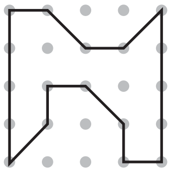
3 Find the area in square units for the given shapes.

a


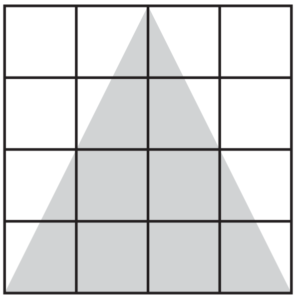
b


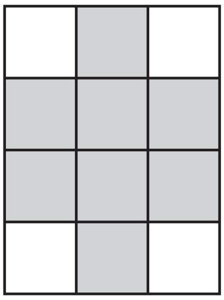
c


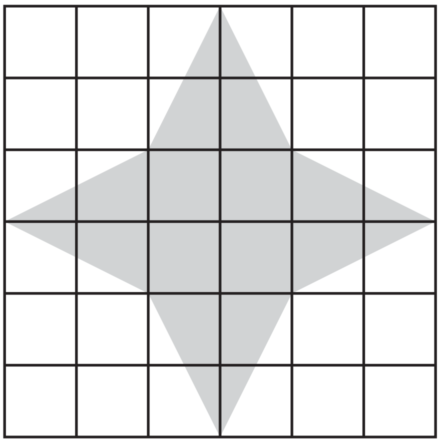
d


e


4 Find the area of the shaded part of the shape.

a


b


c


Answers 14A

1 B, C, A

2 a 6 cm^2 b 12 cm^2
c 8 cm^2 d 6 cm^2

3 a 7·5 square units b 10 square units
c 8 square units d 3 square units
e 10 square units

4 a 8 square units b 8 square units
c 12 square units

14B&C • Using grids to find areas

LB Pages 182–184

Specific learning outcomes

Learners should be able to:

7.14.3.1 Estimate and determine the area of regular and irregular shapes using a grid.

Teaching points

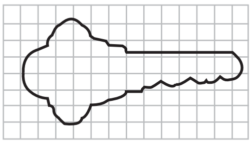
The area of shapes that are regular or irregular can be determined by counting the number of square units that fit exactly or almost exactly (estimate) inside the shape.

Suggested teaching approach

- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercise 14B and Learning task 14C** on pages 182–184 in the LB, or **Activity 14B&C** in the TG below.

Additional notes

We can estimate the area of an irregular shape by counting squares.



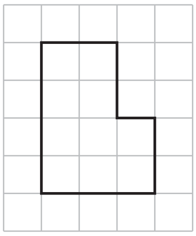
This key shape covers about 36 squares.

If each square represented 1 cm^2 then we would say the area was approximately 36 cm^2.

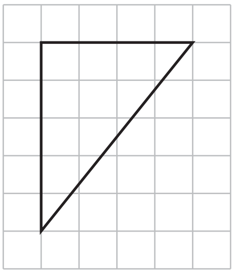
Examples

Example 1
Find the area of the following shapes.

a



b

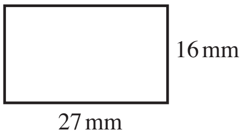


Solution

a 10 square units

b Estimate: 10 square units

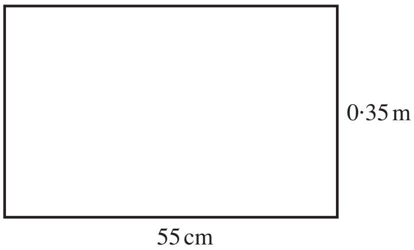
Example 2
Find the area of the rectangle.



Solution

Area = length × width
= 16 mm × 27 mm
= 432 mm^2

Example 3
Find the area of the rectangle.



Solution

Convert the width into centimetres:

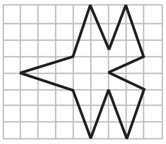
0·35 m × 100 = 35 cm

Use the formula:

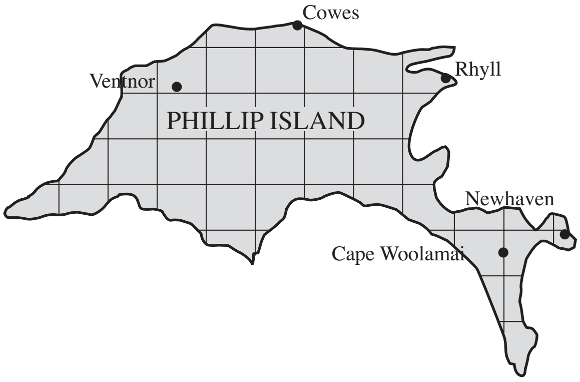
Area = length × width
= 55 × 35
= 1925 cm^2

Activity 14B&C

1 Estimate the area of this shape. (Each square represents 1 cm^2.)



2 This map shows Phillip Island on a grid. Each square represents 1 km^2. Use this information to estimate the area of the island. Give your answer to the nearest km^2.



Answers 14B&C

1 21 cm^2

2 30 km^2

14D • Area of rectangles

LB Pages 185–187

Specific learning outcomes

Learners should be able to:

7.14.4.1 Use the correct formulas and rules to calculate the area of polygon shapes:
Rectangle: area = length × width

Teaching points

1 The area of a rectangle can be found by using the rule:
area of a rectangle = length × width

2 To multiply length by width, both should be in the same units.

Suggested teaching approach

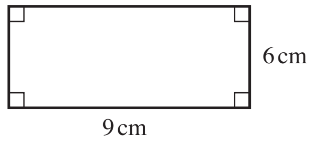
- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercise 14D** on pages 185–187 in the LB, or **Activity 14D** in the TG below.

Additional notes

Area of a rectangle = length × width

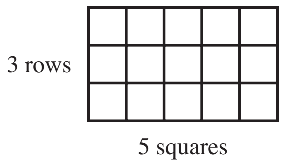
Example

What is the area of this rectangle?



Area = length × width
= 9 cm × 6 cm
= 54 cm^2

The area of a rectangle can also be found by counting squares. For example, the rectangle below is divided into small squares of 1 cm side length.



The rectangle has 3 rows of 5 squares, a total of 15 squares. So the area is equal to 15 squares.

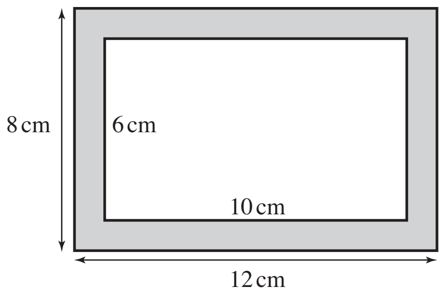
To use the formula to find the area, we multiply the length (5 cm) by the width (3 cm):

Area = 5 cm × 3 cm
= 15 cm^2

Examples

Example 1

Find the shaded area:



Solution

Area of large rectangle
= length × width
= 12 × 8 = 96 cm^2

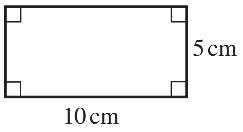
Area of smaller rectangle
= length × width
= 10 × 6 = 60 cm^2

Shaded area
= 96 − 60
= 36 cm^2

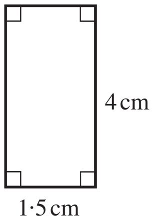
Activity 14D

1 Calculate the area of these rectangles:

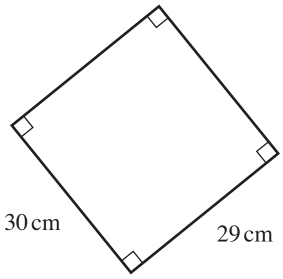
a



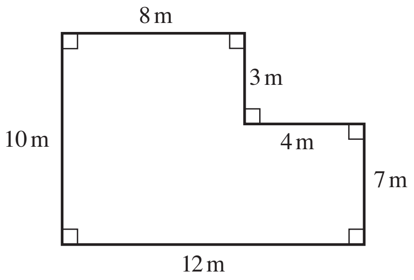
b



c



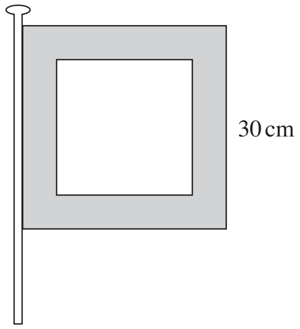
2



a Add a dashed line to divide this shape into two rectangles.

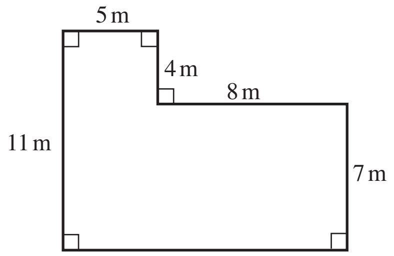
b Calculate the area of the whole shape.

3 This square flag measures 30 cm by 30 cm. The shaded part is 4 cm wide from edge to edge everywhere.



Calculate the area of the material needed for the white part.

4 This is a floor plan for a restaurant.



a What is the total floor area?

b How many square carpet tiles, each measuring 0·5 m by 0·5 m, will be needed to cover the floor? Show your working, and explain what you are calculating.

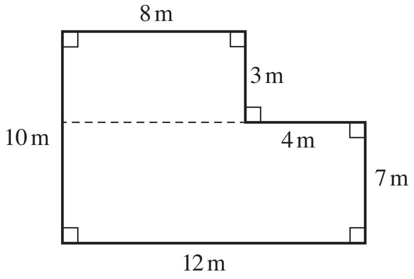
Answers 14D

1 **a** 50 cm^2

  b 6 cm^2

  c 870 cm^2

2 **a** Sample answer:

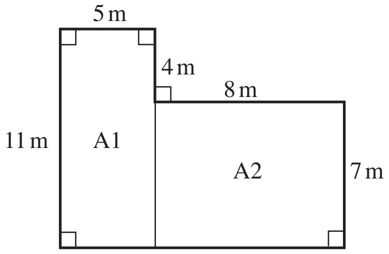


  b 108 m^2

3 A = (30 × 30) − (22 × 22)
  = 416 cm^2

4 **a** 111 m^2

  b



A1 is 10 tiles wide by 22 tiles long = 220 tiles
A2 is 16 tiles wide and 14 tiles long = 224 tiles

The total number of 0·5 m by 0·5 m square tiles required is 444.

14E • Area of parallelograms

LB Pages 188–189

Specific learning outcomes

Learners should be able to:

7.14.4.1 Use the correct formulas and rules to calculate the area of polygon shapes:
Parallelogram: area = base × height

Teaching points

1 Learners should be able to identify a parallelogram.

2 Learners should be able to identify the properties of a parallelogram – it is a special kind of quadrilateral. It has two pairs of parallel sides.

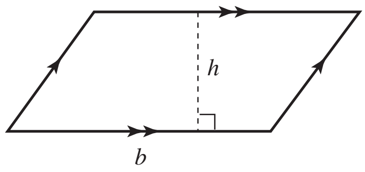
3 The area of a parallelogram can be calculated using the formula: area = base × height.

Suggested teaching approach

- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercise 14E** on pages 188–189 in the LB, or **Activity 14E** in the TG below.

Additional notes

A **parallelogram** is a four-sided shape that has two pairs of parallel sides. The pairs of parallel sides are marked by ➤ and ➤➤ symbols. The parallelogram has a **base** *b*, and **height**, *h*, which is perpendicular to the base. **Perpendicular** means ‘at right angles to’. This is shown by the symbol for the right angle, ∟.



Area of a parallelogram

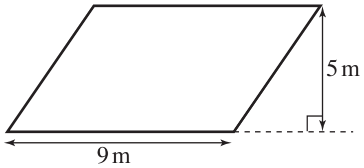
Multiply the base (*b*) by its perpendicular height (*h*).

$A = bh$

Sides that are marked with the same number of ➤ symbols are parallel.

Examples

Example 1
Find the area of the parallelogram.

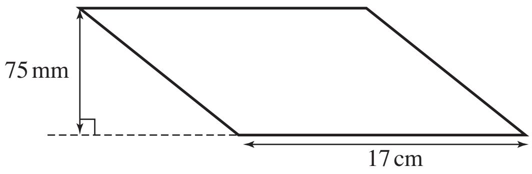


Solution

As the units are the same, use the rule straight away.

Area = base × height
  = 9 × 5
  = 45 m^2

Example 2
Find the area of the parallelogram.



Solution

Change the units of the height to centimetres to make the units the same.

75 mm ÷ 10 = 7·5 cm

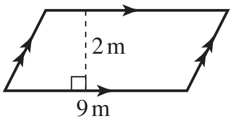
Use the rule:

Area = base × height
= 17 × 7·5
= 127·5 cm^2

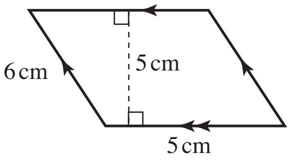
Activity 14E

1 Calculate the area of each parallelogram:

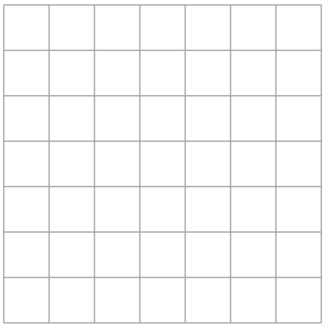
a



b



2 On this grid, draw a parallelogram that has an area of 10 squares.



Additional activity

3 Give each learner a parallelogram that you have drawn on paper and copied for them. Give learners the following instructions:

- **a** Mark the base and the height on the *inside* of the parallelogram.
- **b** Cut out the parallelogram.
- **c** Cut a straight line from one diagonal to the other.

Demonstrate to the learners that:

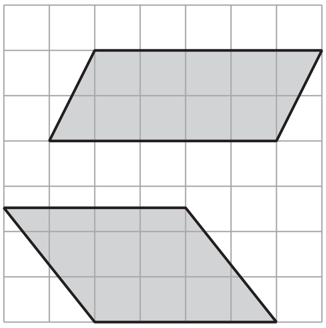
- the two triangles fit into the parallelogram exactly, *and*
- the area of each triangle is *half* the area of the parallelogram.

Have them paste it into their workbooks and write down the formula for the area of a triangle and parallelogram.

Answers 14E

1 **a** 18 m^2
b 25 cm^2

2 Two examples are shown:
5 × 2 = 10 squares
4 × 2·5 = 10 squares



3 Learner activity

14F • Area of triangles

LB Pages 190–192

Specific learning outcomes

Learners should be able to:

7.14.4.1 Use the correct formula and rules to calculate the area of a triangle:
Triangle: area = $\frac{1}{2}$ *base × height*

Teaching points

1 Learners should be able to identify the base and height of given triangles.

2 To calculate the area of a triangle, use the formula:
area = $\frac{1}{2}$ base × height.

Suggested teaching approach

- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercise 14F** on pages 190–192 in the LB, or **Activity 14F** in the TG below.

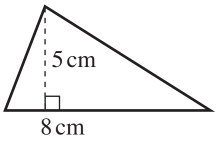
Additional notes

The area of a triangle is calculated using the rule: 'half base times height'.

$A = \frac{1}{2}(b \times h)$

Example

What is the area of this triangle?

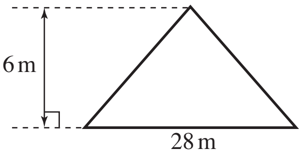


$A = \frac{1}{2}(b \times h)$
$= \frac{1}{2}(8 \times 5)$
$= \frac{1}{2} \times 40$
$= 20\text{ cm}^2$

Examples

Example 1

Find the area of the triangle.



