Foundation Mathematics

Unit 3

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Note to Teachers

About This Book

This book is the third in the Foundation Mathematics series, designed to help older students to learn to become more numerate in their daily lives; in their personal life and in work, education and community aspects of their lives. This book is broken into sections, with each linked to a content area from the Mathematics Foundation Course and the Australian Curriculum.

Planning Across the Semester

This book is designed to be used for one school semester. Some students may need to move more slowly through the content, and some might need to move faster. The schedule below is a guide only, and should be modified to suit the needs of your students.

One semester consisting of 20 weeks of classes, with 5 lessons per week = 100 lessons. Ten of these may be allocated to assessment or other activities. Therefore this schedule is based on 90 lessons (of 45–60 minutes).

Section	Number of lessons allocated
1 The four operations: whole numbers and money; fractions and decimals	50
2 Percentages linked with fractions and decimals	20
3 Location, time and temperature	10
4 Space and design	10

The content is arranged in order and builds from one section to the next, and from one topic to the next. Therefore it is suggested that students work through the book in the order of presentation. However, some sections could, and should be revisited throughout the semester.

The Mathematics Foundation Course

The Mathematics Foundation Course consists of the following four units. This book supports the third unit.

<table>
<tr><th>Unit One</th><th>Unit Two</th><th>Unit Three</th><th>Unit Four</th></tr>
<tr><td>1.1: Whole numbers and money</td><td>2.1: Understanding fractions and decimals</td><td>3.2: Percentages linked with fractions and decimals</td><td rowspan="2">4.1: Rates and ratios</td></tr>
<tr><td>1.2: Addition and subtraction with whole numbers and money</td><td>2.2: Multiplication and division with whole numbers and money</td><td>3.1: The four operations: whole numbers and money
3.3: The four operations: fractions and decimals</td></tr>
<tr><td>1.3: Length, mass and capacity
1.4: Time</td><td>2.3: Metric relationships
2.4: Perimeter, area and volume</td><td>3.4: Location, time and temperature
3.5: Space and design</td><td></td></tr>
<tr><td>1.5: Data, graphs and tables</td><td>2.5: The probability of everyday events</td><td></td><td>4.2: Statistics and probability</td></tr>
<tr><td></td><td></td><td></td><td>4.3: Application of the Mathematical Thinking Process</td></tr>
</table>

The course is designed to support students to learn, not only the mathematics content, but the mathematical thinking and decision making processes they will need as adults. This is integrated into this book and throughout the course.

For more information about the WACE Mathematics Foundation Course and Assessment ideas go to:

http://wace1516.scsa.wa.edu.au/mathematics/

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Section One

The Four Operations – Whole Numbers and Money

Content Focus

Mathematics Foundation	Australian Curriculum Link
3.1.1 Plan to solve an everyday problem involving whole numbers and/or money by selecting: • whether an estimation or accurate answer is needed • the relevant numbers • one of the operations • calculator or spreadsheet	ACMNA031 Recognise and represent multiplication as repeated addition, groups and arrays
3.1.2 Understand and use the relationships between the four operations to assist in calculations.	ACMNA054 Recognise and explain the connection between addition and subtraction
3.1.3 Choose and use the appropriate operation and strategy to efficiently solve a problem on a calculator or spreadsheet	ACMNA083 Use equivalent number sentences involving addition and subtraction to find unknown quantities
3.1.4 Choose and use the appropriate operation and strategy to efficiently solve a problem mentally, using informal jottings to keep track if needed	ACMNA099 Use estimation and rounding to check the reasonableness of answers to calculations
3.1.5 Determine the order of operations when solving problems involving multistep calculations	ACMNA121 Use equivalent number sentences involving multiplication and division to find unknown quantities
3.1.6 Use properties of operations to anticipate the effect of operations on numbers	ACMNA123 select and apply efficient mental and written strategies and appropriate digital technologies to solve problem involving all four operations with whole numbers
3.1.7 Use estimation strategies, including rounding, when an accurate answer is not required	ACMNA134 Explore the use of brackets and order of operations to write number sentences
3.1.8 Determine whether an answer is reasonable by using properties of operations, estimation and the context of the problem	ACMNA291 Use efficient mental and written strategies and apply appropriate digital technologies to solve problems
3.1.9 Communicate solutions and processes used to reach solutions using language and symbols consistent with the context	

Topic 1

Choosing an Operation to Solve Everyday Problems

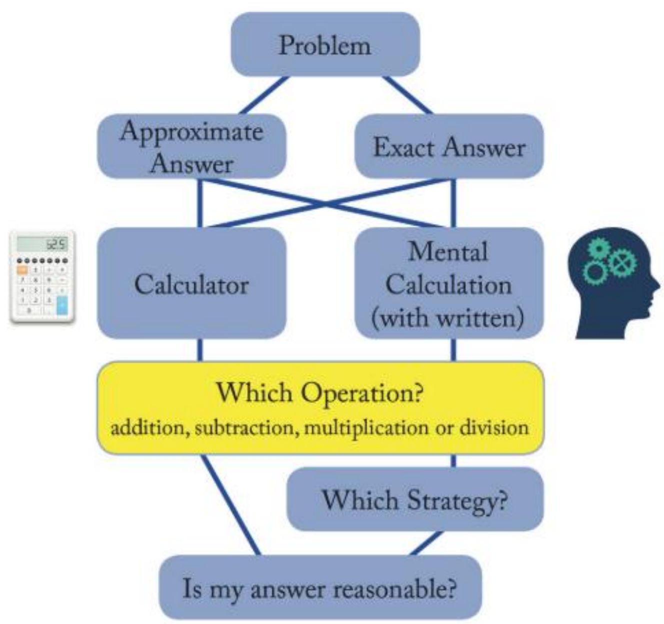
Mathematics Discussion

When solving problems, we make many decisions. The list of decisions is shown in the flow chart below. In this section, we will be focussing on which operation: addition, subtraction, multiplication or division to choose, in order to solve everyday problems.

In order to help us choose the operation, we will be using part–part whole and array diagrams to represent different kinds of problems.

Let's think back to what we learnt about choosing operations in Units 1 and 2.

Addition and subtraction problems involve two types of quantities- a whole amount and some parts. For example, Tom's weekly rent is $370. He has $280. How much more does he need this week? We can write a number sentence to reflect how we think about the problem: $280 + ? = $370 and can then place the numbers in a Part-Part Whole diagram to determine whether to add or subtract, or indeed if we can do either.



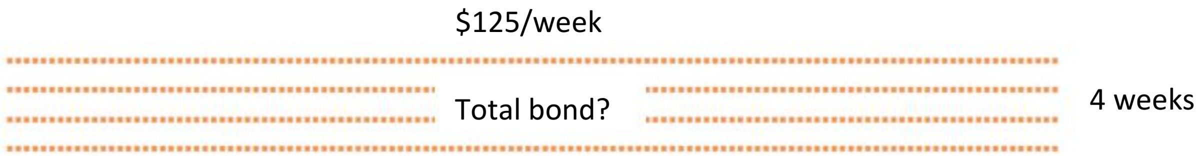
If the 'WHOLE' is missing we add. If one of the 'PARTs' is missing, we can add or subtract. However, if we decide to use a calculator we would use subtraction $370 – $280 =?

Note: $280 + ? = $370 and $370 – $280 = ? are equivalent number sentences as they both represent the problem.

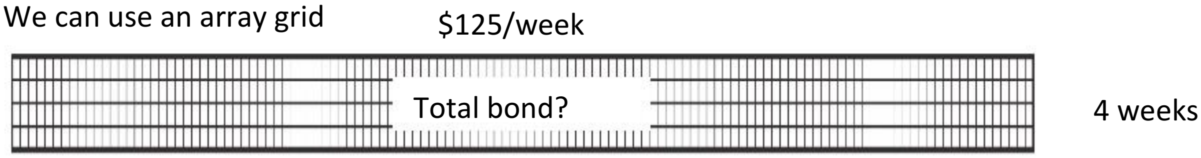
Multiplication and division problems involve three types of quantities: a TOTAL amount, a NUMBER OF GROUPS or PORTIONS and the SIZE OF EACH GROUP or PORTION. For example, Katie needs to pay 4 weeks rent for bond. If the rent is $125/week, how much is the bond?

In this problem, we know the size of the groups and the number of groups. We can represent the problem as an array in order to help us decide which operation to use. We can use different kinds of array diagrams to represent the problem.

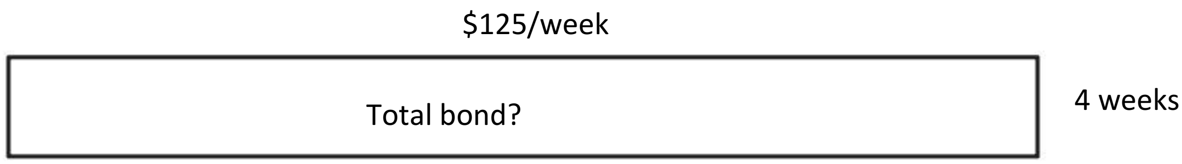
We can draw dots



We can use an array grid



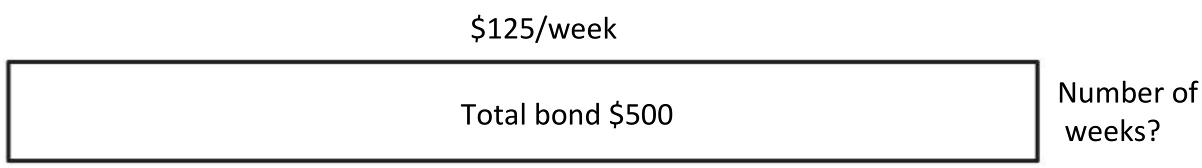
We can use a representation of an array grid so we do not have to draw in all the squares for larger number problems.



For efficiency, this last array is the representation we will use for multiplication and division problems.

We can see that for Katie's problem, we do not know the TOTAL amount and so the problem is a multiplication 4 x 125 = ?

If, for example, we knew the total bond ($500) and the rent per week ($125) and wanted to know how many weeks of rent the bond was worth, we could write this number sentence, $125 × ? = $500. We could then place the numbers in the diagram as follows:



We know that the:

SIZE OF EACH GROUP × NUMBER OF GROUPS = TOTAL

- If the TOTAL is missing, we use MULTIPLICATION
- If the TOTAL is present, we use DIVISION

As the TOTAL is present, we use division. The number sentence we would enter in a calculator would be $500 ÷ $125 = ?

Note: $125 × ? = $500 and $500 ÷ $125 = ? are equivalent number sentences as they both represent the problem.

Whole Class Activity 1

Think: What key information in a problem helps us know that addition or subtraction is involved?

The following is a copy of a receipt that Bree got when she went shopping at her local supermarket.

We can create addition or subtraction word problems using data from this receipt. It helps to know that addition and subtraction problems involve changing an amount by adding some more or taking some away, thinking of an amount as a combination of two or more parts, comparing amounts or making two amounts equal.

BREE'S SHOPPING RECEIPT	
Vee Washing Powder	\$7.38
Cree Washing Powder	\$6.99
Tins of tomatoes (\$1.50 each)	\$4.50
Plain Flour	\$1.80
Self-Raising Flour (4 packets)	\$8.60
Tubs of Butter (2 tubs)	\$7.30
TOTAL	\$36.51

For example, we can create a word problem that involves comparing two amounts:

PROBLEM: How much more did Bree pay for Vee Washing Powder than Cree Washing Powder?

We can write a number sentence that reflects the problem: e.g. \$6.99 + ? = \$7.38
We can also place the numbers into a Part–Part Whole diagram.

<table>
<tr><td>$6.99</td><td>?</td></tr>
<tr><td colspan="2">$7.38</td></tr>
</table>

A part is unknown, therefore we can subtract.
The number sentence we put in the calculator is \$7.38 – \$6.99. In the table below, create and write one word problem that uses addition to solve and one word problem that uses subtraction to solve, using two pieces of data from this receipt.

YOUR PROBLEMS

<table>
<tr><th>ADDITION PROBLEM</th><th>SUBTRACTION PROBLEM</th></tr>
<tr><td></td><td></td></tr>
<tr><td colspan="2">WRITE A NUMBER SENTENCE TO REFLECT THE PROBLEM</td></tr>
<tr><td></td><td></td></tr>
<tr><td colspan="2">PLACE THE NUMBERS USED IN EACH PROBLEM INTO THE PART–PART WHOLE DIAGRAMS</td></tr>
<tr><td></td><td></td></tr>
</table>

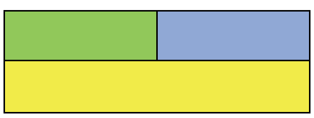
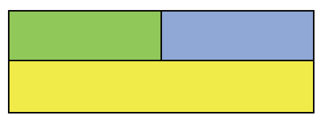
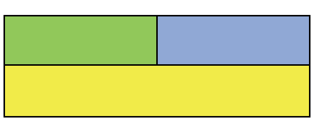
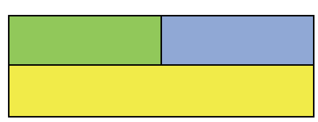
WRITE A NUMBER SENTENCE THAT YOU WOULD PUT INTO A CALCULATOR (THIS MAY OR MAY NOT BE THE SAME AS THE PREVIOUS NUMBER SENTENCE)	

Copy the two word problems you wrote, onto two blank A4 sheets of paper.

Pass the A4 sheets around the classroom. Choose 4 problems from other class members to copy into the table below. Choose two that use addition to solve and two that use subtraction.

Place the information from the problems into the Part-Part Whole models. Show your thinking in the table below.

CLASS PROBLEMS

ADDITION PROBLEMS	SUBTRACTION PROBLEMS
1. PROBLEM NUMBER SENTENCE TO REFLECT PROBLEM: PART-PART WHOLE DIAGRAM:  NUMBER SENTENCE TO ENTER IN CALCULATOR:	1. PROBLEM NUMBER SENTENCE TO REFLECT PROBLEM: PART-PART WHOLE DIAGRAM:  NUMBER SENTENCE TO ENTER IN CALCULATOR:
2. PROBLEM NUMBER SENTENCE TO REFLECT PROBLEM: PART-PART WHOLE DIAGRAM:  NUMBER SENTENCE TO ENTER IN CALCULATOR:	2. PROBLEM NUMBER SENTENCE TO REFLECT PROBLEM: PART-PART WHOLE DIAGRAM:  NUMBER SENTENCE TO ENTER IN CALCULATOR:

Compare your work in the table above with class members who chose the same problems.

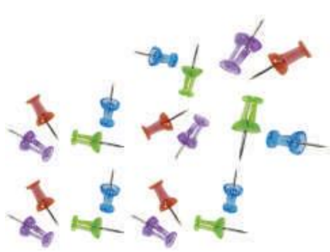
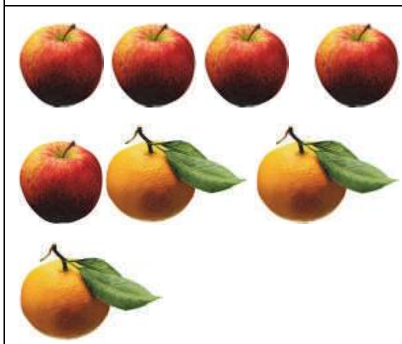
Were the ‘NUMBER SENTENCES TO REFLECT PROBLEM’ the same for all students? Were there any problems where you used an addition number sentence but another class member used subtraction? If so, would this change how the problem is solved? Discuss.

Did you write the numbers in the number sentences in the same order? Did this matter when solving the problems?

Did any students write problems in the table that were best solved using multiplication or division? What key information in a problem helps us know that addition or subtraction is involved?

Practice Exercise 1

1. Using the following diagrams, write one addition and one subtraction problem that could be applied to the picture. Remember, addition and subtraction problems are used when we change an amount by adding more or taking some away, think of an amount as a combination of two or more parts, compare amounts or make two amounts equal.

SITUATION	ADDITION PROBLEM	SUBTRACTION PROBLEM
		
		

2. Jessica made a list of items that she thought she needed to buy in order to start her new holiday part-time job at a local fast food restaurant.

Comfortable closed shoes	$65	A pair of black pants	$19.78
Company T-Shirt	$27.50	Travel card	$14.25 per week
Toiletries	$18	Lunch money	$7.50 per day.

The following questions all relate to Jessica's list. Circle the problems that are *best* solved using addition or subtraction.

a) How much do the shoes and the toiletries cost altogether?

b) Jessica decided to purchase a Travelcard for each week of her 8–week job. How much would this cost her?

c) How much more does a T-shirt cost than a pair of pants?

d) If Jessica had $60 saved, how many lunches could she buy?

e) Jessica had a $50 note and purchased one item from her list. She received $35.75 change. What did she buy?

f) Jessica bought a Travelcard and another item. The total cost of her purchases was $41.75. What was the other item that she bought?

3. For each problem you circled in Question 2:

A. Write a number sentence that reflects the problem

B. Circle addition or subtraction: PART missing (subtraction) or WHOLE missing (addition).

C. Write an equation that can be solved on a calculator. (This may be the same as A.)

Show all your working in the table below

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PROBLEM	WORKING
	A B ADDITION OR SUBTRACTION C
	A B ADDITION OR SUBTRACTION C
	A B ADDITION OR SUBTRACTION C
	A B ADDITION OR SUBTRACTION C

4. Danni set up a market stall selling punnets of berries at the Goomalling Farmer's Market

BLUEBERRIES	\$6.25 per punnet
STRAWBERRIES	\$4.85 per punnet
CRANBERRIES	\$12.50 per punnet
GOOSEBERRIES	\$7.99 per punnet

Circle the operation she would key into her calculator to find out:

- How much more expensive were blueberries than strawberries?
  6.25 ÷ 4.85 6.25 – 4.85 4.85 + 6.25 6.25 × 4.85 none of these

- How much change from a \$20 note she would give, if a person bought a punnet of cranberries?
  20 × 12.5 20 + 12.5 20 – 12.5 20 ÷ 12.5 none of these

- Danni paired and arranged punnets of gooseberries with punnets of strawberries. If there were 237 punnets of gooseberries and 115 punnets of strawberries, how many punnets of gooseberries does she have left over after the pairing?
  237 ÷ 115 237 – 115 237 + 115 115 × 237 none of these

- What is the cost of 7 punnets of cranberries?
  7 × 12.5 7 + 12.5 12.5 – 7 12.5 ÷ 7 none of these

- If at the end of the market, she returned 23 punnets of blueberries and 54 punnets of cranberries back to her van, how many more punnets of cranberries did she return than blueberries?
  23 – 54 54 ÷ 23 54 – 23 23 + 54 none of these

- Danni sold 46 punnets of cranberries. She was left with 27 punnets at the end of the market. How many did she have to start with?

  27 × 46 27 + 46 46 – 27 46 ÷ 27 none of these

Whole Class Activity 2

Think: What key information in a problem helps us know that multiplication and division is involved?