Solution

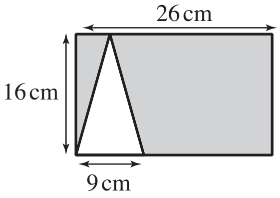
Height = 16 m, base = 28 m

The units are the same, so use the rule:

$$\text{Area} = \frac{1}{2} \times \text{base} \times \text{height}$$
$$= \frac{1}{2} \times 28 \times 16$$
$$= 224\,\text{m}^2$$

Example 2

Find the shaded area:



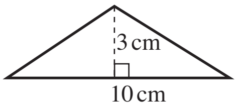
Solution

$$\text{Shaded area} = \text{rectangle area} - \text{triangle area}$$
$$= 26 \times 16 - \frac{1}{2} \times 9 \times 16$$
$$= 416 - 72$$
$$= 344\,\text{cm}^2$$

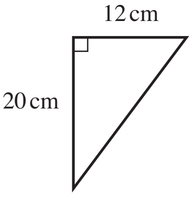
Activity 14F

1 Calculate the areas of these triangles:

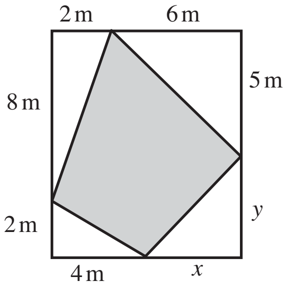
a



b



2 The corners of this shaded quadrilateral are touching the rectangle.



a What are the lengths marked x and y?

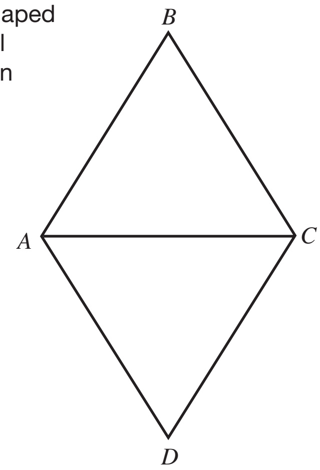
b Calculate the area of the shaded quadrilateral.

c Write a sentence explaining how you worked out the answer.

3 This is a plan for a diamond-shaped road sign. The four sides are all equal. The plan has been drawn to scale. The scale is 1:50.

a The side labeled AB in the diagram measures 2·8 cm. What will be the length of this side of the road sign?

b To calculate the area of $\triangle ABC$ we need the 'height'. Draw in a line to represent the height if we use AB as the base.



Answers 14F

1 a 15 cm^2

b 120 cm^2

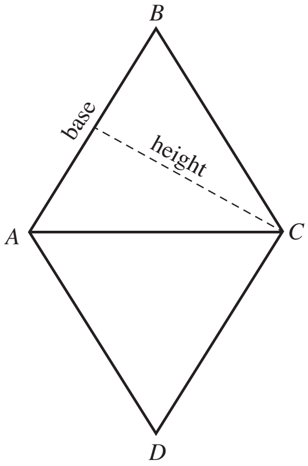
2 a x = 4 m, y = 5 m

b 43 m^2

c Answers will vary; possible response: I found the area of each triangle (4 + 8 + 15 + 10 = 37 cm^2), then subtracted the sum of these from the area of the whole rectangle (80 m^2).

3 a 2·8 × 50 = 140 cm

b



14G • Volume as a measure of space

LB Pages 193–194

Specific learning outcomes

Learners should be able to:

7.14.5.1 Define ‘volume’.

7.14.6.1 Determine the volume of solids by counting the number of cubic units that fit inside the shape.

7.14.6.2 Count the number of cubes to determine the volume of each shape if each cube is a cubic centimetre.

Teaching points

1. **Volume** is the amount of space that is enclosed within a three-dimensional shape or object.
2. Volume is determined by counting the number of cubic units that fit into the shape.

Suggested teaching approach

- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercise 14G** on page 194 of the LB, or **Activity 14G** in the TG below.

Additional notes

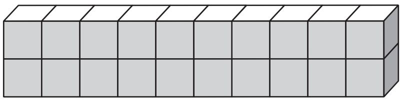
Volume is measured in **cubic** units.

Unit		Used for	Example
cubic centimetre	cm^3	small objects	The volume of a bottle of liquid paper is $15\,cm^3$
cubic metre	m^3	large objects	The volume of a classroom is $144\,m^3$

Examples

Example 1

Find the volume of the following solid, where each cube is a cubic centimetre:



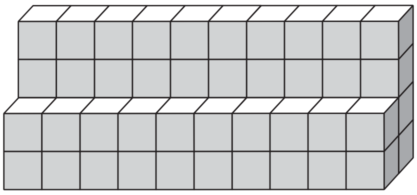
Solution

There are two rows of 10 cubes. The volume of each cube is $1\,cm^3$.

The volume of the solid is $20\,cm^3$.

Example 2

Find the volume of the following solid, where each cube is a cubic centimetre:



Solution

The back section of the solid has 4 rows of 10 cubes = 40 cubes

The front section has 2 rows of 10 cubes = 20 cubes

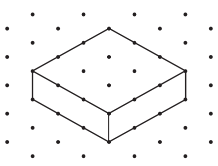
Volume = 40 + 20
= 60 cubes

Volume is $60\,cm^3$.

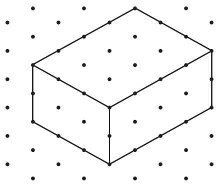
Activity 14G

1 The volume of each small cube is $1\,cm^3$. What is the volume of each of these shapes?

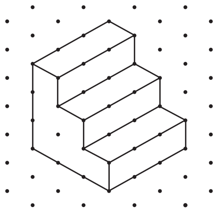
a



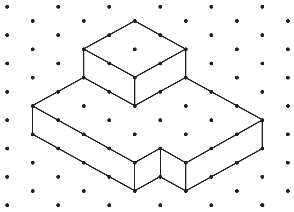
b



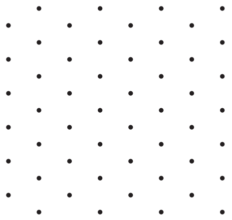
c



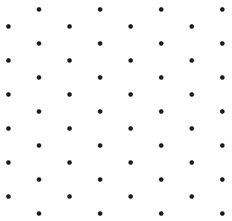
d



2 Use the grid below to draw a shape that has a volume of $3\,cm^3$.



3 Use the grid below to draw a cube that has a volume of $8\,cm^3$.

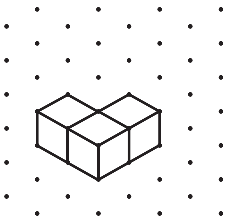


Answers 14G

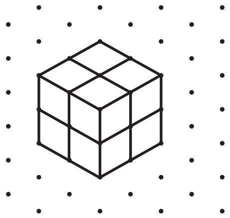
1 **a** $9\,cm^3$ **b** $24\,cm^3$

c $18\,cm^3$ **d** $23\,cm^3$

2 Sample answer:



3 Sample answer:



14I • Volume of rectangular prisms

LB Pages 196–197

Specific learning outcomes

Learners should be able to:

7.14.7.1 Derive a rule or formula using blocks or tables that can be used to calculate the volume of shapes and objects

7.14.8.1 Calculate the volume of shapes and prisms using the formula:
Volume = length × width × height

Teaching points

1. A **rectangular prism** has a rectangle as its base, and straight sides.
2. To calculate the volume of a rectangular prism, three side lengths must be identified: length, width and height.
3. To calculate the volume of a given rectangular prism, use the formula:
   Volume = length × width × height

Suggested teaching approach

- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercise 14I** on pages 196–197 in the LB, or **Activity 14I** in the TG below.

Additional notes

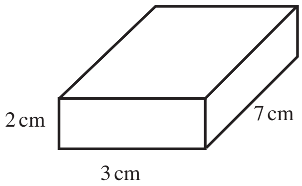
Volume of a rectangular prism = length × width × height

$V = l \times w \times h$ or $V = lwh$

Example

The volume of this rectangular prism is 42 cm^3.

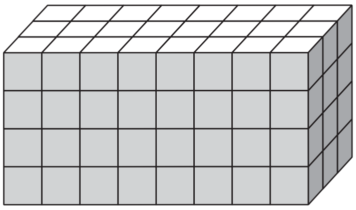
$V = l \times w \times h$
$= 7 \times 3 \times 2$
$= 42\text{ cm}^3$



Examples

Example 1

Find the volume of the following solid (each cube represents 1 cm^3:



Solution

Base: 8 cubes across the front by 3 cubes deep.

8 × 3 = 24 cubes in the base.

There are 4 layers.

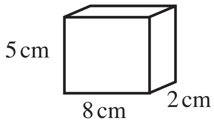
Number of cubes: 4 × 24 = 96

Volume of the solid is 96 cm^3.

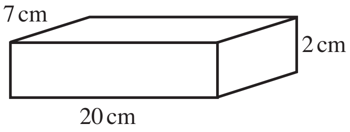
Activity 14I

1 Calculate the volumes of these rectangular prisms:

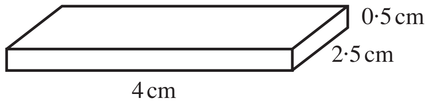
a



b



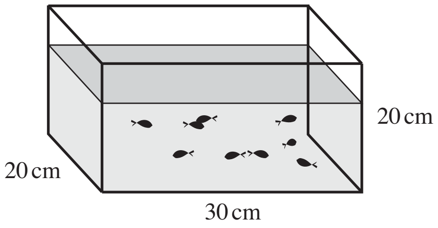
c



2 This table gives the measurements of some rectangular prisms. Calculate values *A* to *D*.

Length (cm)	Width (cm)	Height (cm)	Volume (cm^3)
4	2	5	*A*
16	0·5	3	*B*
4	4	*C*	48
5	*D*	8	10

3 Calculate the volume of this fish tank:



Answers 14I

1 **a** 80 cm^3 **b** 280 cm^3 **c** 5 cm^3

2 A = 40 cm^3, B = 24 cm^3, C = 3 cm, D = 0·25 cm

3 12 000 cm^3

14J • Volume of prisms

LB Pages 198–199

Specific learning outcomes

Learners should be able to:

7.14.9.1 Calculate the volume of prisms and objects by determining the area of the base first. *Volume = area of base × height*

Teaching points

1. To calculate the volume of a prism, first find the area of the base. Then multiply the base by the height.
2. The formula to calculate the volume of a prism is: *Volume = base × height*.

Suggested teaching approach

- Read through the **Additional notes** provided.
- Model the **Examples** provided in the LB and TG.
- Learners complete **Exercise 14J** on pages 198–199 in the LB, or **Activity 14J** in the TG below.

Additional notes

A **prism** is a shape that has the same **cross-section** all the way along its length. The end faces are the same shape and size, and are parallel.

The **volume of a prism** is calculated by multiplying:

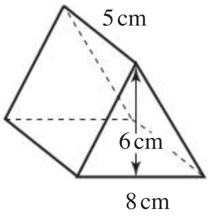
- area of the cross-section (*A*) by
- distance (*d*) between the end faces.

Volume of prism = $A \times d$

Examples

Example 1

Calculate the volume of this prism. First work out the area of the cross-section. Then multiply this by the height or length to determine the volume.



Solution

The cross-section is a triangle:

First find *A*:

$A = \frac{1}{2}(b \times h) = \frac{1}{2} \times (8 \times 6) = 24\,\text{cm}^2$

Now use the formula:

$V = A \times d$

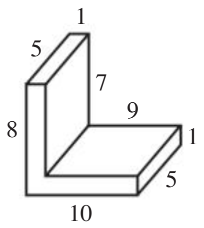
$A = 24\,\text{cm}^2,\ d = 5\,\text{cm}$

$V = 24\,\text{cm}^2 \times 5\,\text{cm}$
$= 120\,\text{cm}^3$

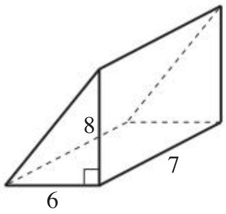
Activity 14J

1 Calculate the volume of these prisms. The lengths are in cm.

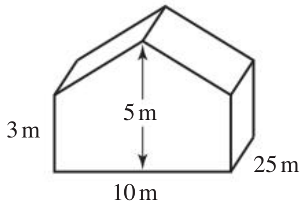
a



b



2 This is a plan of a school assembly hall.



a Write down some calculations to show that the area of the cross-section is 40 m^2.

b Work out the volume of the hall.

c One of the rules for air quality in public buildings is that each person should have at least 3 m^3 of space.

Complete this notice:

Maximum number of students

The number of students in this hall must not exceed ________ .

Answers 14J

1 **a** 85 cm^3
b 168 cm^3

2 **a** Divide cross-section into rectangle and triangle:
Area of rectangle = 3 × 10 = 30 m^2
Area of triangle = 0·5 × 10 × 2 = 10 m^2
Cross-section area = 30 + 10 = 40 m^2

b $V = A \times d$
$= 40 \times 25$
$= 1000\,\text{m}^3$

c The number of students in this hall must not exceed 333.

• Chapter 1 Test •

Whole Numbers

Multiple-choice questions

Circle the correct answer

1 68 represented in Roman numerals is

A LVVVIII

B XLVII

C LXVIII

D XXXXXXVIII

2 Eight thousand, six hundred and thirty-two written in figures is

A 8632

B 86 032

C 80 632

D 86 302

3 The sum of 45 831 and 627 is

A 52 101

B 108 531

C 451 458

D 46 458

4 Subtract 3851 from 12 932.

A 9801

B 9081

C 9810

D 9018

5 What is 723 multiplied by 96?

A 69 408

B 69 480

C 69 840

D 69 804

6 1296 divided by 72 is

A 38

B 8

C 28

D 18

7 192 ÷ 4 × 6 – (2 × 3) is equal to

A 18

B 2

C 282

D 10·6

8 The estimated answer to 53 × 781 when rounded to the nearest multiple of 10 and 100 is

A 40 000

B 39 000

C 41 393

D 42 900

9 The Roman numeral XIV converted to modern Hindu–Arabic is

A 95

B 104

C 14

D 16

10 351 628 written in words is

A three hundred and fifty-one thousand, six hundred and twenty-eight.

B thirty-five and one thousand, six hundred and twenty-eight.

C thirty thousand, fifty-one thousand and six hundred and twenty-eight.

D three thousand, fifty-one thousand and six hundred and twenty-eight.

Short-answer questions

11 Write 53 using the ancient Hindu–Arabic (Brahmi) number system.

12 What is the place value of 4 in 1 247 539?

13 Calculate:

$$\begin{array}{r} 487 \\ +\ \ 65 \\ \hline \end{array}$$

14 Calculate:

$$\begin{array}{r} 6359 \\ -\,1473 \\ \hline \end{array}$$

15 Calculate:

$$\begin{array}{r} 329 \\ \times\ \ 58 \\ \hline \end{array}$$

16 Jason works at ITA Hardware store. He works from Monday to Friday, and earns $680 per week. How much does he earn per day?

17 Cathy buys 26 betel nut fruits for $1.50 each. At Kastom Garden market, Judy buys 15 for $2 each. How much do Cathy and Judy spend in total?

18 Jimmy wishes to purchase the following items at LELS Second-hand Clothing: jeans – $175, T-shirts – $123, bed sheets – $483, sports pants – $64.

Estimate how much money Jimmy needs to have in his wallet to cover the cost of his purchases.

19 Aileen has brought $750 in her purse. If she purchases mixed goods worth $549, how much money will she have left?

20 A farmer sells 3000 eggs. If he sells them for $38 per dozen, how much will he earn?

• Chapter 2 Test •

Number Patterns

Multiple-choice questions

Circle the correct answer

1 The next number in the number pattern {25, 33, 43, 55, 69…} is

A 75

B 80

C 85

D 90

2 The multiples of 12 between 10 and 30 are

A {12, 24, 28}

B {12, 24, 30}

C {24, 28}

D {12, 24}

3 The factors of 15 are

A {1, 3, 5, 15}

B {3, 5, 15}

C {5, 15}

D {15}

4 Which of the following numbers is divisible by 9?

A 539

B 513

C 527

D 554

5 When 6 × 6 × 6 × 6 is written in index form, it is written as

A 4^6

B $2^6 \times 2^6$

C $6^2 \times 6^2$

D 6^4

6 Which of the following is an even number?

A 562

B 171

C 293

D 465

7 Which of the descriptions below best describes this number pattern?

{3, 5, 9, 15, 23…}

A adding consecutive odd numbers to the next number

B adding consecutive even numbers to the next number

C adding consecutive prime numbers to the next number

D adding composite numbers to the next number

8 The lowest common multiple of 2 and 6 is

A 2

B 3

C 6

D 4

9 Factors of 63 are

A {11, 13, 17}

B {11, 13}

C {7, 9, 13}

D {3, 7, 9}

10 Which of the following numbers is divisible by 7?

A 532

B 527

C 514

D 449

Short-answer questions

11 Write the next two numbers of this number pattern:

{1, 6, 11, 16…}

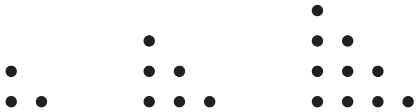
12 Write the lowest common multiple of 7 and 28.