The following is a copy of a receipt that Bree got when she went shopping at her local supermarket.

BREE'S SHOPPING RECEIPT	
Vee Washing Powder	$7.38
Cree Washing Powder	$6.99
Tins of tomatoes ($1.50 each)	$4.50
Plain Flour	$1.80
Self-Raising Flour (4 packets)	$8.60
Tubs of Butter (2 tubs)	$7.30
TOTAL	$36.51

We can create multiplication and division word problems using data from this receipt. It helps to know that multiplication and division problems include repeated equal quantities, arrays, times as many problems, rates, or measurement problems (usually area or volume). Although division problems relate to the same situations they involve sharing or grouping.

An example of a problem that we could create using data on the receipt and the idea of 'times as many' could be:

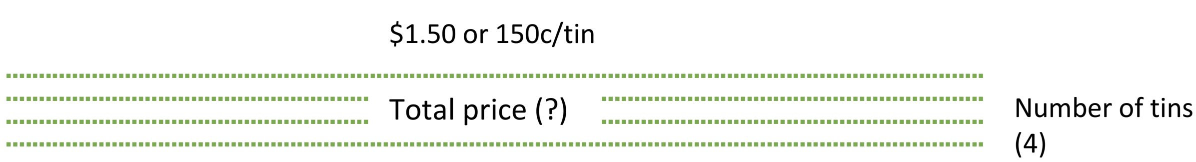
PROBLEM: Bree mentioned to her cousin living in a remote community, that tins of tomatoes cost $1.50. Her cousin complained bitterly that tins of tomatoes cost four times that much. How much were tins of tomatoes in the remote community?

We can write a number sentence that reflects the problem:

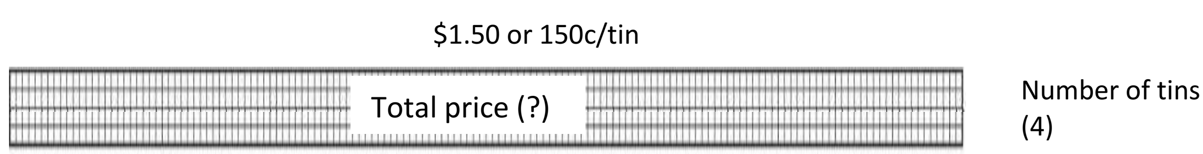
e.g. 4 × $1.50 =?

We can use different types of array diagrams to represent the TOTAL amount, the NUMBER OF GROUPS or PORTIONS and the SIZE OF EACH GROUP or PORTION.

For Bree's problem we can represent the individual cents, which is the size of the group, in an array with dots.



We can represent the individual cents in an array grid



We can use a representation of an array grid that does not show the size of each group as individual cents.

$1.50 or 150c/tin

Total price (?)

Number of tins (4)

From these array diagrams, we can see that we know the SIZE OF EACH GROUP or PORTION and the NUMBER OF GROUPS or PORTIONS. The TOTAL amount is missing, so we multiply. The multiplication is the same as above: 4 × $1.50 =?

The number sentence we put in the calculator is 4 × 1.50 = or 4 x 150 =

Another example of a multiplication or division problem that we could create using data on the receipt and repeated equal quantities could be:

PROBLEM: If Bree spent $4.50 on 3 tins of tomatoes, how much was each tin?

We can write a number sentence that reflects the problem:

e.g. 3 × ? = $4.50

We can use an array to represent the problem. For this problem the last array shown above is the most efficient.

Cost of one tin (?)

Total cost ($4.50)

Number of tins (3)

From this, we know the TOTAL cost ($4.50) and the NUMBER OF GROUPS (3 tins). We do not know the SIZE OF EACH GROUP (cost of each tin). Therefore, this problem is a division problem and can be represented as $4.50 ÷ 3 =? The number sentence we put in the calculator is 4.50 ÷ 3 =

Remember the number sentences 3 × ? = $4.50 and $4.50 ÷ 3 =? are equivalent, as both represent the problem. However, only one can be entered into a calculator.

Roberta made some array sketches that represent multiplication or division problems, using the data from the receipt. Consider what the problem might be for each sketch and complete the required number sentences.

PROBLEM: ARRAY DIAGRAM $7.38 Total cost? 4	PROBLEM: ARRAY DIAGRAM $1.80 Total cost $5.40 ?
PROBLEM: ARRAY DIAGRAM ? Total cost $3.60 2	PROBLEM: ARRAY DIAGRAM $6.99 Total cost ? 5

In the table below, create and write one word problem that uses multiplication to solve and one word problem that uses division to solve, using data from this receipt.

YOUR PROBLEMS

MULTIPLICATION PROBLEM	DIVISION PROBLEM
DECIDE WHETHER THE TOTAL IS MISSING (×) OR PRESENT (÷) An array diagram may help you decide	
WRITE A NUMBER SENTENCE TO REFLECT THE PROBLEM	
WRITE A NUMBER SENTENCE THAT YOU WOULD PUT INTO A CALCULATOR (This may or may not be the same as the previous number sentence)	

Copy the two word problems you wrote, onto two blank A4 sheets of paper.

Pass the A4 sheets around the classroom. Choose 4 problems from class members to copy into the table below. Choose two that use multiplication to solve (TOTAL missing) and two that use division to solve (TOTAL present).

CLASS PROBLEMS

MULTIPLICATION PROBLEMS	DIVISION PROBLEMS
1. Problem Array Diagram Number Sentence to Reflect Problem: Number Sentence to Enter in Calculator:	1. Problem Array Diagram Number Sentence to Reflect Problem: Number Sentence to Enter in Calculator:
2. Problem Array Diagram Number Sentence to Reflect Problem: Number Sentence to Enter in Calculator:	2. Problem Array Diagram Number Sentence to Reflect Problem: Number Sentence to Enter in Calculator:

Compare your work in the table above with class members who chose the same problems.

Was the 'NUMBER SENTENCE TO REFLECT PROBLEM' the same for all students? Were there any problems that you used multiplication in the number sentence but another class member used division? If so, would this change how the problem is solved? Discuss.

Did you write the numbers in the number sentences in the same order? Did this matter when solving the problems?

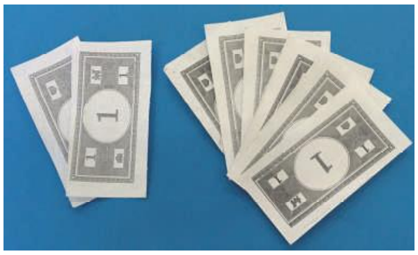
Did you use an array diagram to represent any problems? If so, how did that help you to make sense of those problems?

Were any problems in the table that were best solved using addition or subtraction rather than multiplication or division? What key information in a problem helps us know that multiplication or division is involved?

Practice Exercise 2

1. Using the following diagrams, write one multiplication and one division problem that could be applied to the picture. Remember, multiplication problems generally concern repeated equal quantities, arrays, measurement (usually area or volume), times as many problems or rates. Division problems usually involve the same situations (as division is the inverse to multiplication) and any problems involving sharing or grouping.

Situation	Multiplication Problem	Division Problem
		
		
		

<table>
<tr><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td></tr>
</table>

2. The following problems all concern Paul's volunteer work at a local soup kitchen.

Circle the problems that are *best* solved using multiplication or division

a) Paul peels and chops potatoes at the soup kitchen at a rate of 2 potatoes per minute. How many potatoes would he peel and chop in 30 minutes?

b) Paul stacks containers of soup in rows of 16, 7 deep. How many containers does he stack?

c) Paul served 182 customers before 4.30 pm. After 4.30 pm, he served 893 more. How many customers did Paul serve for the day?

d) The area of the van Paul works from is 55 440 square centimetres. If the front of the van is 240 cm, how deep is the van?

e) At the end of his shift, Paul has 39 bread rolls remaining. If there are 13 customers still to be served, how many bread rolls could each customer receive?

f) Paul served three times fewer customers in this shift as he did in the previous shift. If he served 723 customers in the previous shift, how many did he serve in this shift?

3. For each problem you circled in Question 2:

A. Write a number sentence that reflects the problem

B. Circle multiplication or division: TOTAL missing (×), TOTAL present (÷)

C. Write an equation that can be solved on a calculator. (This may be the same as A.)

Show all your working in the table below

PROBLEM	WORKING
	A B MULTIPLICATION or DIVISION C
	A B MULTIPLICATION or DIVISION C
	A B MULTIPLICATION or DIVISION C
	A B MULTIPLICATION or DIVISION C
	A B MULTIPLICATION or DIVISION C

4. Danni had 2 options of size and price of stall when setting up her market shop selling punnets of berries at the Goomalling Farmer's Market.

OPTION 1: rectangular stall measuring 190 cm by 172 cm costing $23 per week

OPTION 2: rectangular stall of area 17 400 square cm costing $21.50 per week

Circle the operation she would key into her calculator to find out:

- The area of the stall in OPTION 1.
  190 ÷ 172 190 – 172 190 + 172 190 × 172 none of these

6 How many weeks she could hire a stall from OPTION 1 if she has a budget of $115.
23 × 115 115 ÷ 23 23 + 115 115 – 23 none of these

7 The length of the stall in OPTION 2 if the width was 145 cm.
17 400 × 145 17 400 + 145 17 400 – 145 17 400 ÷ 145 none of these

8 How much more it would cost to hire a stall from OPTION 2 than OPTION 1.
23 ÷ 21.5 23 – 21.5 23 + 821.5 23 × 21.5 none of these

9 The cost of hiring a stall from OPTION 2 if after the first week the cost was doubled.
2 × 21.5 2 + 21.5 21.5 – 2 21.5 ÷ 2 none of these

10 The cost of hiring the stall per hour with OPTION 1, if she operated the stall for 6 hours
23 – 6 23 ÷ 6 23 × 6 23 + 6 none of these

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Practice Exercise 3

1. Match the word problems with one of the following number sentences:

161 + 7, 161 – 7, 161 × 7, 161 ÷ 7

a) Seven buses carried 161 students from Karratha to Perth for Country Week. How many students are in each bus?

b) Out of the 161 students, seven were in the debating team. How many were not in the debating team?

c) Seven Country Week teams scored 161 points each. How many points did these seven teams score in total?

d) Seven students joined the Karratha students in Perth for Country Week. How many students were in the team now?

e) For one evening, the 161 students spent time with host families. Each family took 7 students. How many host families were required?

2. Match the word problems with one of the following number sentences:

320 + 160, 320 – 160, 320 × 160, 320 ÷ 160

a) What would the area of Nick's garden be if it measured 320 cm by 160 cm?

b) Nick's garden bed had a length of 320 cm. His next– door neighbour's garden bed was 160 cm longer. How much longer was Nick's neighbour's garden bed?

c) Nick gave away 160 plums from the fruit trees in his garden. If he had grown 320 plums, how many plums did he keep for himself?

d) How many times longer was the length of the garden than the width of the garden?

e) Nick needs 320 g of basil for a recipe but only has 160 g. How much basil does he need to ask his neighbour for?

3. The following table guides part of the decision making process as outlined by the flow diagram on page 8. Complete the table. The first example has been completed for you.

a) PROBLEM: Huu is saving for a car. He deposits $47 into his savings account and his transaction slip says he now has $2 364.29. How much did he have in his savings account to start with?	
NUMBER SENTENCE TO REFLECT PROBLEM	? + $47 = $2 364.29
WHICH OPERATION? +, – or × , ÷?	+ or –
NUMBER SENTENCE TO ENTER CALCULATOR	2 364.29 – 47 =

b) PROBLEM: Keryn is saving for a car. She calculates she can save $138 per fortnight. How much will she have saved over the year?	
NUMBER SENTENCE TO REFLECT PROBLEM	
WHICH OPERATION? +, − × or ÷?	
NUMBER SENTENCE TO ENTER CALCULATOR	

c) PROBLEM: Ray wants to buy a car worth $10 000 in a year's time. How much will he need to save per week?	
NUMBER SENTENCE TO REFLECT PROBLEM	
WHICH OPERATION? +, − × or ÷?	
NUMBER SENTENCE TO ENTER CALCULATOR	

d) PROBLEM: Kate is saving for a car. She had to withdraw $152 from her savings to pay for an emergency dentist appointment. She now has $789.74 left in her account. How much did she have to start with?	
NUMBER SENTENCE TO REFLECT PROBLEM	
WHICH OPERATION? +, − × or ÷?	
NUMBER SENTENCE TO ENTER CALCULATOR	

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Reflection and Discussion

In everyday life there is often extra information in maths situations. We have to choose the relevant numbers as well as the correct operation to solve the problem.

Tick the problem for which 278 – 180 would give the answer:

☐ Leith had completed 180 minutes of homework. Julie had completed 194 minutes, Michael 278 minutes and Lorraine 203 minutes. How many more minutes did Michael work than Leith?

☐ Miffi had $278 in the bank and Noah had $180. How much money did they have altogether?

☐ In a factory warehouse, there were 180 boxes of nails in the north east corner of the shed, 278 boxes in the north west corner and 144 boxes in the south east corner. If 53 boxes were taken from the north west corner, how many boxes would be left in this corner?

☐ On a Monday morning 180 dogs were counted at the Attadale dog park. 63 were black and 27 white. In the afternoon, 278 dogs were counted of which 45 were white. How many less dogs were at the park in the morning than in the afternoon?

How did you decide which numbers would give the correct answer? Discuss with your class.

4. At Julie's work placement at a Health and Fitness Centre, there were 30 fitness instructors, 8 office staff, 3 managerial staff and 5 maintenance crew.

Match the word problems with one of the following number sentences:

30 + 5, 30 × 5, 30 ÷ 5, 30 – 5, 8 – 3, 8 × 3, 8 + 3, 8 ÷ 3, 30 + 42

a) How many times bigger was the fitness staff than the maintenance crew?

b) How many office staff and managerial staff were there altogether?

c) If each of the fitness staff ran 5 fitness sessions per fortnight, how many fitness sessions were held in total over the fortnight?

d) How many more managerial staff would need to be employed so that there were the equal numbers of managerial staff as office staff?

e) At a Health and Fitness Centre party, all the maintenance crew left and there were 30 people remaining. How many people were at the party to start with?

5. A large cheesecake at a bakery has a kilojoule value of 11 600 kilojoules. It is usually cut into 8 slices and sells for $42 for the whole cake. The smaller size cheesecake has a kilojoule value of 8 400 kj. It is cut into 6 pieces and sells for $5.10 per piece.

Match the word problems with one of the following number sentences:

42 × 8,   42 ÷ 8,   11 600 + 8 400,   11 600 – 8 400,   11 600 × 8
11 600 ÷ 8, $5.10 × 8, $5.10 + $42

a) What is the kilojoule value of one slice of the large cheesecake?

b) Nick bought a large and a small cheesecake. What is the total kilojoules for this purchase?

c) How much would one piece of the large cheesecake cost?

d) Rebecca bought 8 large cheesecakes. What is the kilojoule count for this purchase?

e) How many kilojoules less, is the smaller cheesecake than the larger?

f) How much would Rebecca's purchase of 8 large cheesecakes cost?

Reflection on Learning

A. Read the following problems concerning Robert's work placement at a real estate office.

- Circle the problems in blue that are best solved using addition or subtraction
- Circle the problems in red that are best solved using multiplication or division

1. Robert visits 6 rental houses for inspections with an office worker. If each visit takes 35 minutes, how long did the visits take in total?

2. There was some paper in the photocopier. Robert added 235 sheets more. Altogether there were now 1 078 sheets of paper in the photocopier. How many were there in the beginning?

3. It takes Robert 5 times as long to enter a housing listing on the office website, as it takes the manager. If it takes Robert 85 minutes, how long does it take the manager?

4. Robert takes a phone call from a home buyer who wants to place an offer $27 565 below the asking price of a house on the market for $438 000. What was the offer that the home buyer made?

5. Robert did the banking for the office in 47 minutes. The office manager does it in 32 minutes. How much longer does Robert take, than the office manager, to complete the banking?

6. The rent on a house, managed by the real estate company, is paid in advance for 8 weeks. If the renter gave a cheque to the real estate company for $3 880, what was the rent on the house per week?

7. Robert delivered 745 real estate pamphlets to letterboxes and his co–worker delivered 659. How many pamphlets did they deliver altogether?

8. A rectangular block for sale is listed as having an area of 731 square metres. If its street frontage is 17 metres, how long is the block?

9. Robert stacks reams of photocopying paper in the shed of the real estate office in 14 rows, with reams 11 high. How many reams of paper are in the shed?

10. Robert brings a plate of 52 cookies to share between the 13 office members, as a thank you for having him on work placement. How many cookies would each office member receive?

B. For each question, use the table below to:

- Write a number sentence that reflects the problem in the box below.
- Use a diagram to show the information
- Write an equivalent number sentence that you would enter in a calculator
- Are these the same sentence? Why? Why not?

No	ADDITION AND SUBTRACTION PROBLEMS	No	MULTIPLICATION AND DIVISION PROBLEMS

C. In the space below, write a paragraph to summarize your learning in this topic.

Begin this paragraph with the topic sentence: ‘In this topic, we have focussed on which operation; addition, subtraction, multiplication or division to choose, in order to solve everyday problems.’

Share your paragraph with a partner and then the class.

OLNA Practice Questions

1. Alex is saving for a $3 995 car. He has $2 789.32 in the bank. If Alex wanted to find out how much he still had to save, the operation he would key into a calculator would be?

A. ADDITION B. SUBTRACTION C. MULTIPLICATION D. DIVISION

2. Ruby buys 3 kg of pears. Pears cost $8.99 /kg. The number sentence Ruby would key into her calculator, to find the total cost of the pears, would be?

A. 8.99 + 3 B. 8.99 ÷ 3 C. 8.99 – 3 D. 8.99 × 3

Topic 2

Choosing an Operation and Using Mental Strategies to Solve Everyday Problems

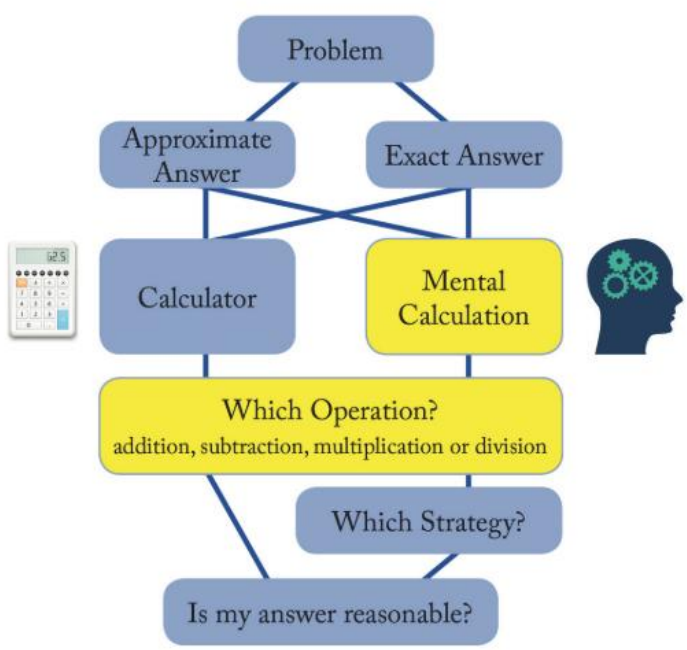
Mathematics Discussion

When solving everyday maths problems, we firstly decide whether an exact answer to a calculation is needed or whether an approximate answer to a calculation will solve the problem.