13 List all the factors of 21.

14 Write two 3-digit numbers that are divisible by 8.

15 Evaluate 2^3

16 Write down the next two numbers of this pattern:



17 Use a factor tree to express 420 as a product of its prime factor.

18 Taps and Kure ride their bicycle around Lawson Tama Soccer Field. Taps completes one lap in 42 seconds, while Kure takes 60 seconds.

If they started together, how long will it be before they are together at the start again, and how many laps will each boy have done?

19 Mr Jay Timmy has 48 students in his business class, and he wishes to work with them in groups. How many students would be in each group if all the groups have the same number of students and no students are left out? In each case, how many groups would Mr Timmy have?

20 Calculate five to the power of three added to two to the power of 5.

• Chapter 3 Test •

Decimals and Percentages

Multiple-choice questions

Circle the correct answer

1 The place value of 4 in 2561·341 is

A ones (units).

B tenths.

C hundredths.

D thousandths.

2 When values are rounded off to the closest whole number, an estimated answer for 235·89 + 32·35 is

A 230

B 270

C 268

D 268·3

3 56·285 rounded off to the nearest whole number is

A 56

B 60

C 100

D 55

4 What is the sum of 45·42 and 35·76?

A 81·0

B 80·0

C 81·18

D 81·2

5 The difference between 63·61 and 13·55 is

A 50·60

B 50·10

C 50·01

D 50·06

6 Calculate 23·48 × 1·2

A 28·176

B 2·8176

C 281·76

D 0·28176

7 Evaluate 5·6 ÷ 8

A 7·0

B 0·7

C 0·07

D 0·007

8 Divide 0·48 by 0·6

A 0·08

B 0·008

C 0·8

D 8·0

9 Convert $\frac{5}{8}$ to a decimal.

A 0·00625

B 0·0625

C 6·25

D 0·625

10 Convert 0·13 to a fraction.

A $\frac{13}{100}$

B $\frac{13}{1000}$

C $\frac{13}{10}$

D $\frac{100}{13}$

Short-answer questions

11 How many decimal places are in the number 458·921?

12 Evaluate 36·21 – 18·375

13 Round off 14·8452 correct to 2 decimal places.

14 Calculate:

$$\begin{array}{r} 23.84 \\ +\ 5.75 \\ \hline \end{array}$$

15 Calculate:

$$\begin{array}{r} 256.21 \\ -\ \ 83.85 \\ \hline \end{array}$$

16 Marcos filled his Pajero with 53·82 litres of diesel, which costs $7.80 per litre. How much would this cost him?

17 Elsie is given $490.50 for her meal allowance for 5 days. If there are 3 meals a day, what would be the cost of each meal?

18 A carton of 1st grade Taiyo costs $396.80. There are 48 tins in a carton. How much will it cost Jane if she wants to buy 6 tins?

19 Jonathan's family spent $346.78 on groceries at the Kukum Bulk Shop. How much change did they get from $500.00?

20 Find the product of 28·12 and 14·46 correct to 1 decimal place.

• Chapter 4 Test •

Length and Perimeter

Multiple-choice questions

Circle the correct answer

1 Which unit would be the best to use when measuring the diameter of a soccer ball?

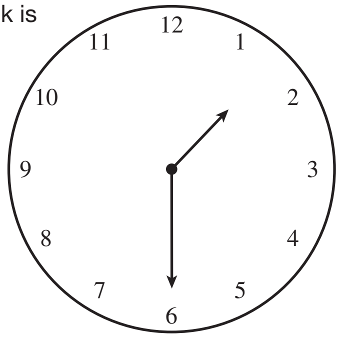
A millimetres

B centimetres

C metres

D kilometres

2 The time shown on the clock is



A 12:30

B 12:35

C 13:30

D 13:35

3 130 cm converted to mm is

A 0·13

B 1·3

C 13

D 1300

4 Calculate 52 mm + 4 cm

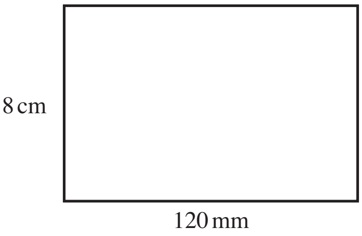
A 92 mm

B 92 cm

C 56 mm

D 56 cm

5 The perimeter of the rectangle shown is



A 40 mm

B 40 cm

C 128 cm

D 128 mm

6 The estimated distance from Honiara to Yandina would be approximately

A 24 000 m

B 45 000 000 mm

C 100 km

D 650 000 cm

7 0·275 km converted to cm is

A 27 500

B 2750

C 275

D 27·5

8 The difference between 4300 m and 1·8 km is

A 250 m

B 2·5 km

C 2500 cm

D 25 000 mm

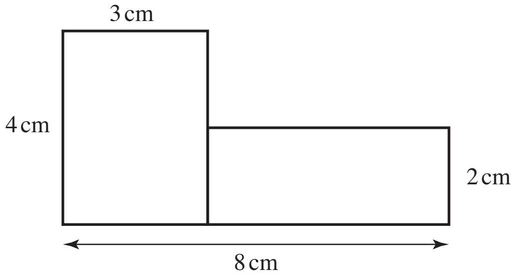
Short-answer questions

9 Which length unit would be best to measure the length of the football field?

10 Convert $2\frac{5}{8}$ km into metres.

11 Calculate 2·4 m + 56 cm – 420 mm.

12 Find the perimeter of the composite shape given.



13 What would be the best instrument to use to measure the height of a tree?

14 A rectangular playground is 32 m long and 14 m wide. How many metres of edging are needed to enclose the playground?

15 David was told that his jump was measured at 6·45 m by an official and 0·0064 km by a friend. Which was the greater measurement?

16 Find out the time difference between 10:30 am and 7:00 pm.

17 If a fingernail grows 2 mm a week, how many cm would it grow in 1 year?

• Chapter 5 Test •

Statistics

Multiple-choice questions

Circle the correct answer

Questions 1–4 refer to the frequency table below.

The frequency table shows the number of bonitos Stanley caught during one of his fishing trips. He measured their lengths, rounding this off to whole numbers, before tagging them with prices.

Length (cm)	Frequency
20	9
21	7
22	8
23	6
24	5

1 What type of data is displayed in the table?

A discrete

B continuous

C numerical

D histogram

2 What is the total number of bonitos Stanley caught?

A 134

B 110

C 24

D 35

3 An estimate of the average size of the bonitos he caught is

A 20 cm

B 22 cm

C 24 cm

D 7 cm

4 What is the most common size he caught?

A 5 cm

B 20 cm

C 24 cm

D 35 cm

5 The mean of the data {2, 6, 4, 8, 5} is

A 4

B 5

C 6

D 8

6 If the test results for 10 students in a Year 7 maths test are {8, 6, 9, 5, 8, 8, 7, 4, 3, 10}, what is the median score for this test?

A 6·8

B 8

C 7 and 8

D 7·5

7 The range for the test results in Question 6 is

A 2

B 8

C 7

D 68

8 This is a list of temperatures recorded on any particular day in Honiara city: 3·4, 4·5, 6·7, 3·4, 3·8, 5·2, 3·4

Find the mode.

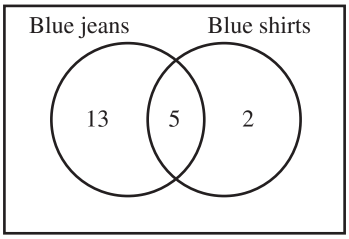
A 6·7

B 5·2

C 4·5

D 3·4

9 The Venn diagram shows the number of students in Form 5A at White River Secondary School who wore blue jeans, blue shirts or a combination of both during their farewell party.



The total number of students who wore blue shirts is:

A 7

B 2

C 5

D 3

10 Refer to the Venn diagram in Question 9. The total number of students in Form 5A is

A 20

B 25

C 10

D 15

Short-answer questions

11 Calculate the median for the following scores:

{6, 6, 4, 5, 2, 3, 8, 4, 3, 5, 5, 4, 3, 9, 7, 8, 3, 5, 5, 6, 3, 7, 8, 4, 4, 5}

12 The table shows a 1-hour survey, taken on a particular day between 8:00 am and 9:00 am, of the total number of passengers carried by buses from Point Cruz to White River.

Bus no.	Total passengers
1	9
2	8
3	12
4	7
5	6
6	5
7	10
8	15
9	12
10	12

a What is the total number of passengers travelling to White River?

b What is the average number of passengers carried by these buses?

c Which is the mode number of passengers travelling to White River?

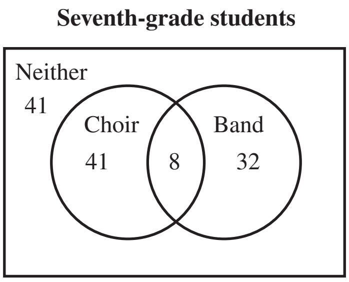
d What is the range of the number of passengers travelling to white River?

e Display this data on a bar graph.

13 Carolyn recorded the temperature, in degrees Fahrenheit, at noon on each day last week. The temperatures are: 77, 72, 81, 82, 77, 75, 69

Make a stem-and-leaf plot to show the temperatures.

14 The Venn diagram shows the number of seventh-grade students who are in the choir, in the band, in both the choir and the band, or in neither.



a What is the total number of students in the seventh grade?

b How many students are in the choir?

c How many students are in both the choir and the band?

• Chapter 6 Test •

Algebra Symbols

Multiple-choice questions

Circle the correct answer

1 A number is multiplied by 12, and then 6 is added. The best expression for this statement is

A $n(12 + 6)$

B $12n + 6n$

C $12n + 6$

D $12(n + 6)$

2 The expression $v + v + v - u + u$ can be further simplified to

A $3v - 2u$

B v

C $v^3 - u^2$

D $3 - 2$

3 The product $p \times q \times 2 \times r$ when simplified is equal to

A $pq \times 2r$

B $p \times 2q \times r$

C $2pq \times r$

D $2pqr$

4 When expanded, $4(a - 2b)$ is equal to

A $4a - 2b$

B $4a - 8b$

C $a - 8b$

D $8ab$

5 If $x = 8$, $y = 2$ and $z = 6$, then $xy - z$ is equal to

A 4

B 6

C 10

D 8

6 The rule used for the number pattern {1, 3, 7, 13, 21, 31…} is:

A Use all odd numbers.

B Double number two and then add.

C Add two.

D Add the consecutive even number.

7 The number m is divided by $\frac{1}{2}$, and then 6 is subtracted. This can be expressed as

A $2m - 6$

B $\frac{1}{2}m - 6$

C $\frac{1}{2}(m - 6)$

D $2m - 3$

8 $8xy + 6yz - 4xy - 2yz$ is equal to

A 8

B $4xy + 4yz$

C $8xy$

D $14xyz - 6xyz$

9 Simplify $\frac{9}{54}ab$

A $\frac{1}{6}$

B 6

C $\frac{1}{6}ab$

D $6ab$

10 When expanded, $6x + 4(x + 3)$ equals

A $18x$

B $6x + 12$

C $10x + 3$

D $10x + 12$

Short-answer questions

11 If $a = 6$, $b = 7$ and $c = 4$, evaluate $3c(a + b)$

12 If the length of a rectangle is 8 cm and its width is 4 cm, calculate its perimeter.

13 Write the expression $(q - 6) \times 12$ in words.

14 Simplify the expression $8x + 2 + 6y - 4x - 2y + 6$

15 Find the product of 8, x and $2y$

16 Expand the expression $8y(2y - 6)$

17 What is the value of $n^2(m + r)$ if $m = 3$, $n = 2$ and $r = 4$?

18 Hilary has \$9 less than Barbara. Together they have \$21. If x represents Barbara's money, write down the expression that best describes this relationship.

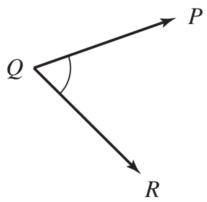
• Chapter 7 Test •

Angles

Multiple-choice questions

Circle the correct answer

1 The name of the angle indicated in the diagram is



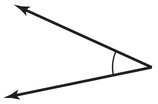
A ∠*PRQ**

B ∠*PQR*

C ∠*RPQ*

D ∠*QPR*

2 The type of angle shown in the dagram is



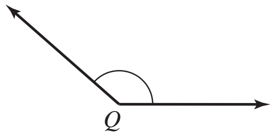
A an obtuse angle.

B a reflex angle.

C an acute angle.

D a right angle.

3 The best estimate of ∠*Q* in the diagram is



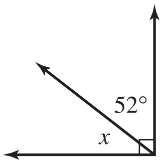
A 135°

B 265°

C 55°

D 315°

4 The size of angle *x* in the diagram is



A 18°

B 48°

C 38°

D 28°

5 The supplement of 106° is

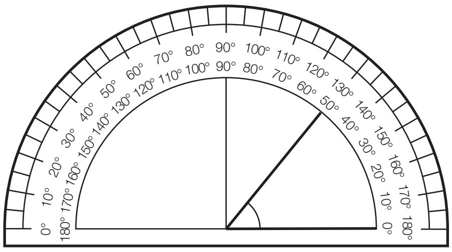
A 4°

B 254°

C 174°

D 74°

6 The angle shown here measures



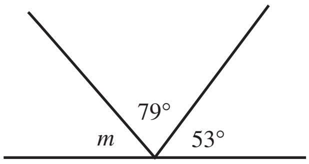
A 50°

B 90°

C 130°

D 150°

7 The value of angle *m* in the diagram is



A 11°

B 37°

C 48°

D 84°

8 A pair of complementary angles is

A 104° and 76°

B 42° and 42°

C 75° and 15°

D 36° and 63°

9 Which angle is a reflex angle?

A 35°

B 364°

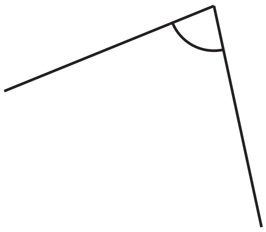
C 191°

D 103°

Short-answer questions

10 Use a protractor to measure the angle shown.

The angle is:



11 Classify the following angles as acute, right, obtuse, straight, reflex or a revolution.

a 180°

b 14°

c 156°

d 304°

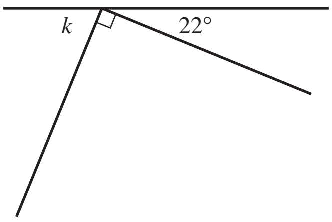
e 360°

12 Draw a 240° angle using a protractor.

13 State the complement of 34°

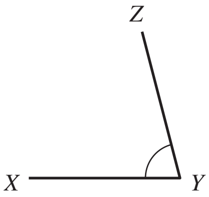
14 A bicycle wheel turned 49°. Calculate the angle that it still needs to turn through before it has completed a revolution.

15 Find the value of angle *k* for the diagram below.



k =

16 What is the name of the following angle?



• Chapter 8 Test •

Directed Numbers

Multiple-choice questions

Circle the correct answer

1 Point *C* on the number line is

A $^-1$

B $^-2$

C $^-3$

D $^-4$

2 The following numbers {$^-2$, 9, $^-11$, $^-6$, 8, 5, 7, $^-10$} arranged from largest to smallest would be

A {$^-11$, $^-10$, 9, 8, 7, $^-6$, 5, 2}

B {$^-11$, $^-10$, $^-6$, 9, 8, 7, 5, 2}

C {9, 8, 7, 5, 2, $^-11$, $^-10$, $^-6$}

D {9, 8, 7, 5, 2, $^-6$, $^-10$, $^-11$}

3 The answer to $8 + {}^-13$ is

A $^-5$

B 5

C 21

D $^-21$

4 What is $7 - {}^-17$ equal to?

A $^-24$

B 24

C $^-10$

D 10

5 The product of $^-8$ and 6 is

A $^-14$

B 14

C $^-48$

D 48

6 When $^-8 \div {}^-2$ the answer is

A $^-10$

B 10

C $^-4$

D 4

7 $^-9 \times 2 + 14 \div {}^-2 + 6$ is equal to

A $^-19$

B 8

C $^-11$

D 36

8 Which relationship is correct?

A $^-6 < {}^-2$

B $^-7 = 7$

C $^-200 > 2$

D $0 > 5$

9 Which are the integers between $^-10$ and $^-5$?

A $^-11$, $^-10$, $^-9$, $^-8$

B $^-5$, $^-5{\cdot}5$, $^-6$, $^-0{\cdot}5$

C $^-9$, $^-8$, $^-7$, $^-6$

D $^-10$, $^-9$, $^-8$, $^-7$

10 Which list of the numbers $^-4$, 1, 0, $^-10$ is arranged in descending order?

A 0, 1, $^-4$, $^-10$

B $^-10$, $^-4$, 0, 1

C 0, $^-4$, 1, $^-10$

D 1, 0, $^-4$, $^-10$

Short-answer questions

11 List the 4 missing numbers to complete the sequence:

{ ______ , ______ , ______ , ______ , 0, 2, 4}

12 Evaluate the following:

a $18 \div ({}^{-}3 - {}^{-}6)$

b $8 + {}^{-}5 - 2 - 3$

13 Find the value of $^{-}9 + {}^{-}12 \times {}^{-}6 \div {}^{-}3$

14 Calculate:

a $^{-}6 + {}^{-}2$

b $5 - {}^{-}3$

c $^{-}4 \times 5$

d $^{-}21 \div {}^{-}3$

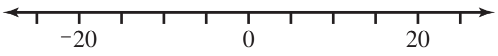
15 Julie completes a dive 5 m below sea level. She comes up 0·5 m every 2 seconds. After 10 seconds, what is her final position?

16 Iro has $847 in his bank account. He withdraws $65 each week for four weeks, and then deposits $22. What is his final balance?

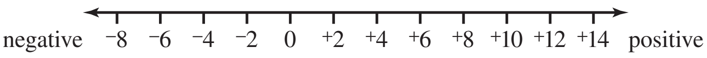
17 Chris has a body temperature of 37°C. He began to develop a fever and his temperature went up by 1·5°C, then down 2°. What is his final temperature?

18 A snail is at the bottom of an empty trough with walls 40 cm high. If the snail manages to move 4 cm up the wall of the trough each day, but slips down 3 cm each night, how long does it take the snail to reach the top of the trough?

19 Complete the number line below and correctly position the following letters: *M* at $^{+}5$, *T* at $^{-}15$, *E* at $^{+}20$ and *I* at $^{-}10$.



20 Using the number line below, insert the sign > or < to make each of the following expressions a true statement.



a $^{-}2$ _____ 4

b $^{-}8$ _____ 0

c 6 _____ 2

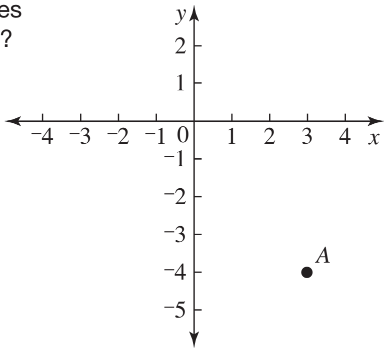
• Chapter 9 Test •

Coordinate Graphs and Location

Multiple-choice questions

Circle the correct answer

1 What are the coordinates of point A on the graph?



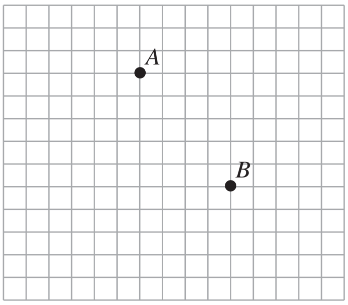
A (−3, −4)

B (−4, 3)

C (3, −4)

D (−4, −3)

2 In the graph, no axes or origin are shown. If point *B*'s coordinates are (10, 3), which of the following would most likely be *A*'s coordinates?



A (10, 6)

B (6, 8)

C (−10, 3)

D (−2, −17)

3 What are the coordinates of the intersection point of the *x*- and *y*-axes?

A (0, 1)

B (1, 1)

C (0, 0)

D (1, 0)

4 If you were to plot the coordinate pair (−3, 5), you would plot which number along the *x*-axis?

A 5

B −3

C both

D 8

5 What is the vertical number line on the coordinate plane called?

A *x*-axis

B origin

C quadrant

D *y*-axis

6 Points in ____________ have positive *x* and positive *y* coordinates.

A Quadrant II

B Quadrant I

C Quadrant III

D Quadrant IV

7 A point on a coordinate plane has (−3, −5) as its coordinates. Where is the point located?

A in Quadrant I

B in Quadrant II

C in Quadrant III

D in Quadrant IV

8 Which of these points lie in Quadrant II of a coordinate plane?

A (−4, −3)

B (−4, 3)

C (4, 3)

D (4, −3)

9 How far is the point (4, 0) from the origin?

A 0 units

B 4 units

C 6 units

D 8 units

10 Which ordered pair has an *x*-coordinate of −7?

A (3, −7)

B (−7,3)

C (7, 3)

D (3, 7)

Short-answer questions

11 Use the diagram below to answer the questions.

a Write the ordered pair for each of the objects listed.

i helicopter ___________________

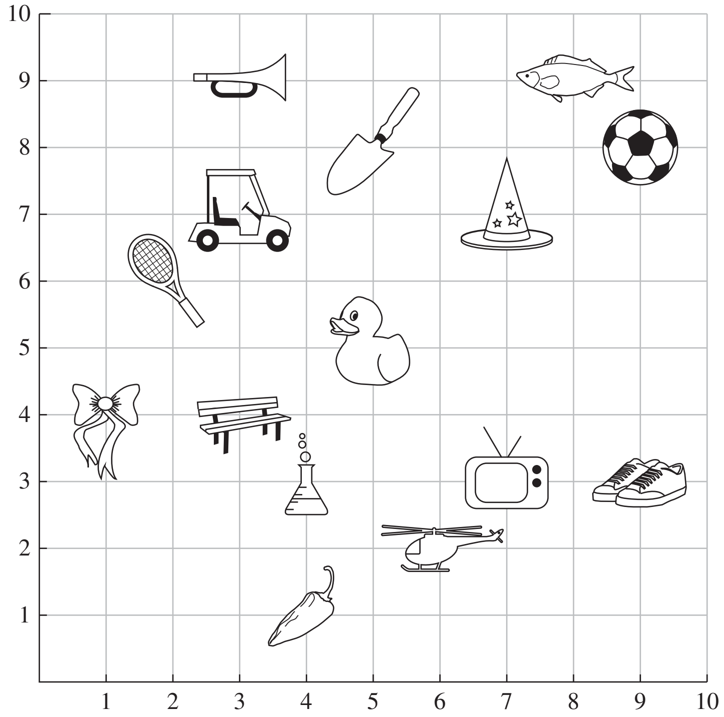
ii shoes ___________________

iii pepper ___________________

iv wizard's hat ___________________

v fish ___________________

vi golf cart ___________________



b State the object located at each point.

i (3, 4) ___________________

ii (2, 6) ___________________

iii (1, 4) ___________________

iv (5, 5) ___________________

v (9, 8) ___________________

vi (3, 9) ___________________

12 Plot the following ordered points on the grid below. Label each point.

$X(-2, 0)$

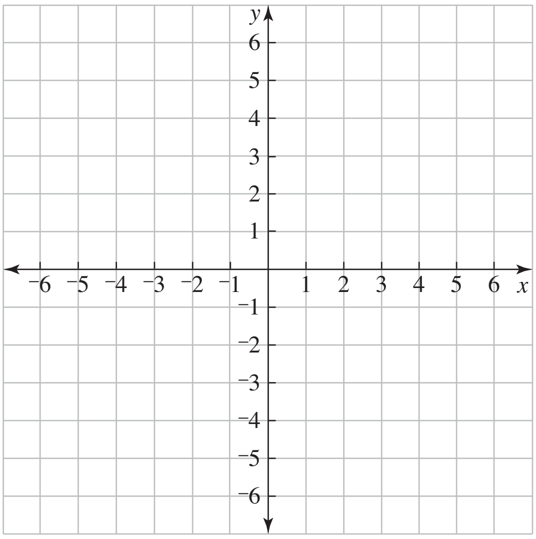
$M(3, 1)$

$J(-1, -1)$

$V(-6, 4)$

$S(6, -2)$

$R(1, 3)$



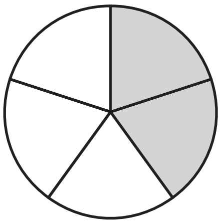
• Chapter 10 Test •

Fractions

Multiple-choice questions

Circle the correct answer

1 How much of the circle is shaded?



A 0·2

B $\frac{3}{5}$

C $\frac{2}{5}$

D 5 out of 2

2 Which of the following numbers when divided by $\frac{1}{2}$ gives a result less than $\frac{1}{2}$?

A $\frac{2}{8}$

B $\frac{7}{12}$

C $\frac{2}{3}$

D $\frac{5}{24}$

3 Find $\frac{1}{4}$ of 32

A 4

B 8

C 16

D 24

4 The answer to $\frac{3}{4} - \frac{1}{4}$ is

A $\frac{1}{2}$

B $\frac{1}{4}$

C $\frac{1}{6}$

D $\frac{1}{8}$

5 When $\frac{1}{2}$ is subtracted from $\frac{4}{5}$ the answer is

A $-\frac{3}{10}$

B $\frac{3}{10}$

C $\frac{3}{5}$

D $\frac{3}{3}$

6 Find $\frac{1}{3} \times \frac{1}{4}$

A $\frac{3}{4}$

B $\frac{2}{7}$

C $\frac{2}{12}$

D $\frac{1}{12}$

Short-answer questions

7 Evaluate $\left(\frac{3}{5}\right)^2$

8 Find the square root of $\frac{36}{81}$

9 Calculate $12 + \frac{1}{3}$ of $21 \div 3$

10 Simplify the fraction $\frac{18}{54}$

11 Change $5\frac{4}{5}$ into an improper fraction.

12 Alice made 48 cupcakes. She frosted $\frac{1}{2}$ of the cupcakes, put sprinkles on $\frac{1}{3}$ of the frosted cupcakes and ate $\frac{1}{4}$ of the frosted cupcakes that had sprinkles. What is the total number of cupcakes that Alice ate?

13 During the Independence Celebrations, $\frac{4}{5}$ of those who were in Honiara displayed the Solomon Islands flag. Five-eighths of these displayed the flag on their homes. What fraction of those who were in Honiara displayed a flag on their home?

• Chapter 11 Test •

Time and Mass

Multiple-choice questions

Circle the correct answer

1 The years in which the following churches arrived in the Solomon Islands is given in the table.

Church	Year
Methodist	1902
Anglican	1861
Seventh Day Adventist	1914
South Sea Evangelical	1894
Roman Catholic	1842

A timeline that describes the arrival of the above churches in the Solomon Islands would be in the following sequence:

A SDA, MC, SSEC, AC and RC

B RC, AC, SSEC, MC and SDA

C RC, AC, MC, SSEC and SDA

D SSEC, AC, RC, SDA and MC

2 A decade is equal to

A 366 days

B 52 weeks

C 100 years

D 10 years

3 The months in a year that have the same number of days are

A January, May, October and December

B January, May, June and December

C January, April, July, and December

D January, May, September and December

4 How many years are there between 12 BC and 63 AD?

A 52

B 74

C 75

D 53

5 The digital time for 12 minutes to 8 in the morning is

A 8:12 am

B 8:48 am

C 7:12 am

D 7:48 am

6 Solomon Islands is 1 hour ahead of Papua New Guinea. If it is 2:30 pm in the Solomons, Papua New Guinea time would be

A 1:30 pm.

B 12:30 pm.

C 3:30 pm.

D 11:30 pm.

7 Which order of events would be best to follow when building a house?

A house plan, posts, foundations, bearers, floor joists, studs, rafters, purlins, roofing

B foundations, house plan, posts, bearers, floor joists, studs, rafters, purlins, roofing

C house plan, foundations, posts, bearers, floor joists, rafters, studs purlins, roofing

D house plan, foundations, posts, bearers, floor joists, studs, rafters, purlins, roofing

8 45 tonnes converted into kilograms is equal to

A 0·045

B 45 000

C 45 000 000

D 0·000 45

9 Express ‘28 to 9 in the evening’ in 24-hour time.

A 0832 hours

B 0928 hours

C 2032 hours

D 2028 hours

10 1500 g converted to kilograms is

A 0·15 kg

B 1·5 kg

C 150 000 kg

D 1 500 000 kg

Short-answer questions

Date	Game
June 15	Brazil *vs* Japan
June 22	Japan *vs* Mexico
June 19	Brazil *vs* Mexico
June 26	Uruguay *vs* Brazil
June 23	Spain *vs* Nigeria
June 30	Brazil *vs* Spain
June 27	Spain *vs* Italy
June 30	Uruguay *vs* Italy
June 23	Tahiti *vs* Uruguay
June 19	Japan *vs* Italy
June 22	Italy *vs* Brazil
June 17	Spain *vs* Uruguay
June 21	Spain *vs* Tahiti
June 18	Tahiti *vs* Nigeria
June 21	Nigeria *vs* Uruguay
June 17	Italy *vs* Mexico

11 The 2013 Confederation Cup was played by eight countries. The table shows some of the game fixtures for the tournament.

Using the information in the table, draw a timeline and mark the dates on which Brazil played other countries.

12 Convert 300 seconds to minutes.

13 How many days are between 21 October and 8 December?

14 Give the digital time for 2354 hours.

15 Fiji is 1 hour ahead of Solomon Islands time. If it is 1934 hours in Fiji, what time is it in the Solomon Islands?

16 Place these steps of how to cook bananas in the correct order in a flow chart.

Eat the bananas.

Put the pot on the fire.

Harvest the bananas.

Light the fire.

Pour water into the cooking pot.

Take the pot off the fire when the bananas are cooked.

17 Sullivans Company sells sausages in packets weighing 500 g, 1000 g, 1500 g, 2000 g, 2500 g, 3000 g, 3500 g, 4000 g, 4500 g and 5000 g.

Brian bought one 1500 g packet and two 3500 g packets.

What is the total weight of sausages in kilograms that Brian bought?

18 How many years are two centuries?

19 What is the total number of days in 17 weeks?

20 How many years are there between 123 BC and 49 AD?

• Chapter 12 Test •

Probability

Multiple-choice questions

Circle the correct answer

1 What is the probability that Solomon Islands is going to win a Soccer World Cup in the future?

A likely **B** unlikely

C highly likely **D** highly unlikely

2 The probability of getting a 4 when tossing a die is

A $\frac{1}{6}$ **B** $\frac{4}{6}$

C $\frac{2}{3}$ **D** $\frac{6}{4}$

3 The probability of randomly choosing the letter U from the word CHOISEUL is

A $\frac{1}{7}$ **B** $\frac{2}{8}$

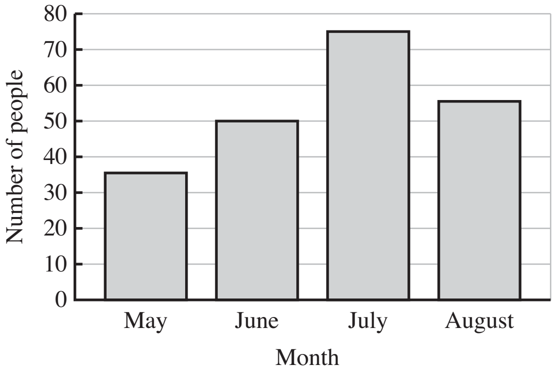
C $\frac{1}{8}$ **D** $\frac{1}{7}$

4 A drawer contains five black socks, four navy socks and six grey socks. What is the probability that a sock chosen at random is navy?