If the problem requires an exact calculation, we can use mental strategies, jottings or a calculator. If the problem can be solved using an approximate calculation, we can use estimation strategies, such as rounding to simplify the calculation. We then use mental strategies or jottings to approximate a solution. We tend to solve a problem mentally (or with written jottings) if the numbers are not too difficult, and use a calculator for all other problems.

We then decide which of the four operations we use to solve the problem. We can use number sentences that reflect how we think about the problem. We can also use diagrams such as Part–Part Whole diagrams or arrays to help us choose between operations.

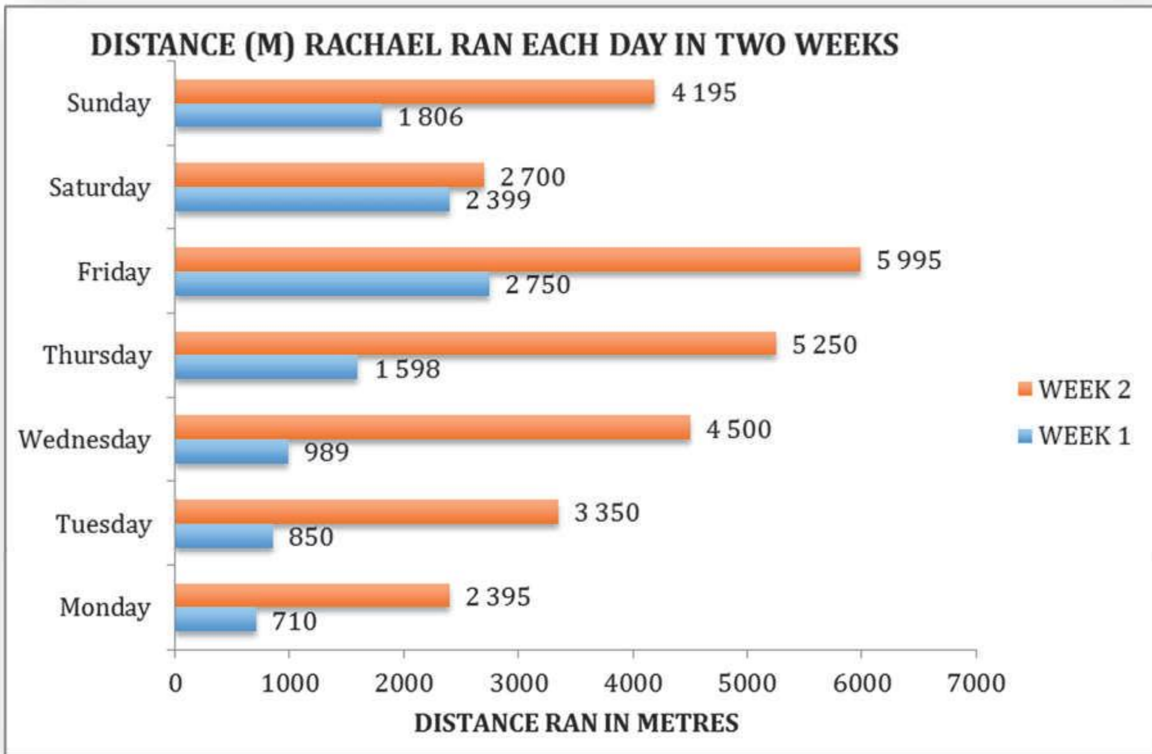
We then decide on a strategy for calculating the answer. You may wish to revisit addition and subtraction mental calculation strategies from Unit One or revisit mental multiplication and division strategies from Unit Two.



We can then communicate our answers using language consistent with the problem.

Whole Class Activity 1

Rachael is a fitness fanatic. Whilst living in Hong Kong, Rachael went on a 2–week intensive fitness campaign, running the Yuen Long Highway. The distances she ran over the two weeks are shown in the following graph:



EXAMPLE 1: How far did Rachael run in total on Monday and Tuesday of the first week?

Is an EXACT or an APPROXIMATE solution required to answer the question? Justify your answer.

Circle the best strategy for the numbers in the problem:

MENTAL CALCULATOR

Justify your answer.

Write a number sentence to reflect the problem:

Draw a diagram and enter the numbers:

(i) A Part/Part Whole diagram if you think the problem is best solved using ADDITION or SUBTRACTION

(ii) An array diagram if you think the problem is best solved using MULTIPLICATION or DIVISION

Write a number sentence you would use to calculate the answer (it may be the same as previously written).

Choose and use a mental strategy, with jottings if necessary, or a calculator to solve. Compare your strategy with other class members. What other mental strategies, with jottings were used in the class to solve this problem? Discuss.

Check your answer. What does the number refer to? Explain why it does/does not make sense?

EXAMPLE 2: On the final Saturday and Sunday, Rachel's friend Lilly ran a total of 6 500 m. Did Rachel run further than her friend on those same days?

Is an EXACT or an APPROXIMATE solution required to answer the question? Justify your answer.

Circle the best strategy for the numbers in the problem:

MENTAL CALCULATOR

Justify your answer.

Write a number sentence to reflect the problem:

Draw a diagram and enter the numbers:

(i) A Part/Part Whole diagram if you think the problem is best solved using
ADDITION or SUBTRACTION

(ii) An array diagram if you think the problem is best solved using
MULTIPLICATION or DIVISION

Write a number sentence you would use to calculate the answer (it may be the same as previously written).

Choose and use a mental strategy, with jottings if necessary, or a calculator to solve. Compare your strategy with other class members. What other mental strategies, with jottings were used in the class to solve this problem? Discuss.

Check your answer. What does the number refer to? Explain why it does/does not make sense?

Using data from the graph on page 29, create two word problems:

1. An addition problem that requires an exact calculation and a mental strategy to solve;
2. A subtraction problem which requires an approximate calculation, and a mental strategy.

Show your thinking using the steps outlined above in the table below:

PROBLEM 1	PROBLEM 2
Circle: EXACT or APPROXIMATE	Circle: EXACT or APPROXIMATE
Circle: MENTAL CALCULATOR	Circle: MENTAL CALCULATOR
Number Sentence to Reflect Problem	Number Sentence to Reflect Problem
Diagram	Diagram
Number Sentence to Calculate (It May Be The Same As C.)	Number Sentence to Calculate (It May Be The Same As C.)
Strategy and Solution	Strategy and Solution
Check Solution	Check Solution
Answer Written in a Form Consistent With Question	Answer Written in a Form Consistent With Question

Share your problems with the class.

What mental strategies were used in the word problems best solved using ADDITION?

What mental strategies were used in the word problems best solved using SUBTRACTION?

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Review the Foundation Mathematics Text Unit 1, Section 3, Topic 2. Make a list of all the addition strategies in the text. Circle the strategies used in the problems above.

Review the Foundation Mathematics Text Unit 1, Section 3, Topic 5. Make a list of all the subtraction strategies in the text. Circle the strategies used in the problems above.

Practice Exercise 1

1. Solve the following four problems using the decision making table below:

a) Paddo was preparing for his 17^{th} birthday party. He purchased soft drink and received $25.55 change from a $50 note. How much was the soft drink?

b) Paddo hired a hall for the party. It was $135 to hire plus an $85 security bond. How much did Paddo initially pay?

c) Paddo purchased plastic cups for $8.97, plastic spoons for $4.48 and streamers for $6.63. He had a $20 note in his wallet. Was this enough to make the purchases?

d) There were 100 chairs included in the hall hire. There were 34 girls and 52 boys. Are there enough chairs?

EXACT OR APPROXIMATE ANSWER?			WHICH OPERATION (+, −, × or ÷) Number Sentences and Diagram	STRATEGY AND SOLUTION	Is your answer reasonable? Yes or No
A					
					
B					
					

C					
					
D					
					

2. Roberto is saving for a holiday in his GAP year. He has a Savings Account that only allows him to deposit money. Roberto has a part–time job and makes regular deposits into his account.

Before completing Roberto's bank statement consider:

a) Are exact answers or approximate answers required to complete the bank statement? Justify your answer.

b) Are the gaps in the bank statement best completed mentally with jottings or with a calculator? Justify your answer.

c) Which operation(s) will you use to complete the table?

d) Complete the table using mental calculations and jottings. What strategies did you use?

AMOUNT IN BANK	DEPOSIT	BALANCE
$70	$29	$99
$99	$19	
		$152
		$222
	$99	
		$408
		$500

e) How can you check whether your answers are reasonable?