A $\frac{4}{5}$ **B** $\frac{4}{6}$

C $\frac{4}{15}$ **D** $\frac{4}{10}$

5 The bar graph shows the number of people who visited the Children's Park at Rove each month last year.

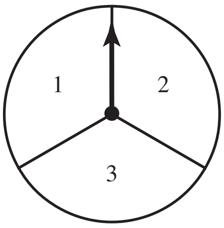


How many more people visited the Children's Park in July than in May?

A 15 people **B** 20 people

C 40 people **D** 110 people

6 Haley has one spinner that is divided into three congruent sections as shown here.



If Haley is going to spin the arrow, what is the probability that the arrow on the spinner will stop on a section with an odd number?

A $\frac{1}{2}$ **B** $\frac{1}{3}$

C $\frac{2}{3}$ **D** $\frac{3}{3}$

7 The number of times you would expect a coin to land on heads when you toss it 30 times is

A 15 **B** 10

C 20 **D** 5

8 The probability of not throwing a 5 when tossing a die is

A $\frac{21}{6}$ **B** $\frac{3}{6}$

C $\frac{4}{6}$ **D** $\frac{5}{6}$

Short-answer questions

9 A die is tossed. What is the probability of throwing:

a a 4?

b an even number?

c a number less than 5?

10 Mrs Allen has 15 students. Eight students belong to the drama club and 10 students belong to the computer club. Some students belong to both clubs. If Mrs Allen chose a student at random, what is the probability that the student would belong to both clubs?

11 A bowl contains eleven lollies. Four of the lollies are blue, four are red and three are green. Find the probability of drawing:

a a red lolly

b a blue lolly

c a green lloly

d not a blue lolly.

• Chapter 13 Test •

Polygons

Multiple-choice questions

Circle the correct answer

1 A triangle has side lengths of 5, 5 and 7 units. What kind of triangle is it?

A equilateral

B isosceles

C right

D scalene

2 Two of the angles in a triangle measure 70° and 40°. What kind of triangle is it?

A equilateral

B isosceles

C right

D scalene

3 If the sides of a triangle are all the same length, what kind of triangle is it?

A equilateral

B isosceles

C right

D scalene

4 One of the angles in an isosceles triangle is 100°. What are the measures of the remaining two angles?

A 40° and 40°

B 40° and 60°

C 20° and 80°

D 20° and 100°

5 The sum of all the interior angles of a polygon with n sides is

A $(n - 2) \times 180°$

B $n - 2 \times 180°$

C $(n + 2) \times 180°$

D $n + 2x \times 180°$

6 How many sides does a polygon have if the sum of its interior angles is 720°?

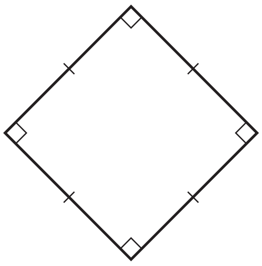
A 5

B 6

C 7

D 8

7 The figure shown here can be classified as



A rectangle, square, quadrilateral, parallelogram, rhombus.

B rectangle, square, parallelogram.

C rhombus, trapezoid, quadrilateral, square.

D square, rectangle, quadrilateral.

8 Which statement is true?

A All quadrilaterals are rectangles.

B All quadrilaterals are squares.

C All rectangles are quadrilaterals.

D All quadrilaterals are parallelograms.

9 Which of the following could *not* be the sum of the interior angles of a polygon?

A 360°

B 540°

C 920°

D 1080°

10 The sum of the interior angles of a regular polygon is 1080°. What is the name of the regular polygon?

A pentagon

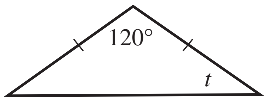
B hexagon

C decagon

D octagon

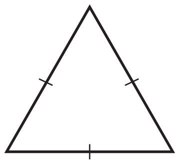
Short-answer questions

11 Find the angle marked *t* in the triangle shown here.

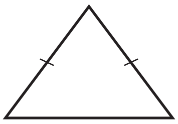


12 Label each diagram with the name of the triangle.

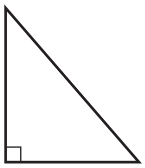
a



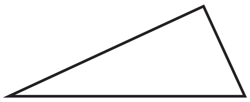
b



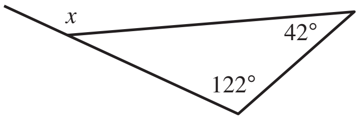
c



d

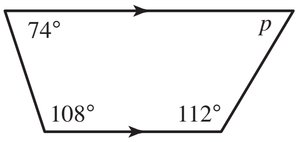


13 Find the size of the exterior angle marked *x* in this triangle.



14 Name the quadrilateral that has opposite sides equal, with all angles equal and measuring 90°.

15 Calculate the angle marked *p* in this quadrilateral.



16 Sophia knows that an interior angle of a regular polygon measures 162°. How many sides does the polygon have?

17 How many triangles can you create in a regular octagon?

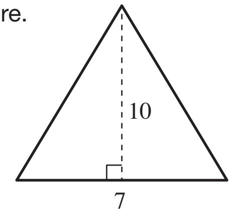
• Chapter 14 Test •

Area and Volume

Multiple-choice questions

Circle the correct answer

1 Find the area of the triangle shown here.



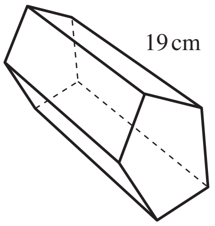
A 70 square units

B 27 square units

C 35 square units

D 8·5 square units

2 For the prism shown here, find the volume to the nearest tenth if the area of the base is 48·91 cm^2.



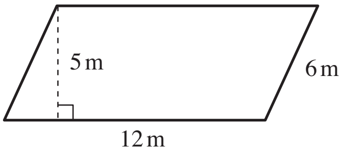
A 2392·2 cm^3

B 361 cm^3

C 67·9 cm^3

D 929·3 cm^3

3 What is the area of this parallelogram?



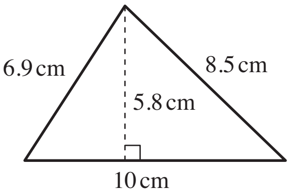
A 36 m^2

B 60 m^2

C 72 m^2

D 360 m^2

4 What is the area of the largest triangle in the diagram below?



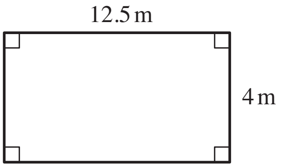
A 29 cm^2

B 34·5 cm^2

C 58 cm^2

D 69 cm^2

5 The diagram shows the dimensions of Emily's hallway. How much carpet does she need to completely cover the floor?



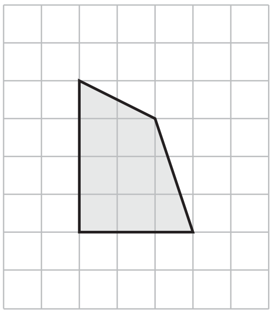
A 16·5 m^2

B 20·5 m^2

C 33 m^2

D 50 m^2

6 What is the area of the shape?



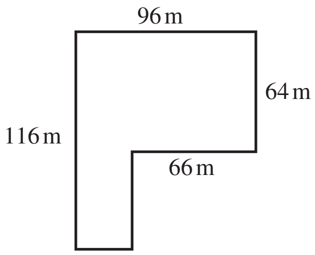
A 6 square units

B 8·5 square units

C 11 square units

D 12 square units

7 The diagram represents Stanley's yard. Find the area of the yard.



A 4224 m^2

B 7704 m^2

C 10 368 m^2

D 11 136 m^2

8 What is the volume of a rectangular toy chest that is 5 metres long, 3 metres wide and 2 metres deep?

A 10 m^3

B 15 m^3

C 30 m^3

D 60 m^3

9 Maria is wrapping a present to post overseas. The shipping box measures 10 cm by 5 cm by 5 cm. A small gift box inside the shipping box measures 2 cm by 2 cm by 2 cm. How much space is left inside the shipping box for packing material?

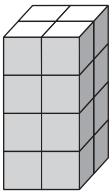
A 8 cm^3

B 242 cm^3

C 250 cm^3

D 258 cm^3

10 Which of the following is a method that can be used to find the volume of the rectangular prism shown?



A Count 4 cubes on the bottom layer and multiply by 4, the number of layers.

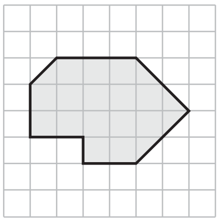
B Count all the cubes in the prism.

C Count 8 cubes on the front face of the cube and multiply by 2.

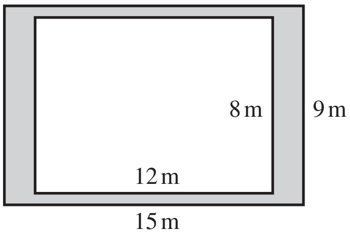
D All of the above.

Short-answer questions

11 What is the area of this shape?



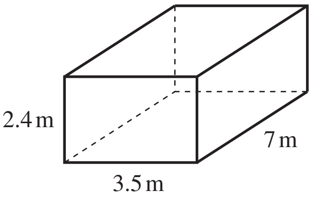
12 The quadrilaterals in the diagram are both rectangles. What is the area of the shaded region?



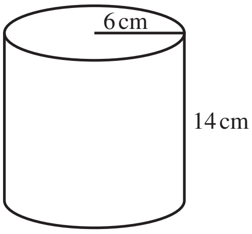
13 A polygon has vertices *A*(1,2), *B*(4,4), *C*(4, −2), *D*(−2,−2) and *E*(2,3).

Find its area.

14 Calculate the volume of the prism given below.



15 Find the volume of the solid if its cross-section area is 113·1 cm^2.



• Chapter Test •

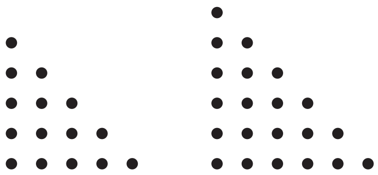
Answers

Chapter 1: Whole Numbers

1 C
2 A
3 D
4 B
5 A
6 D
7 C
8 A
9 C
10 A
11 μ ≡
12 Forty thousand
13 552
14 4886
15 19 082
16 $136
17 $69
18 $850
19 $201
20 $9500

Chapter 2: Number Patterns

1 C
2 D
3 A
4 B
5 D
6 A
7 B
8 C
9 D
10 A
11 {21, 26}
12 28
13 {1, 3, 7, 21}
14 Examples: 200, 208
15 2 × 2 × 2 = 8
16 {15, 21}



17 2 × 2 × 3 × 5 × 7

18 The lowest common factor is 420 seconds. Therefore, after 7 minutes they will be together again. Taps will have done 10 laps, and Kure 7 laps.

19 Mr Timmy's class could be divided into:

4 groups of 12 students
6 groups of 8 students
8 groups of 6 students
12 groups of 4 students
3 groups of 16 students
16 groups of 3 students
2 groups of 24 students
24 groups of 2 students.

20 $5^3 + 2^5 = 5 \times 5 \times 5 + 2 \times 2 \times 2 \times 2 \times 2 = 125 + 32 = 157$

Chapter 3: Decimals and Percentages

1 C
2 C
3 A
4 C
5 D
6 A
7 B
8 C
9 D
10 A
11 3 d.p.
12 17·835
13 14·85
14 29·59
15 172·36
16 $419.80
17 $32.70
18 $49.60
19 $153.22
20 406·6

Chapter 4: Length and Perimeter

1 B
2 C
3 D
4 A
5 B
6 C

7 A

8 B

9 metres

10 2625 m

11 2·54 m = 254 cm = 2540 mm

12 24 cm

13 tape measure

14 92 m

15 The official measurement was greater = 6·45 m.

16 8 hrs and 30 min

17 52 × 2 = 104 mm ÷ 10 = 10·4 cm

Chapter 5: Statistics

1 B

2 D

3 B

4 B

5 B

6 D

7 C

8 D

9 A

10 A

11 {5}

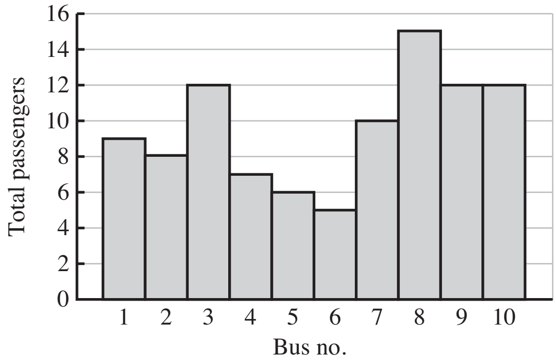
12 **a** 96

b 96 ÷ 10 = 9·6 ≈ 10

c 12

d 15 – 5 = 10

d



13 **Temperature (°F)**

6 | 9
7 | 2 5 7 7
8 | 1 2

6 | 9 means 69

14 **a** 122 **b** 49 **c** 8

Chapter 6: Algebra Symbols

1 C

2 A

3 D

4 B

5 C

6 D

7 A

8 B

9 C

10 D

11 156

12 24 cm

13 6 is subtracted from q and the result is multiplied by 12

14 $4x + 4y + 8$

15 $16xy$

16 $16y^2 - 48y$

17 28

18 $(x - 9) + x = 21$

Chapter 7: Angles

1 B

2 C

3 A

4 C

5 D

6 A

7 C

8 C

9 C

10 80°

11 **a** straight angle

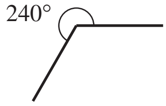
b acute angle

c obtuse angle

d reflex angle

e revolution angle

12



13 56°

14 311°

15 68°

16 $\angle XYZ$ or $\angle ZYX$

Chapter 8: Directed Numbers

1 C

2 D

3 A

4 B

5 C

6 D

7 A

8 A

9 C

10 D

11 {$^-8$, $^-6$, $^-4$, $^-2$}

12 **a** 6

b $^-2$

13 $^-33$

14 **a** $^-8$

b 8

c $^-20$

d 7

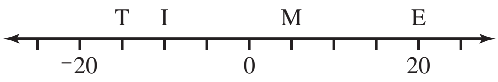
15 $^-2{\cdot}5$ m, or 2·5 m below sea level

16 $609

17 36·5°C

18 40 days

19



20 **a** $^-2 < 4$

b $^-8 < 0$

c $6 > 2$

Chapter 9: Coordinate Graphs and Location

1 C

2 B

3 C

4 B

5 D

6 B

7 C

8 B

9 B

10 B

11 **a** **i** helicopter (6, 2)

ii shoes (9, 3)

iii pepper (4, 1)

iv wizard's hat (7, 7)

v fish (8, 9)

vi golf cart (3, 7)

b **i** (3, 4) bench

ii (2, 6) tennis racket

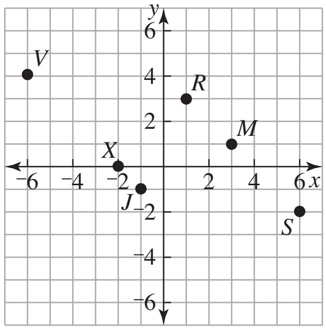
iii (1, 4) bow

iv (5, 5) rubber duck

v (9, 8) soccer ball

vi (3, 9) horn/bugle/trumpet

12



Chapter 10: Fractions

1 C

2 D

3 B

4 A

5 B

6 D

7 $\frac{9}{25}$

8 $\frac{6}{9}$

9 $14\frac{1}{3}$

10 $\frac{1}{3}$

11 $\frac{29}{5}$

12 2

13 $\frac{1}{2}$

Chapter 11: Time and Mass

1 B

2 D

3 A

4 C

5 D

6 A

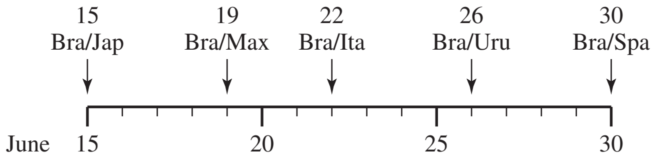
7 D

8 B

9 C

10 B

11 Timeline should show June 15, 19, 22, 26 and 30.



12 5 minutes

13 47 days

14 11:54 pm

15 1834 hours

16 Flow chart order:

1 Harvest the bananas.
2 Light the fire.
3 Pour water into the cooking pot.
4 Put the pot on the fire.
5 Take the pot off the fire when the bananas are cooked.
6 Eat the bananas.