3. Select the number from table 1 and a unit from table 2 to answer the problems on the next page:

Table 1

95.06	148	55.08
90	53.55	54
204	95.05	192

Table 2

centimetres
minutes
dollars

a) Fees for Fiona to play in an indoor netball competition were $164 for the season. An additional $28 was charged to pay umpires. How much would it cost Fiona to play?

b) Fiona purchased netball shoes for $123.99 and received a $34 discount. How much were the shoes now?

c) Fiona was 176 cm tall. Her teammate Jess was 28 cm shorter. How tall was Jess?

d) What change did Fiona receive from a $100 note when buying a sports energy drink for $4.94?

e) Fiona played 47.24 minutes of netball before injuring her ankle. She strapped her ankle and played an additional 7.84 minutes. Fiona wanted to know how much court time she had played.

f) A netball game is played for 60 minutes. In the Grand Final, 6.45 minutes was lost because of injury. How long was the game actually played?

Whole Class Activity 2

The Hong Kong Star Ferry runs a boat tour around Hong Kong Harbour. The ticket fares are shown in the table below:

TICKET FARES	Adult Fare	Concessionary Fare
Single Ride Day Round Trip Ticket	HK$90	HK$81
Single Ride Night Round Trip Ticket	HK$169.97	HK$150
A Symphony of Lights Harbour Cruise	HK$194.10	HK$170.09

EXAMPLE 1: Rachael has $520 in her wallet. She buys 3 Adult Fare Single Ride Night Round Trip Tickets. Does Rachel have enough money?

Is an EXACT or an APPROXIMATE solution required to answer the question? Justify your answer.

Circle the best strategy for the numbers in the problem:

MENTAL CALCULATOR

Justify your answer.

Write a number sentence to reflect the problem

Draw a diagram and enter the numbers

(i) A Part/Part Whole diagram if you think the problem is best solved using ADDITION or SUBTRACTION

(ii) An array diagram if you think the problem is best solved using MULTIPLICATION or DIVISION

Write a number sentence you would use to calculate the answer (this may be the same as that above).

Choose and use a mental strategy, with jottings if necessary, or a calculator to solve. Compare your strategy with other class members. What other mental strategies, with jottings were used in the class to solve this problem? Discuss.

Check your answer. What does the number refer to? Explain why it does/does not make sense?

EXAMPLE 2: Rachael spent $324 on Concessionary Single Ride Day Round Trip tickets. How many tickets did she buy?

Is an EXACT or an APPROXIMATE solution required to answer the question? Justify your answer.

Circle the best strategy for the numbers in the problem:

MENTAL CALCULATOR

Justify your answer.

Write a number sentence to reflect the problem

Draw a diagram and enter the numbers

(i) A Part/Part Whole diagram if you think the problem is best solved using ADDITION or SUBTRACTION

(ii) An array diagram if you think the problem is best solved using MULTIPLICATION or DIVISION

Write a number sentence you would use to calculate the answer (this may be the same as that above).

Choose and use a mental strategy, with jottings if necessary, or a calculator to solve. Compare your strategy with other class members. What other mental strategies, with jottings were used in the class to solve this problem? Discuss.

Check your answer. What does the number refer to? Explain why it does/does not make sense?

Using data from the Ticket Fare table, create two word problems:

1. A multiplication problem that requires an exact calculation and a mental strategy to solve;

2. A division problem which could be solved with an approximate calculation and a mental strategy.

Show your thinking using the steps outlined above. Complete the table below:

PROBLEM 1	PROBLEM 2
Circle: EXACT or APPROXIMATE	Circle: EXACT or APPROXIMATE
Circle: MENTAL CALCULATOR	Circle: MENTAL CALCULATOR
Number Sentence to Reflect Problem	Number Sentence to Reflect Problem
Diagram	Diagram
Number Sentence to Calculate	Number Sentence to Calculate
Strategy and Solution	Strategy and Solution
Check Solution	Check Solution
Answer Written in a Form Consistent With Question	Answer Written in a Form Consistent With Question

Share your problems with the class.

What mental strategies were used in the word problems best solved using MULTIPLICATION?

What mental strategies were used in the word problems best solved using DIVISION?

Review the Foundation Mathematics Text Unit 2, Section 2, Topic 2. Make a list of all the multiplication strategies outlined in the text. Circle the strategies listed that were used in the class problems above.

Review the Foundation Mathematics Text Unit 2, Section 2, Topic 4. Make a list of all the division strategies outlined in the text. Circle the strategies listed that were used in the class problems above.

Practice Exercise 2

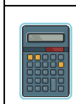
1. Solve the following four problems using the decision making table below:

a) Paddo was preparing for his 17th birthday party. He invited 13 girls to the party. There were 3 times as many boys as girls. How many boys were invited?

b) Paddo had $20 in his wallet. He wanted to purchase 6 packets of chips at $3.19 per packet. Did Paddo have enough money?

c) Paddo hired a 64 square metre hall for the party that had a width of 8 metres. What was the length of the hall?

d) Paddo had a playlist of 124 songs on his iPhone that he wanted to play at the party. If each song played for an average of 3 minutes, how long would the music be playing for at Paddo's party?

EXACT OR APPROXIMATE ANSWER?			WHICH OPERATION? (+, – , × or ÷) Number Sentences and Diagram	STRATEGY AND SOLUTION	Is your answer reasonable? Yes or No
a					
					
b					
					

c					
					
d					
					

2. Select the number from table 1 and unit from table 2 to best answer the problems below:

Table 1

24	9.1	52
209	4	104
204	4.66	23.96

Table 2

m/sec	kg
dollars	photos
seconds	cm

a) Fees for Sub Juniors to play in the local boy's hockey competition were $26. Fees for Seniors were four times this amount. How much were the Senior's fees?

b) Frank can run the 91 metre sideline of a hockey field in 10 seconds. What is Frank's average speed?

c) Frank is 195 cm tall. His teammate Phillip is 14 cm taller. How tall is Phillip?

d) Five members of the hockey team shared a pizza meal after a game. The bill came to $119.80. How much was this per person?

e) Hockey Premiership team photos are arranged on a wall. There are 3 rows with 14 photos in each row. How many photos are there?

f) Frank bought sausages for a hockey fundraiser. He was given $40. If sausages were $9.95 kg, how many kilograms could he buy?

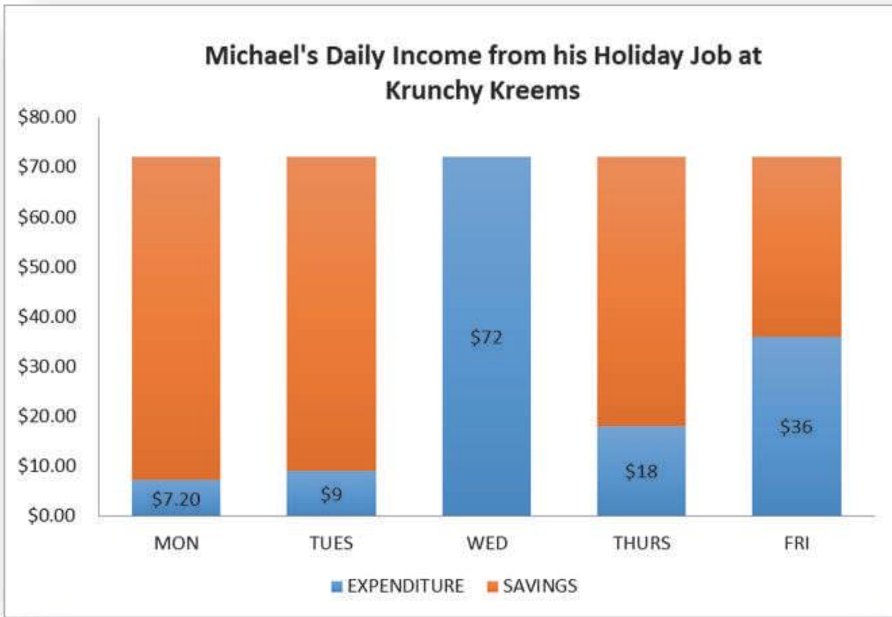
3. The following chart shows Michael's income, expenditure and savings over the week beginning July 3rd 2016.

a) What was Michael's income for the week?

b) On what day was Michael's income four times his expenditure?

c) Michael said 'If I spent 10 times more than what I did today I would have spent all that I earned'. What day was this?

d) How many times more was income than expenditure on Tuesday?



Whole Class Activity 3

Bernard was planning a holiday for 7 nights in Cambodia in a year's time. Bernard makes a list of the costs of going on the holiday.

COSTS			
Airfare	$945	Accommodation	$630
Passport	$164.95	Food and Spending money	$1 890
Visa	$49.97	Clothes	$315

Bernard sets up a savings plan with his bank where he deposits $200 per fortnight.

Using data from the table above, create 2 word problems;

PROBLEM 1: Requires an approximate answer, addition or subtraction and a mental calculation to solve.

PROBLEM 2: Requires an exact answer, multiplication or division and a mental calculation to solve.

Show your thinking in the table below.

PROBLEM 1	PROBLEM 2
Circle: EXACT or APPROXIMATE	Circle: EXACT or APPROXIMATE
Circle: MENTAL CALCULATOR	Circle: MENTAL CALCULATOR
Number Sentence to Reflect Problem	Number Sentence to Reflect Problem
Diagram	Diagram
Number Sentence to Calculate	Number Sentence to Calculate
Strategy and Solution	Strategy and Solution
Check Solution	Check Solution
Answer Written in a Form Consistent With Question	Answer Written in a Form Consistent With Question

Copy the two word problems you wrote, onto two blank A4 sheets of paper.

Pass the A4 sheets around the classroom. Choose 4 problems from other class members to copy into the correct operation in the table below.

CLASS PROBLEMS

ADDITION PROBLEM	SUBTRACTION PROBLEM
    SOLUTION:	 SOLUTION:
MULTIPLICATION PROBLEM	**DIVISION PROBLEM**
    SOLUTION:	 SOLUTION:

Compare your answers with class members who chose the same problems. Did your classmates place the problems in the same position in the table? Justify any differences in thinking.