17 8·5 kg

18 200 years

19 119 days

20 172 years

Chapter 12: Probability

1 D

2 A

3 C

4 C

5 C

6 C

7 A

8 D

9 **a** $\frac{1}{6}$

b $\frac{1}{2}$

c $\frac{2}{3}$

10 $\frac{3}{15} = \frac{1}{5}$

11 **a** $\frac{4}{11}$

b $\frac{4}{11}$

c $\frac{3}{11}$

d $\frac{7}{11}$

Chapter 13: Polygons

1 B

2 B

3 A

4 A

5 A

6 B

7 D

8 C

9 C

10 D

11 $t = 30^\circ$

12 **a** equilateral triangle

b isosceles triangle

c right-angled triangle

d scalene triangle

13 $x = 164^\circ$

14 rectangle

15 $p = 66^\circ$

16 20

17 6

Chapter 14: Area and Volume

1 C

2 D

3 B

4 A

5 D

6 B

7 B

8 C

9 B

10 D

11 17·5 square units

12 39 m^2

13 20 square units

14 1583·4 m^3

15 1583·4 cm^2

Appendix 1: Suggested teaching methods

A range of strategies for helping learners to achieve the overall learning outcomes are shown here.

OUTCOMES MAY BE ACHIEVED THROUGH

Problem solving

- Brief design
- Model building
- Whole group extended
- Decision-making process
- Testing solutions

Ideas

- Concept mapping
- Brainstorming
- Inquiry and curiosity
- Predict, observe, explain
- Open-minded experiments

Research

- Small-group research
- Library assignments
- Analysis of data
- Collection of material

People

- Peer teaching
- Cooperative learning
- Interviews
- Visits and visitors

Skills and processes

- Investigative processes
- Practices
- Mastery learning
- Skills development
- Values clarification
- Process writing

Media

- Debates
- Storytelling
- Small-group discussion
- Class discussions
- Creative writing
- Quality questioning

Personal experience

- Learners' personal experiences
- Investigations
- Hands-on activities
- Interactive learning
- Excursions, field trips

Presentations

- Role-play
- Drama and dance
- Talks and reports
- Demonstration
- Posters
- Story shells
- Simulation
- Collage, cartoons

Appendix 2: Lesson plan format

<table>
<tr><td>**Name of school:**</td><td>**Class teacher:**</td></tr>
<tr><td>**Lesson title:**</td><td>**Date:**</td></tr>
<tr><td colspan="2">**Learning outcomes**
• What are the main things I want learners to learn and be able to do as a result of the lesson? How are lesson outcomes linked to syllabus outcomes?
• What other things do I want learners to learn?</td></tr>
<tr><td colspan="2">**Lesson content**
• What are the key facts, concepts or procedures that I want learners to understand as a result of this lesson?</td></tr>
<tr><td colspan="2">**Introduction**
• How will I get learners motivated, curious and ready to learn? (Allocate 3–5 minutes.)</td></tr>
<tr><td>**Teacher activities**
• What am I going to do during the lesson in order for learners to achieve the learning outcomes? (Allocate 8–10 minutes.)</td><td>**Learner activities**
• What are the learners going to do during the lesson in order for them to achieve the learning outcomes? (Allocate 20–25 minutes.)</td></tr>
<tr><td colspan="2">**Conclusion**
• How will I bring the lesson to a logical and meaningful conclusion? (Allocate 5–7 minutes.)</td></tr>
<tr><td colspan="2">**Learner assessment**
• How will I know that learners have achieved what I wanted them to achieve?</td></tr>
<tr><td colspan="2">**Lesson evaluation**
• How will I evaluate the success of the lesson?</td></tr>
<tr><td colspan="2">**Lesson endorsement:** (To be signed by Head of Department/Head teacher/Principal)</td></tr>
<tr><td>**Head of Department**</td><td>**Head teacher/Principal**</td></tr>
</table>

Appendix 3: Sample learner's record form

Learner's name:

Year level:

Class:

Strand	**Sub-strand**	**Assessment event**	**Specific Learning Outcomes and benchmarks** (use appropriate code)		**Achievement levels** (ratings)						**Achievement award** Achieved (A) Partially Achieved (PA 1–4) Not Achieved (NA) Key: 5 = A, 1–4 = PA, 0 = NA
			Code	**Specific Learning Outcome and benchmark**	**5**	**4**	**3**	**2**	**1**	**0**	

Calculation of progressive achievement level for formative assessment:

Descriptive comments:

Class teacher:

Signature:

Date:

Appendix 4: Sample class monitoring form

Class:				**Term/Semester:**			**Year level:**
Strand:							**Sub-strand:**
Topic/Unit:							**Remarks:** (Comment on learning progress of each learner, e.g. Improved; Steady; Not improved; Seems to improve during the learning process over a term/semester/year.)
Assessment events	**1**	**2**	**3**	**4**	**5**	**6**	
Coded SLO benchmark							
Class teacher:							**Signature:** **Date:**

Appendix 5: Sample class analysis form

<table>
<tr><td colspan="3">Class:</td><td colspan="3">Term/Semester:</td><td colspan="2">Year level:</td></tr>
<tr><td colspan="3">Strand/Sub-strand:</td><td colspan="3">Total number of learners:</td><td colspan="2">Topic/Unit remarks:</td></tr>
<tr><td>Assessment event</td><td>Code</td><td>Specific Learning Outcome and benchmark (use appropriate code)</td><td>A</td><td>PA</td><td>NA</td><td>Enrichment support</td><td>Remedial work</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
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<tr><td colspan="6">Class teacher:</td><td>Signature:</td><td>Date:</td></tr>
</table>

Appendix 6: Sample learner's remedial work form

Learner's name:			**Class:**			**Term/Semester:**	**Year:**
Strand:			**Sub-strand:**				
Assessment event	**Specific Learning Outcomes and benchmarks** (use appropriate code)						
	Code	**Description of outcomes assessed**	**A** 5	**PA** 4, 3, 2, 1	**NA** 0	**Remedial work required**	**Results after remedial work**
Class teacher:						**Signature:**	**Date:**

Appendix 7: Sample summative assessment recording form

Learner's name:				**Class:**	**Year level:**						
Strand	**Sub-strand**	**Summative task**	**Specific Learning Outcomes and benchmarks** (use appropriate code)		**Achievement levels** (Ratings)						**Achievement award** Achieved (A) Partially Achieved (PA 1–4) Not Achieved (NA) Key: 5 = A, 1–4 = PA, 0 = NA
			Code	**Specific Learning Outcome and benchmark**	**5**	**4**	**3**	**2**	**1**	**0**	
Calculation of progressive achievement level for summative assessment:											
Descriptive comments:											
Class teacher:				**Signature:**							**Date:**

Appendix 8: Sample learner's classroom report form

<table>
<tr><td>Learner's name:</td><td>Class:</td><td>Semester:</td><td colspan="2">Year level:</td></tr>
<tr><td colspan="5">Results for formative assessment: The progressive achievement level for formative assessment is ___________________</td></tr>
<tr><td>Strand:</td><td>Sub-strand:</td><td colspan="3">Achievement level and award
Achieved (A), Partially Achieved (PA) or Not Achieved (NA)</td></tr>
<tr><td>Code</td><td>Specific Learning Outcome and benchmark
(use appropriate code)</td><td>A</td><td>PA</td><td>NA</td></tr>
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<tr><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="5">Descriptive remarks:
(must include results after remedial work has been completed by the learner)</td></tr>
<tr><td>Strand:</td><td>Sub-strand:</td><td colspan="3">Achievement award
Achieved (A), Partially Achieved (PA) or Not Achieved (NA)</td></tr>
<tr><td>Code</td><td>Specific Learning Outcome and benchmark
(use appropriate code)</td><td>A</td><td>PA</td><td>NA</td></tr>
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<tr><td colspan="5">Descriptive remarks:
(must include results after remedial work has been completed by the learner)</td></tr>
</table>

Appendix 8: Sample learner's classroom report form (*continued*)

Results for summative assessment: The progressive achievement level for summative assessment is __________________				
Strand:	**Combination of sub-strands:**	**Specific Learning Outcomes and benchmarks** Achieved (A), Partially Achieved (PA) or Not Achieved (NA)		
Descriptive remarks from summative assessment:				
Overall achievement level (combination of formative and summative):	**Overall award:**			
School administration report on learner's behaviour and character:				
Name of class teacher:	**Signature:**			**Date:**
Class teacher comments:				
Name of Head teacher/Principal:	**Signature:**			**Date:**
Head teacher/Principal comments:				

Appendix 9: Sample learner's school report form

Takwa Community High School

Name: ______________________________Year level: ______

Reporting period: _____________________________________

Subjects	**Score (100%)**	**Overall achievement level, award and certification**	**Grade**	**Comments**
English	95%	5, AWE, Gold	A	Well done
Mathematics				
Science				
Social Studies	90%	4, AWM, Silver	B	Good work
Health Education				
Christian Education	60%	3, AWMS, Bronze	C	Satisfactory work
Creative Arts and Culture				
Physical Education	21%	2, ABMS	D	Needs to attend practical sessions in PE
ICT	0%	0, NA	E	Needs to put more effort in ICT

Class teacher comments on learner's attitude, behaviour and character:

Head teacher/Principal comments:

Key

95%–100%: Achieved With Excellence (AWE), Gold
80%–94%: Achieved With Merit (AWM), Silver
50%–79%: Achieved (A), Bronze
20%–49%: Not Achieved (NA)
1%–19%: Not Achieved (NA)
0%: Not Achieved (NA)

Glossary

Acute angle An angle that is less than 90°.

Acute-angled triangle A triangle with no angles equal to or greater than 90°.

Addition The operation of combining numbers to obtain a sum or total.

Adding decimals Summing decimal numbers is best done vertically, to ensure that numerals with the same place value are aligned in the same columns. For example: 23·21 + 0·052 + 104·6 is calculated like this, with the numerals with the smallest place values added first (working right to left by columns):

$$\begin{array}{r} 23{\cdot}21 \\ 0{\cdot}052 \\ +\ 104{\cdot}6 \\ \hline 127{\cdot}862 \\ \hline \end{array}$$

Adding fractions To add simple fractions, first convert each fraction to an equivalent fraction with a common denominator. Only the numerators are added.
The denominator is left unchanged. For example:

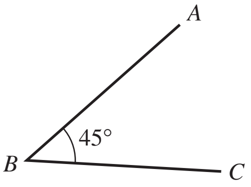
$$\frac{3}{4} + \frac{2}{5} = \frac{3 \times 5}{4 \times 5} + \frac{2 \times 4}{5 \times 4} = \frac{15}{20} + \frac{8}{20} = \frac{15 + 8}{20} = \frac{23}{20} = 1\frac{3}{20}$$

Adding mixed fractions is best done by adding the whole numbers and fractions separately and simplifying the total. For example:

$$2\frac{3}{4} + 7\frac{2}{5} = (2 + 7) + \left(\frac{3}{4} + \frac{2}{5}\right) = 9 + 1\frac{3}{20} + 10\frac{3}{20}$$

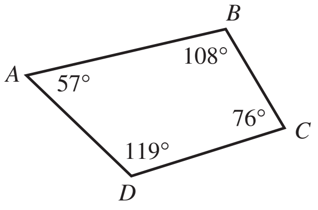
Algebra The study of number systems and their properties. Algebra solves problems by using letters or symbols to stand for quantities.

Angle A measure of the turn between two lines around a common point (see diagram). Angles can be measured in degrees with a protractor. A full turn is 360 degrees (360º).



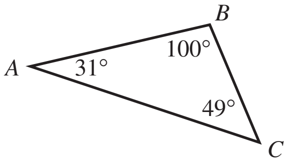
Angle sum The total of all interior angles of a polygon.

The **angle sum of a quadrilateral** is 360°. That is, the four interior angles always add to 360°. For example:



$$57° + 108° + 76° + 119° = 360°$$

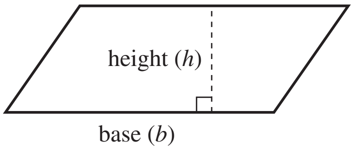
The **angle sum of a triangle** is 180°. That is, the three interior angles always add to 180°. For example:



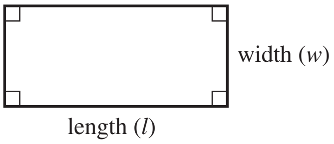
$$31° + 100° + 49° = 180°$$

Area The surface covered by any two-dimensional (2D) shape. Area can be measured in mm^2, cm^2, m^2, hectares or km^2, etc.

Area of a parallelogram is calculated by:
base × perpendicular height, or $A = b \times h$.

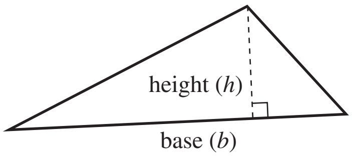


Area of a rectangle is calculated by:
length × width, or $A = l \times w$.



Area of a triangle is calculated by:

half × base × height, or $A = \frac{1}{2} \times b \times h$.



Average A number that represents a measure of central tendency of a set of statistical values. The most common type of average is the *mean*, which is found by adding all the values and then dividing by the number of values. Other types of numbers that measure central tendency are *median* and *mode*.

Axes The plural of *axis*. The *x*- and *y*-axes are the horizontal and vertical lines used for measurement on a Cartesian plane.

Bar graph A statistical graph that uses horizontal bars to represent data. See also *Column graph*.

Base In index notation, the base is the number that is being multipled by itself. (See *Index notation*.) In geometry, the base (*b*) is the length of the side of a polygon that is perpendicular to the height (*h*).

Bearings Compass directions used to identify the location of an object relative to another object. See *True bearings* and *Compass bearings*.

BODMAS A set of rules for calculating according to the **order of operations**:

- **B** Work out the calculations inside the brackets first. If there is more than one operation inside the brackets, they must also follow the rules of BODMAS.
- **O** If the question contains fractions of or powers of, then these are calculated next.
- **D** Work out the division and
- **M** Multiplication calculations, working from left to right.
- **A** Work out the addition and
- **S** subtraction calculations, working from left to right.

Cartesian plane A system of mapping points on a flat surface or graph according to two coordinates (*x*, *y*). This system was invented by mathematician René Descartes.

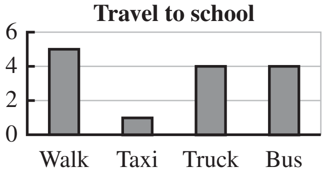
Centimetre A metric length (abbreviation: 1 cm) equivalent to one one-hundredth ($\frac{1}{100}$) of a metre, or 10 millimetres (10 mm).

Certain The probability of an event that will definitely occur. On a probability scale 0 to 1, a certain outcome has the value of 1.

Chance The likelihood of an event happening. Used in probability.

Coefficient In algebra, a number written in front of a pronumeral. (See *pronumeral*.) For example, in 4*ab*, the coefficient is 4.

Column graph A statistical graph that uses vertical columns to represent data. Sometimes called a vertical bar graph. (See also *Bar graph*.) An example of a column graph is shown here.



Compass bearings A direction that is taken from a fixed point and is measured in degrees (symbol °). For example, the bearing for north is either 000° or 360°, east is 090° and south-west is 225°. Bearings are usually spoken with three figures, to ensure accurate communication. (See also *Bearings* and *True bearings*.)

Complementary angles Two angles that add to 90°.

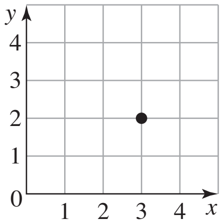
Composite number A number that is not a prime number. Examples are 6, 25 or 400. Composite numbers have more than two factors (e.g. factors of 6 are 1, 2, 3 and 6; factors of 25 are 1, 5 and 25), whereas prime numbers have only two factors (themselves and 1), See also *Prime number*.

Constant In algebra, another name for 'number' – it means a number itself, with no pronumeral.

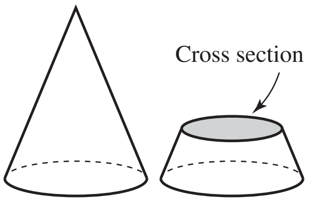
Continuous numerical data Data such as time or distance that can be represented as a continuous line on a graph. (See also *Discrete numerical data*.)

Coordinate plane A graph consisting of a grid and *x*- and *y*-axes.

Coordinates Numbers or letters used to show location on a grid. For example, the coordinates of the point shown below are (3, 2). The first coordinate refers to the horizontal position (*x*-axis), the second coordinate refers to the vertical position (*y*-axis). Maps also use coordinates.



Cross section The face that is obtained when a three-dimensional shape has been cut through (across the long axis). For example: the cross section of this cone is a circle.



Data Information that has been collected, such as a set of numbers or facts, or the results of a survey.

Day A 24-hour time period. The time it takes the Earth to rotate once on its axis.

Decagon A two-dimensional shape with 10 straight sides: a 10-sided polygon.

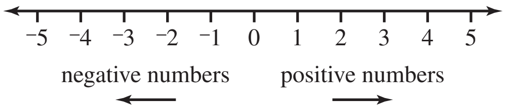
Decimal A number system with a base of ten. A decimal point is used to separate whole numbers from decimal fractions.

Denominator The number below the line in a fraction. It tells how many parts make up the whole. For example, in the fraction $\frac{1}{3}$, 1 is the numerator and 3 is the denominator.

Die Singular of *dice*. A die is one cube marked with dots or numbers from 1 to 6.

Digit A symbol used to represent a numeral. For example, 7 is a one-digit number and 276 is a three-digit number.

Directed numbers Signed numbers associated with points on the number line. Numbers to the right of zero are called positive numbers, and those to the left are negative numbers.



Discrete numerical data Data that records countable or whole-number items. An example is the number of children in a family – this is not continuous data, but is discrete. (See also *Continuous numerical data*.)

Distributive law Says that, to remove (expand) the brackets from an equation, multiply the term outside the brackets by each term inside the brackets. For example, $a(b + c) = a \times b + a \times c$.

If $a = 2$, $b = 5$ and $c = 7$,
then $a \times (b + c) = 2 \times (5 + 7) = 2 \times 12 = 24$.
Also, $a \times b + a \times c = 2 \times 5 + 2 \times 7 = 10 + 14 = 24$.

Dividend The number that is divided by a divisor in a division calculation. For example, in the calculation $16 \div 2 = 8$, the dividend is 16.

Dividing by decimals Classroom methods for dividing a number by a decimal require the divisor to be a whole number. So the first step is to convert the dividend and divisor into an equivalent fraction. For example:
$6 \div 1{\cdot}5 = \frac{6}{1{\cdot}5} = \frac{6 \times 10}{1{\cdot}5 \times 10} = \frac{60}{15} = 4$.

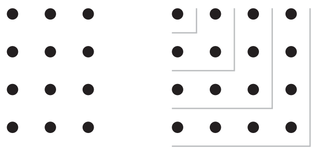
Dividing by fractions The first step is to convert any mixed fractions to improper fractions. The divisor is then reciprocated (inverted, or turned upside-down) and the calculation becomes a multiplication. For example:
$2\frac{1}{2} \div \frac{1}{4} = \frac{5}{2} \div \frac{1}{4} = \frac{5}{2} \times \frac{4}{1} = \frac{5 \times 4}{2 \times 1} = \frac{20}{2} = 10$. Explanations such as 'There are 10 quarters in two-and-a-half' can be helpful here.

Divisibility rule A number is *divisible* if it can be divided without a remainder. For example: 6 is divisible by 6, 3, 2 and 1 but not by 5, because $6 \div 5 = 1$ remainder 1. There are a number of tests that students can use to check whether a number is divisible. For example: 1000, 55 and 105 are all divisible by 5 because their ones or units place value is a 5 or 0. Divisibility tests are useful for checking for prime factors.

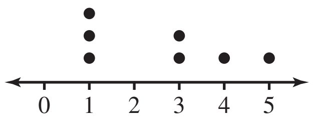
Division The mathematical operation that involves breaking up groups or numbers into equal parts. *Sharing* is another term to describe this operation. Other terms associated with division are: *quotient*, *divisor* and *dividend*.

Divisor The number that is to be divided into the dividend. For example, in the calculation $16 \div 2 = 8$, the divisor is 2.

Dot pattern An array of counters to help learners visualise sequences of number patterns. The example at left shows a multiplication: 3×4, and the example at right shows square numbers 1, 4, 9 and 16.



Dot plot A statistical graph illustrating data along a number line. For example, the numbers 1, 1, 1, 3, 3, 4, 5 can be represented as:



Doubling Making twice as much. Multiplying by two.

Equation In algebra, a mathematical statement that includes an equals (=) sign.

Equilateral triangle A triangle with three equal sides and three equal angles.

Equivalent fractions Fractions with the same value. For example: $\frac{3}{9}$, $\frac{4}{12}$ and $\frac{6}{18}$ are all equivalent to $\frac{1}{3}$.

Estimation An approximation. A useful skill to check whether the answer to a calculation is sensible. For example, because 19×31 is approximately 20×30, an answer close to 600 would be expected (19×31 is actually 589). Estimation can also be applied to measurements. For example, a sensible height for a door is 1·6 m, but 16 cm is not sensible.

Evaluate To find the value of an algebraic expression. For example, to evaluate $2f + 3c$ when $f = 4$ and $c = 7$, substitute the values: $2 \times 4 + 3 \times 7 = 8 + 21 = 29$.

Even number Any number that can be divided by 2 and not leave a remainder.

Event In statistics, an event is the result of one trial. For example, it might be the outcome of tossing a coin or rolling a die.

Expanding brackets In algebra, two expressions in brackets may be expanded by multiplying them, as in this example: $(a + b)(c + d) = a(c + d) + b(c + d) = ac + ad + bc + bd$. It may be necessary to simplify the expansion by combining like terms. For example: $(x + 3)(x - 2) = x(x - 2) + 3(x - 2)$
$= x^2 - 2x + 3x - 6 = x^2 + x - 6$

Expression A description of any combination of mathematical terms. Examples of expressions are: 7, $5 - 3$, $4y$, $x^2 - 3x + 8$ and $4(x + 7)$.

Exterior angle of a triangle The angle outside a triangle, formed when one of the sides of the triangle is extended. The exterior angle and the interior angle next to it add to 180º.

Factor Because $2 \times 4 = 8$, the numbers 2 and 4 are both factors of 8. That is, 8 is divisible by both 2 and 4. In algebra, because $3 \times y = 3$y, both 3 and y are factors of $3y$. Again, $3y$ is divisible by both 3 and y.

Fibonacci sequence A pattern of numbers where the next number in the sequence is the sum of the two previous numbers. Named after a famous mathematician, Fibonacci's sequence starts like this: 1, 1, 2, 3, 5, 8, 13, 21, …

Flow chart A set of instructions in a chart form. Instructions are often written in quadrilateral-shaped boxes and linked with arrows. Question boxes may determine the flow through the chart according to whether the answer is 'yes' or 'no'.

Formula (formulae) A rule or principle expressed in algebraic symbols. For example, the formula for the area of a rectangle is $A = l \times w$. The plural of formula is formulae.

Fraction A part of a whole. Can be written either as a common fraction or as a decimal fraction. For example, three-quarters of 15 is calculated as:
$\frac{3}{4} \times 15 = \frac{3}{4} \times \frac{15}{1} = \frac{3 \times 15}{4 \times 1} = \frac{45}{4} = 11\frac{1}{4}$ or 11·25

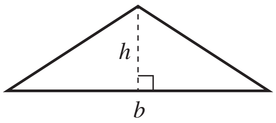
Frequency How often something has happened in the past. See also *Relative frequency*.

Gram A metric unit of measurement for mass. Written as g. There are 1000 g in a kilogram.

Greater than A symbol (>) used to show the relationship between numbers. For example, $8 > 1$ means '8 is greater than 1'.

Halving Dividing by 2.

Height The distance measuring the altitude (*h*) of a polygon; height is perpendicular to the base (*b*).



Hexagon A six-sided polygon.

Highest common factor The largest number that is a divisor of a set of numbers. For example, the highest common factor of 30 and 24 is 6, because the factors of 30 are 1, 2, 3, 5, 6, 10, 15 and 30, and the factors of 24 are 1, 2, 3, 4, 6, 12, 24, and 6 is the largest factor that is common to both. Also called the greatest common factor.

Hour A unit of measurement of time. One hour equals 60 minutes.

Impossible The probability of an event that will definitely not occur. On a probability scale of 0 to 1, an impossible outcome (such as rolling the number 8 with a standard die) is given the value of 0.

Improper fraction A fraction with a larger numerator than denominator. An improper fraction is often simplified by changing it into a mixed fraction. For example, $\frac{13}{4}$ is an improper fraction that is equivalent to the mixed fraction $3\frac{1}{4}$. Sometimes called a vulgar fraction.

Index The superscript number in index notation. See *Index notation*.

Index notation A method of writing a number that is multiplied by itself. For example: $y \times y \times y$ written in index notation is y^3, where 3 is the index.

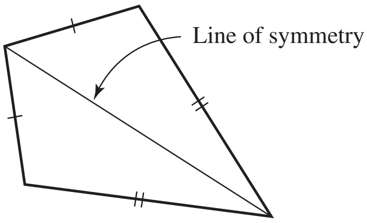
Intersection In geometry, the point where two or more lines meet.

Isosceles triangle A triangle with two equal sides and two equal angles.

Kilogram A metric measurement for mass. Abbreviation: kg. One kilogram is equal to a thousand grams.

Kilometre A metric measurement for distance. Abbreviation: km. One kilometre is equal to a thousand metres.

Kite A quadrilateral with two pairs of equal sides and only one line of symmetry.



Leap year A year in which there are 366 days, not 365. Occurs every fourth year.

Length The measurement of a line, or the longer measurement of a shape.

Less than The symbol <. For example: 3 < 7 means 3 is a smaller number than 7.

Like terms In algebra, like terms are mathematical terms that include the same pronumeral(s). For example: 4*ab* and 27*ab* are like terms.

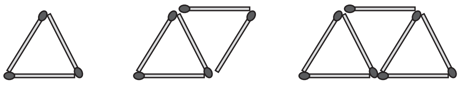
Likely A term used in probability to indicate that an outcome might occur but is not certain.

Line graph A graph formed by line segments that join a series of points representing data.

Lowest common multiple The smallest number that is a multiple of a set of two or more numbers. For example, the lowest common multiple of 4, 5 and 10 is 20.

Mass The amount of substance in an object. Common mass measurements are grams (g), kilograms (kg) and tonnes (t). (Mass is also commonly referred to as 'weight', athough strictly speaking, this is scientifically incorrect.)

Match pattern A diagram using matches to illustrate a number pattern. For example, 3, 5, 7 … might be represented as:



Mean The mean of a set of scores is the *sum* of the scores divided by the *number* of scores. (The term *average* is sometimes used instead of *mean*.)

Median The number that comes in the middle of a set of scores when they are placed in order.

Metre A metric unit of measurement for length. 1 metre equals 100 centimetres (1 m = 100 cm).

Metric system A system of measurement. The basic units are the metre (length), the gram (mass) and the litre (volume or capacity).

Milligram A thousandth of a gram. Abbreviation: mg.

Millimetre A thousandth of a metre. Abbreviation: mm. There are 10 millimetres in one centimetre.

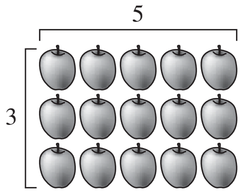
Minute A measure of time that is one sixtieth of an hour. A minute is equivalent to 60 seconds.

Mixed number A number that is made up of a whole number and a fraction. For example: $5\frac{3}{8}$

Mode The number that appears most often in a set of data.

Month Approximately four weeks of time; varies between 28 and 31 days. There are 12 months in a year.

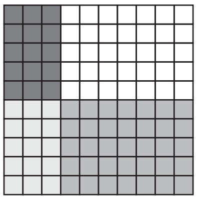
Multiplication The operation to find the product of two numbers. A word commonly used to mean 'multiply by' is 'times'. The basic idea of multiplying is repeated addition. For example: 3 × 5 = 5 + 5 + 5 = 15.



15 apples

Multiple A number that has a factor. For example, the factors of 6 are: 1, 2, 3 and 6, so 6 is a multiple of 2. It is also a multiple of 1, 3 and 6.

Multiplying decimals For **multiplying decimals less than 1**, multiplication can be illustrated by shading areas within a unit square that has been divided into 100 squares. Each small square is 0·01. For example, 0·3 × 0·5 = 0·15 is shown in the diagram below, where 0·3 is shaded dark grey, 0·5 is coloured medium grey, and the product 0·15 is the pale grey overlap.



For **multiplying decimals greater than 1**, use the same long multiplication method as for whole numbers, and then divide by 10 for each digit after the decimal point in the original numbers. For example:

1·2 × 3·05
= (12 × 0·1) × (305 × 0·01)
= (12 × 305) × (0·1 × 0·01)
= 3660 × 0·001
= 3·660 or 3·66

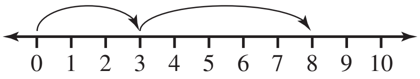
Check whether the answer is sensible by rounding: 1 × 3 = 3

Multiplying fractions The standard method is to convert both numbers to improper (or vulgar) fractions, multiply the numerators and the denominators separately, and convert the product back to a mixed fraction. For example:

$$6\frac{1}{4} \times 8\frac{2}{3} = \frac{25}{4} \times \frac{26}{3} = \frac{25 \times 26}{4 \times 3} = \frac{650}{12} = 54\frac{2}{12} = 54\frac{1}{6}$$

Negative number A number that has a value less than zero. A minus sign is placed in front of the number to identify it. Examples are: $^{-}5$, $^{-}67$.

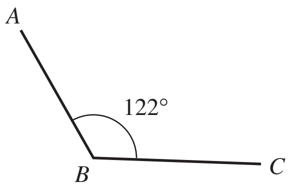
Number line A line on which numbers are marked. Number lines can be used to represent operations. For example: 3 + 5 = 8 can be shown on the number line as:



Number patterns Any arrangement of numbers, pictures or symbols that indicates patterns or relationships between numbers. See also *Dot patterns*.

Numerator The number above the line in a fraction; indicates how many parts of the whole. For example, in the fraction $\frac{2}{3}$, 2 is the numerator (3 is the denominator). See *Denominator*.

Obtuse angle An angle between 90° and 180°.



Obtuse-angled triangle A triangle with an obtuse angle (>90° but <180°).

Octagon An eight-sided polygon.

Odd number A number that has a remainder of 1 when divided by 2. For example: 1, 3, 5, 7, 9, 11, 13 are odd numbers.

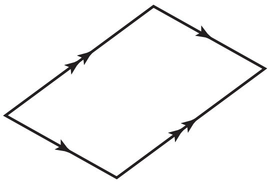
Order of operations See *BODMAS*.

Ordered pair The format in which *x*- and *y*-coordinates are written – that is, in brackets, with the *x*-coordinate first: (*x*, *y*).

Origin The point on a Cartesian plane (coordinate plane) where the *x*-axis and *y*-axis intersect. The coordinate of the origin is (0, 0).