Practice Exercise 3

1. Solve the following four problems using the decision making table below:

a) Paddo was preparing for his 17th birthday party. He arranged 81 cans of soft drink in 3 rows on a table. How many cans were in each row?

b) Paddo invited 28 friends from school. He invited 17 friends from his neighbourhood. How many friends were invited?

c) Paddo had a budget of $250 for the party. He spent $173.50 on the hall hire. How much did he have left to spend on food and drinks?

d) Paddo purchased 1.47 kg of mixed nuts at $19.99 /kg. How much did this approximately cost?

EXACT OR APPROXIMATE ANSWER?			WHICH OPERATION? (+, −, × or ÷) Number Sentences and Diagram	STRATEGY AND SOLUTION	Is your answer reasonable? Yes or No
A					
					

B					
					
C					
					
D					
					

2. For the following problems:

Circle the problems that are best solved using:

- addition and a mental strategy in blue
- subtraction and a mental strategy in red
- multiplication and a mental strategy in green
- division and a mental strategy in black.

a) If Piotr saved $20 per week for a year, what would be his savings at the end of the year?

b) Amy bought 1.29kg of cashews at $23.92 /kg. How much did this cost Amy?

c) How many 250 mL cups of milk are in 5000 mL (5 Litres)?

d) Jake had 42 records in his vintage record collection. Milly had 19 fewer. How many records did Milly have?

e) Mia had $720 in her bank account. She withdrew $50 from the ATM. How much did she have left in her account?

f) At the farmers market, the Victoria Park Primary School P&C sold 32 bags of apples and 56 bags of oranges. How many bags did they sell altogether?

g) Dennis cut out a 32 cm by 57 cm rectangle. What was the area of the rectangle?

h) Share $720 between 8 friends. How much does each friend receive?

3. Solve the circled problems from Question 2 in the space below. Use number sentences, diagrams and mental strategies to help. Check if your answers are reasonable and write each answer in a sentence, using words from the question.

4. The top 8 teams on the AFL ladder on August 12th 2015 were as follows:

AFL SEASON 2015

POSITION	TEAM	WIN	LOSS	DRAW	POINTS
1.	Fremantle		2	0	
2.	WC Eagles	13	4	1	54
3.	Hawthorn	13			52
4.	W Bulldogs		6	0	
5.	Sydney Swans	12		0	
6.	Nth Melbourne		7	0	44
7.	Richmond	11	7		
8.	Geelong	10	7	0	

By August 12th, all teams had played 18 games of football except Geelong who had only played 17.

Fill in all missing gaps in the table and answer the following questions:

(HINT: A 'Win' in AFL is worth 4 points and a 'Draw' is worth 2 points)

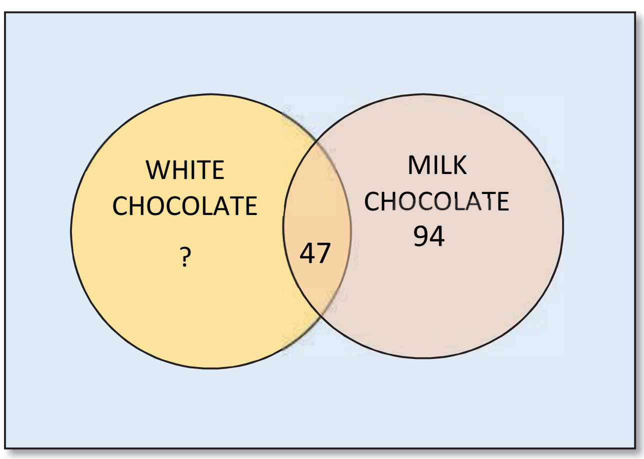
a) How many more points did Hawthorn have than Richmond?

b) How many points did the two West Australian teams at the top of the ladder have in total?

c) By the end of the home and away season, Hawthorn predicted they would have 72 points. How many games did they expect to win in the season overall?

d) At the start of the season Fremantle predicted that they would win 17 games. How many points is this?

5. The following Venn diagram shows the results of a survey of 300 people conducted by a chocolate factory, asking which of white or milk chocolate they preferred.



a) If 188 people liked white chocolate, how many liked white chocolate only?

b) How many people liked milk chocolate?

c) 'Twice as many people liked milk chocolate only than liked both milk and white'
True or False? Justify your answer.

d) If a new survey was conducted with three times as many people asked, how many would you expect would like both milk and white chocolate?

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6. The following table shows entry prices to the Bridgecity Aquatic Centre.

Entry	Prices	Concession
Adult Single Visit (11 yrs+)	$6.00	$5.40
10 Visit Pass	$54.00	$48.60
20 Visit Pass	$105.00	$94.50
40 Visit Pass	$204.00	$183.60

a) If you purchase a 10 Visit Adult Pass, how much does this work out to be per visit?

b) How much more is an Adult Single Visit ticket than a Single Concession Visit ticket?

c) How much would 3 Single Concession tickets cost?

d) The total cost of entrance fees for Mrs Kerrigan was $36. If she bought all Adult Single Visit tickets, how many tickets did she buy?

e) What is the price difference between a 40 Visit Pass and a 40 Visit Concession Pass?

Reflection on Learning

Read the following problems.

- Choose a problem that matches each of the boxes in the table below.
- Write the number of the problem in the matching box.
- Write a number sentence that reflects the problem you have chosen in the box.
- Solve the problems you have chosen using diagrams, further number sentences and strategies.
- Check that your answer makes sense.
- Write each answer in a sentence using the words from the question.

1. Mary Kate had $12 768.96. Ashley had four times more. How much did Ashley have?
2. A square has a perimeter of 64 cm. What is its side length?
3. Henry invested an $82 765.98 inheritance. He earned $7861.54 in interest. How much was his investment worth now?
4. Belinda cycled at 27 km/h for 4 hours. How far did she travel?
5. Jill had $840. Her brother borrowed $50. How much did Jill have left?
6. Mrs Brown earned $24.70 /h. Mr Brown earned $21.40 /hr. What was their combined income per hour?
7. Harry was given a $13.76 discount on a computer game retailing at $51.94 because it had a scratched package. How much did Harry pay for the game?
8. How many dozen eggs are there if there are 8676 eggs?

SOLVE BY SUBTRACTION AND MENTAL STRATEGY	SOLVE BY MULTIPLICATION AND MENTAL STRATEGY
SOLVE BY DIVISION AND MENTAL STRATEGY	SOLVE BY ADDITION AND MENTAL STRATEGY

OLNA Practice Questions

1. There are 52 guests at a party. 19 guests are men. How many women are at the party?

A. 23 B. 33 C. 71 D. 988

2. Telena is building a picket fence that is 4 200 centimetres long. She is using pickets that are all 7 centimetres wide. There are no gaps between the pickets.

How should Telena calculate how many pickets she will need altogether?

A. 4 200 ÷ 7 B. 4 200 + 7 C. 4 200 – 7 D. 4 200 × 7

Topic 3

Using a Calculator or Spreadsheet to Solve Everyday Problems

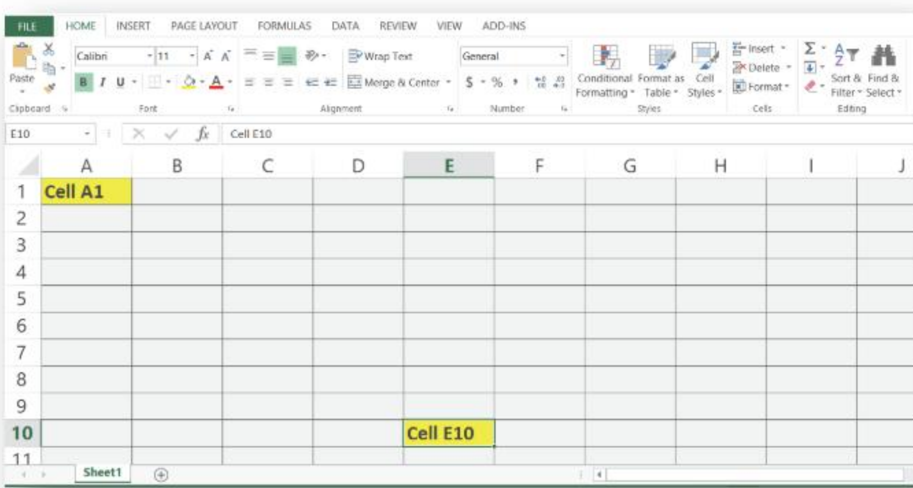
Mathematics Discussion

When solving everyday problems, we decide whether an approximate or exact solution is required and then we usually decide whether to solve the problem mentally or with a digital resource. We then proceed to calculate a solution and check the reasonableness of our result.

In this section, we will be focussing on the 'calculator' part of the flow diagram on page 8. We will be using digital technologies such as a calculator or a spreadsheet to solve everyday problems.

We tend to use a calculator when the problem has numbers we cannot solve mentally and requires usually one, but sometimes a few steps on the way to a solution. We use a spreadsheet when we need to calculate a lot of data or data that sometimes needs to be changed or added to.

A spreadsheet is a program found on a computer or iPad that is a table, divided into rows and columns. The highlighted cells in the image below are called A1 and E10. We can enter words, numbers or formulae into the cells. Words are used for titles and headings, numbers are the data and the formula tells the computer what operation(s) to carry out on the particular set of numbers. When we input a formula many calculations can be performed instantaneously. One of the challenges in using a spreadsheet to carry out calculations, is being able to input the operation/s that you want the computer to perform.