Outcome The result of any chance event. For example, an outcome of throwing a die could be: 'rolling a 5'.

Parallelogram A quadrilateral with two pairs of parallel sides. A rhombus is a special type of parallelogram.



Pentagon A five-sided polygon.

Percentage A fraction of 100. *Per cent* means 'out of a hundred'. For example: 65% means 65 out of 100.

Perigon A revolution, or an angle of 360 degrees.

Perimeter The total distance around a polygon. The perimeter of a circle is its circumference. The perimeter of a field is the sum of the lengths of each side.

Perpendicular At right angles to.

Pie graph A circular graph used to represent how the whole of something is divided up. The parts look like parts of a cake. Also known as a circle graph, a pie chart or a sector graph.

Place value The value of a digit, depending on its place in a number. For example, in the number 328·5, the digit 3 has a place value of 300, 2 has a value of 20, 8 has a value of 8, and 5 has a value of 0·5.

Polygon A closed, two-dimensional shape with three or more angles or sides. Examples are: triangle, rectangle, pentagon and hexagon.

Positive number A number that has a value greater than zero. A plus sign is sometimes placed in front of the number to identify it. If there is no sign, it is assumed to be a positive number. Examples: $^{+}5$, 67.

Possible A description for an outcome that has some chance of occurring.

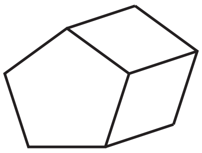
Power Also known as index. The number of times a number is multiplied by itself. See *Index notation*.

Predict Guess or estimate a statistical outcome of an event using knowledge of the likely probabilities.

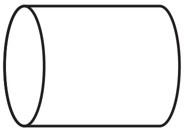
Prime factor A factor of a number that is also a prime number. For example, the prime factors of 42 are 2, 3 and 7. This is because 42 = 2 × 3 × 7, and 2, 3 and 7 are all prime numbers.

Prime number A natural number that has no other factors except 1 and itself. For example: 2, 3, 5, 7, 11, 13, 17, 19, 23… are prime numbers. 1 is not considered a prime number.

Prism A three-dimensional solid with two similar, parallel ends joined by rectangular faces. Two examples of prisms are a pentagonal prism and a cylinder, both shown here:



Pentagonal prism



Cylinder

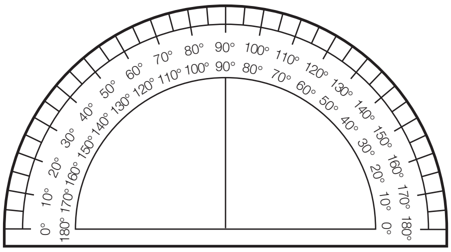
Probability The chance or likelihood that something will occur.

Product The answer of a multiplication calculation.

Pronumeral In algebra, a pronumeral (or variable) is the letter or symbol that stands for an unknown number. For example, in 5*y* – 3 = 7, the pronumeral is *y*.

Proper fraction A fraction with a numerator smaller than the denominator. For example, $\frac{3}{5}$ and $\frac{1}{9}$ are proper fractions, $\frac{5}{3}$ and $\frac{22}{7}$. See also *Improper fractions*

Protractor A tool (shown here) for measuring angles in degrees.



Quadrilateral Any four-sided polygon.

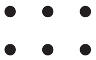
Quotient The answer of a division calculation. For example, in the calculation 16 ÷ 2 = 8, the quotient is 8.

Random A term used to describe events in which all outcomes have a fair chance of being picked – e.g. choosing a name from a box, or rolling a die.

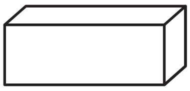
Range A statistical measurement found by subtracting the smallest data value from the largest. For example, for the data: 6, 4, 3, 7, 9, the range is 9 – 3 = 6.

Rectangle A four-sided polygon with four right angles and two pairs of parallel sides. An oblong is a rectangle with two sets of parallel sides of different lengths. A square is a special rectangle with all sides of equal length.

Rectangular number A number that can be represented by dots or other symbols in the shape of a rectangle. For example, the number 6 can be represented as:



Rectangular prism A three-dimensional prism with two similar rectangular ends, like the example shown here.



Reflex angle An angle between 180° and 360°.

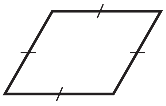
Regular polygon A polygon with all sides and angles equal. Examples are an equilateral triangle and a square.

Relative frequency A fraction consisting of the frequency of a past outcome as numerator and the total number of past outcomes as the denominator.

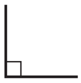
Remainder The whole number left over after a number has been divided. For example: 17 ÷ 5 = 3 remainder 2.

Revolution An angle of 360 degrees. Also known as a perigon.

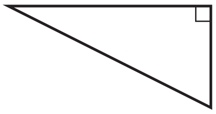
Rhombus A quadrilateral with four equal sides and two diagonal lines of symmetry. A square is a special form of rhombus.



Right angle An angle of 90°. Often marked as a square in a diagram.



Right-angled triangle A triangle that includes a right angle.

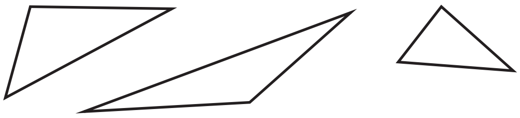


Roman numerals The notation system used by the ancient Romans. The first ten symbols are: I, II, III, IV, V, VI, VII, VIII, IX, X. Other symbols are L (50), C (100), D (500) and M (1000).

Rounding numbers To approximate an exact number to a more convenient or sensible value. For example, when a metre of ribbon is cut into three equal lengths, each part would be 33·333 cm long. This would be more sensibly rounded to 33·3 cm, which is to one decimal place.

Scale diagram A diagram such as a plan or map on which each feature is represented according to a suitable scale. For example: a house plan might have a scale 1:100 where 1 cm on the plan represents 100 cm in the actual house.

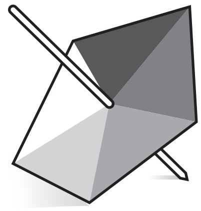
Scalene triangle A triangle with sides of different lengths and angles of different sizes. Some examples are shown.

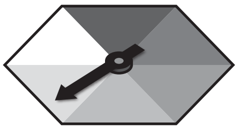


Second A sixtieth part of a minute; or a position between first and third.

Sector graph See *Pie graph*.

Spinner A device such as a top (shown at left) or a spinning arrow (shown at right) to determine random outcomes.





Square A quadrilateral with all four sides equal in length and each angle 90º.

Square number The product of a number multiplied by itself. For example: $2^2 = 2 \times 2 = 4$, $13^2 = 13 \times 13 = 169$.

Square root The square root of a number is a value that can be multiplied by itself to give the original number. For example: the square root of 9 is 3, because 3 × 3 = 9. The symbol for square root is $\sqrt{\ }$ so $\sqrt{9} = 3$. This is spoken as 'The square root of 9 equals 3'.

Squares and square roots of fractions Found by calculating the square (or square root) of the numerator and denominator separately, then simplifying the answer. For example:

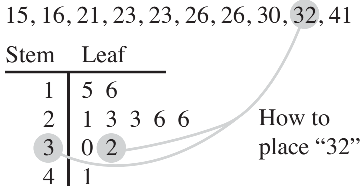
$$\left(\frac{3}{4}\right)^2 = \frac{3}{4} \times \frac{3}{4} = \frac{3 \times 3}{4 \times 4} = \frac{9}{16}$$

and:

$$\sqrt{\frac{16}{9}} = \frac{\sqrt{16}}{\sqrt{9}} = \frac{4}{3} = 1\frac{1}{3}$$

Statistics The branch of mathematics that deals with probability.

Stem-and-leaf plot A form of statistical graph where each data value is split into a 'leaf' (usually the last digit) and a stem (usually the other digits). For example: 32 would be split into '3' on the stem and '2' (the leaf). The 'stem' values are listed vertically, and the 'leaf' values horizontally. This groups the scores according to the 'stems' and the 'leaf' scores are ordered according to size.



15, 16, 21, 23, 23, 26, 26, 30, 32, 41

Stem	Leaf
1	5 6
2	1 3 3 6 6
3	0 2
4	1

How to place "32"

Straight angle An angle along a straight line, 180º.

Substitution The replacement of a variable by a numeral. For example: a formula to calculate the profit (P) on the cost (C) of an item might be $P = 0{\cdot}1C$. Calculation of the profit for an item costing 150 Vatu requires the substitution of $C = 150$ into the formula. That is, $P = 0{\cdot}1 \times 150 = 15$ Vatu.

Subtracting decimals This is done in the same way as subtracting whole numbers, but ensuring that the place values (and the decimal points) line up vertically. For example: 234·6 – 61·35 is calculated as:

$$\begin{array}{r} 234{\cdot}6 \\ -\ \ 61{\cdot}35 \\ \hline 173{\cdot}25 \\ \hline \end{array}$$

Subtracting fractions The same method is used as for adding fractions, while noting that the final step involves finding the difference of the numerators but not the denominators.

Subtraction The operation to find the difference of two numbers. The term 'subtract' is the same as 'take away' and 'minus'.

Supplementary angles Two angles whose sum is 180º. Each angle is the supplement of the other.

Survey The collection of statistical data, usually requiring the recording of the answers to a series of questions.

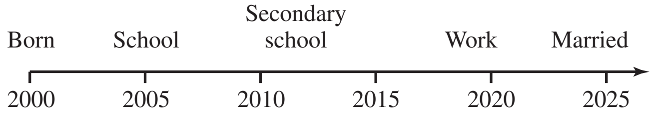
Term In algebra, a term is part of a mathematical expression. See *Expression*.

Theoretical probability An estimation of the probability of an outcome based on theoretical factors. For example, the theoretical probability of throwing a 'head' with one toss of a coin is $\frac{1}{2}$, so if the coin was tossed 100 times, the expected number of 'heads' would be 50. In practice, it is likely that the number of 'heads' would not be exactly 50, which is why the probability is theoretical.

Three-dimensional A solid shape, having three dimensions – width, length and height.

Time zones Regions on the Earth that share the same time. The time differences usually vary according to longitude.

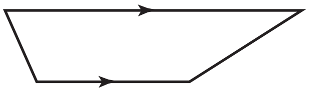
Timeline A line that represents a period of time. Intervals of time can be shown on the line. For example:



Timetable A reference table for the expected time of particular events. Examples are the school timetable of lesson times, a TV/radio timetable for programme times, or a boat timetable for sailing times.

Tonne A metric unit of mass; 1 tonne = 1000 kilograms.

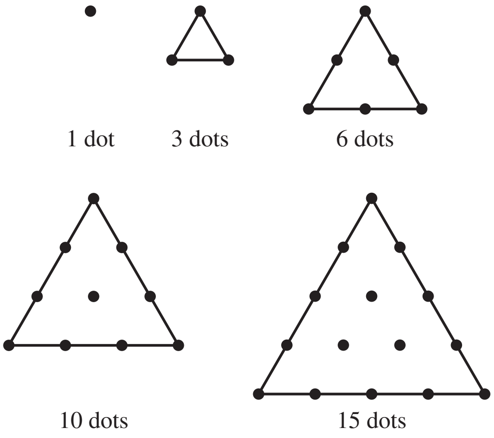
Trapezium A quadrilateral with only one pair of parallel sides.



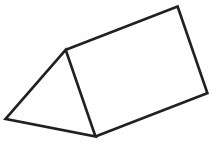
Tree diagram A branching diagram to calculate combinations or probabilities. For example: A girl has 3 tops and 2 skirts, all of different colours. A tree diagram can show how many different combinations of a top and a skirt she can wear.

Triangle A polygon with three straight sides and three angles.

Triangular numbers A number that can make a triangular dot pattern. For example: 1, 3, 6, 10 and 15 are triangular numbers.



Triangular prism A solid with two triangular ends that are parallel to each other and three rectangular sides. For example:



True bearings The angle of a turn measured clockwise from north, e.g. 065°. See also *Compass bearings* and *Bearings*.

Two-dimensional A flat shape, having two dimensions – width and length only (no height). Solid shapes have three dimensions, while flat shapes have only two dimensions.

Two-way table A table with rows and columns showing the results of all the possible combinations. This table showing multiplications is an example:

×	**1**	**3**	**5**	**7**
1	1	3	5	7
3	3	9	15	21
5	5	15	25	35
7	7	21	35	49

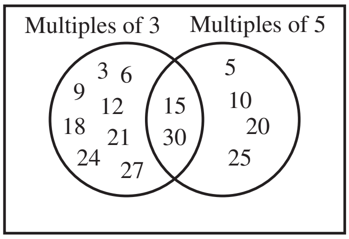
Unknown In algebra, an unknown is a number that is represented by a pronumeral. See *Pronumeral*.

Unlike terms In algebra, unlike terms are mathematical terms that do not include exactly the same pronumeral(s). For example: *ab* and *xy* are unlike terms.

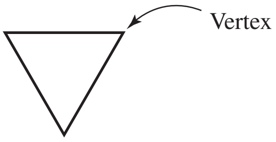
Unlikely A term, used in probability, for an outcome that has little chance of occurring.

Variable See *Pronumeral*.

Venn diagram A diagram using overlapping circles to show how two or more items are linked according to certain properties. For example:



Vertex A point where two or more lines meet to form an angle.



Volume The amount of space occupied by a three-dimensional object. The basic units for measuring volume are cubic metres (m^3), cubic centimetres (cm^3) litres (L) and millilitres (mL).

Volume of a prism Calculated by multiplying the area of the end of a prism by the length of the prism. $V = A \times d$, where *A* is the area of the cross-section and d is the distance between the two end faces

Week A time period of seven days.

Width The shorter side of a rectangular shape. Sometimes called *breadth*.

***x*-axis** The horizontal scaled axis on a Cartesian plane. The *x*-axis intersects the vertical *y*-axis at the origin (0, 0), from which all points on the graph are referenced by coordinate pairs (*x*, *y*).

x*-coordinate** A number representing the horizontal distance a point is from the origin (0, 0) on a Cartesian plane. The first term of a coordinate pair (x***, *y*).

***y*-axis** The vertical scaled axis on a Cartesian plane.

y*-coordinate** A number representing the vertical distance a point is from the origin (0, 0) on a Cartesian plane. The second term of a coordinate pair (*x*, ***y).

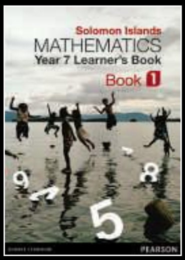
Year A unit of time, based on the amount of time it takes the Earth to orbit the Sun. There are 365 days in a year, or 366 days in a leap year. January 1 is the first day of the year.

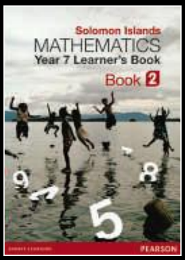
Solomon Islands
MATHEMATICS
Year 7 Teacher's Guide

This *Solomon Islands Mathematics Year 7 Teacher's Guide* has been written to provide additional support and resources for teachers to assist them in covering the Solomon Islands Secondary Mathematics Years 7 to 9 Syllabus and has been designed to accompany and enhance the approach of the *Solomon Islands Mathematics Year 7 Learner's Book*.

There are 14 chapters in this Teacher's Guide, with an overview for each chapter, including chapter skills that shows the scope and sequences to be covered and a teaching plan that aims to assist the teacher to effectively teach the Specific Learning Outcomes and General Learning Outcomes in the syllabus. Each chapter in the Teacher's Guide corresponds to a chapter in the Learner's Book and includes useful teaching tips, remedies for common learner difficulties, starter activities, additional examples and fully worked solutions, additional assessment activities and chapter tests.

Mathematics is a very practical subject and is part of everyday life for Solomon Islanders. We use mathematical skills and knowledge in many situations inside and outside of the classroom. The mathematical knowledge and skills that are developed are essential for all Solomon Islanders to fully participate in life, both at school and in their communities now and in the future as adults.





solomon islands
CURRICULUM DEVELOPMENT DIVISION

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