People use spreadsheets in the home and work place to keep records and data of, for example, budgets, sales figures and sporting statistics.

Whole Class Activity 1

Think: When is it best to use a calculator and when is it best to use a spreadsheet to solve everyday problems?

Reuben lives at home with his parents whilst studying full–time at TAFE. He has a part–time job and works 30 hours per week. He is finding it difficult to manage his lifestyle given his limited income.

Reuben sets up the following table with pen and paper, to track his total spending over an average month. The table shows the 'words' (i.e. titles or headings), the 'data' (e.g. $125) and the 'Total'.

REUBEN'S EXPENSES FOR FEBRUARY 2016

	WEEK 1	WEEK 2	WEEK 3	WEEK 4	TOTAL
Board	$125	$125	$125	$125	
Car Payments	$67.74	$67.74	$67.74	$67.74	
Petrol	$27	$13.76	$54.23	$9.34	
Insurance	$15.30	$15.30	$15.30	$15.30	
Entertainment	$32	$23.50	$11.70	$88	
Phone Plan	$12.50	$12.50	$12.50	$12.50	
Total					

Which operation (+, – , ×, ÷) is best used to complete this table? Justify your answer.

USING A CALCULATOR:

Use a calculator to complete the 'TOTAL' columns in the table above.

In March 2016, Reuben's parents decide to increase his board to $135 per week. Reuben also decides to have a strict budget of $30 per week for entertainment. The other expenses remain the same. Draw and complete a new table for March in the space below. Use a calculator to find the totals.

What is Reuben's total spending for March based on this data?

What was easy about solving this problem using a calculator? What was hard? Discuss.

USING A SPREADSHEET:

Watch the following YouTube clip: ‘Microsoft Excel Tutorial for Beginners #1 – Overview’

https://www.youtube.com/watch?v=8L1OVkw2ZQ8

Use the information in the clip, to input the data from ‘REUBEN’S EXPENSES FOR FEBRUARY 2016’ into a spreadsheet. Find the totals of each row and column using the Σ button. You may have to select the ‘Formulas’ Tab to see the Σ Autosum on the toolbar. Save your worksheet giving it the name ‘Reuben’s Expenses’, by selecting *Save As* from the *File* menu and entering the file name. Print and staple your spreadsheet to the side of this page.

In March 2016, Reuben’s parents decide to increase his board to $135 per week. Reuben also decides to have a strict budget of $30 per week for entertainment. Open your February spreadsheet. Highlight and copy the table. Open a new worksheet and paste the table. Change the date to March. Now change the board and entertainment amounts on the spreadsheet. What happens to the amounts in the ‘TOTAL’ columns?

Save and print the completed spreadsheet for March 2016 and staple it to the side of this page.

Compare your answer in USING A SPREADSHEET to USING A CALCULATOR. Were they the same? Which method is more likely to be accurate? Discuss.

Reuben decides that he must earn between $300 and $350 per week to cover all expenses. Is this reasonable? Justify your answer.

What was easy about solving this problem using a spreadsheet? What was hard? Discuss.

Which was the best tool, calculator or spreadsheet, for solving this everyday problem? Justify your answer.

What type of problem is best solved using a calculator? What type of problem is best solved using a spreadsheet? Explain your thinking.

Practice Exercise 1

1. Place the following questions in the correct place in the table below. Justify your choice

a) Finding the area of a rectangle of length 147 cm and width 117 cm.

b) Finding the total wages earned by 23 employees, with different job descriptions, in a factory over one year.

c) A tree plantation has 34 578 trees. 7 894 trees are cut down. How many trees are remaining?

d) The amount owing on a home loan of $550 000 after 20 years of repayments where interest and repayments have been calculated at a monthly rate.

e) The value of a house after 15 years given that it increases in value by at least 3% each year

f) The amount each person in a 30 person Lotto syndicate win if the syndicate scoops the Division 1 prize pool of $35 000 000.

Problems Best Solved By Calculator	Problems Best Solved By Spreadsheet
Justify Your Answer	Justify Your Answer

2. Open a new spreadsheet workbook and enter the following data. Change the column widths so that all text can be read.

1	A	B
2	RUNNING A MOPED	$
3	Petrol	700
4	Service	345
5	Tyres	249.95
6	Registration	113.50
7	Comprehensive Insurance	415.75
8	TOTAL COST FOR 1 YEAR	

a) Use the Σ button to calculate the TOTAL. Write your answer cell B8 above.

b) The comprehensive Insurance increased to $504.85. Make this change to the spreadsheet. What will the new TOTAL COST be?

c) The data in this problem is quite small and the total could be found using a calculator. Why is it helpful to use a spreadsheet to calculate ‘Running a Moped’?

d) Katie has enough savings to buy a moped. She currently earns $40 per week babysitting. Should Katie buy the moped? Justify your answer.

3. Three friends decide to play four holes of golf to decide who the best player is. They use a spreadsheet on their mini iPad to record their results.

Open a new spreadsheet workbook and enter this data:

	A	B	C	D	E
1			SCORES		
2		PETER	MICHAEL	LEITH	
3	HOLE 1	5	9	4	
4	HOLE 2	5	6	5	
5	HOLE 3	7	6	6	
6	HOLE 4	3	3	3	
7	TOTAL				

a) Use the Σ button to calculate Michael's score in cell C7. Delete this total.

b) Enter the formula '=C3+C4+C5+C6' into cell C7. Press enter. What do you notice?

c) Calculate Peter's total using a formula. Calculate Leith's total using a formula. Check your results using the Σ button.

d) What formula would you put in cell E3 to calculate how many shots were played on Hole 1? Press 'enter' to calculate the total.

e) Click in cell E3. Hold and scroll down column E from the black cross in the corner of cell E3 until E6. What happens to column E?

f) Complete all totals and save your worksheet giving it the name 'Golf Results', by selecting *Save As* from the *File* menu and entering the file name. Print and staple your spreadsheet to the side of this page.

g) Who is the best golfer? Justify your answer.

h) Percy asks for his golf scores to be added to the spreadsheet. Add a new column to the spreadsheet by clicking anywhere in column D. Select 'Insert' from the toolbar and choose 'columns' (you may have to access the 'Insert' tab by clicking on the Home tab first). Enter Percy's name and his scores of 5, 4, 6 and 4 for the 4 rounds of golf. Does this alter your answer to (g)? Explain.

i) The golfers want to play a deciding round. Add a new row to the spreadsheet by clicking anywhere in row 6, selecting 'insert' from the toolbar and choosing 'rows'. Enter the following scores for HOLE 5; Peter – 2, Michael – 3, Leith – 5 and Percy – 4. Does this alter your answer to (g). Explain.

j) The data in this problem is quite simple and could be calculated mentally. Why is it helpful to use a spreadsheet to calculate 'Golf Results'?

Whole Class Activity 2

Think: How do we input the operations into spreadsheets to solve everyday problems?

In Question 3 of Practice Exercise 1, the operation used to find the totals of rows and columns was addition. This was calculated on the spreadsheet using either the 'Σ' button or a formula such as '=b3+c3+d3+e3'.

There are no buttons on spreadsheets like 'Σ', which automatically perform operations other than addition. What symbol would you use in a formula in a spreadsheet for subtraction, multiplication, division or powers such as squaring?

Use a search engine such as Google to find the symbols used in formula for mathematical operations in a spreadsheet. Complete the following table:

Operation	Addition	Subtraction	Multiplication	Division	Power (E.g.Squared)
Symbol					

A formula like the area of a rectangle where the length of the rectangle is in cell B2 and the width in cell B3 would be written in cell B4 as '=b2*b3'

Notice:

- All formula entered into a spreadsheet must start with an equals '=' sign
- Either capital l or lower case letters can be used when using formulae in spreadsheets.

What formula would be typed in cell C3 for the computer to calculate?

a) cell A3 – cell B3

b) 2 × cell A3

c) cell A3 – 6

d) cell A3 ÷ cell B3

e) Cell A3 squared

f) 1000 ÷ cell B3

Discuss the formulae with class members.

Whole Class Activity 3

Think: How do we design and use a spreadsheet to solve problems?

Helen has been employed for 8 months (February to September) in a part time job at 'Coffee Too' where she is paid $12.55 /hour. Helen is saving for a second hand car and wants to apply for a bank loan. She wants to set up a spreadsheet with her monthly earnings to show a loans manager.

Open a new spreadsheet workbook. Work together as a class to design an efficient spreadsheet. Points you may wish to consider are:

a) The title of the spreadsheet

b) The layout of the spreadsheet

c) The headings on the columns or rows

d) Efficiently entering in the 8 months of Helen's employment

e) Entering Helen's monthly hours: 23, 29, 37, 13.25, 26, 36, 24.5, 22.

f) The formula to calculate total wage for each month

g) Efficiently calculating her total income over the 8 months

h) Just before Helen's appointment with the bank manager, Helen was told that she was to be back–paid for her last 2 months of work. She had been acting store supervisor and should have been paid double time. Recalculate Helen's total wage using the spreadsheet.

Complete the spreadsheet and save your worksheet by selecting *Save As* from the *File* menu and entering the file name. Print and staple your spreadsheet to the side of this page.

Tegan and Des, students at Rossmoyne SHS, argued about the layout and formula of the spreadsheet.

Tegan said that the headings should be titled HOURS, HOURLY RATE and WAGE. She entered 12.55 in the cell under or next to HOURLY RATE and used the 'Fill' button to complete the row or column with 12.55. The formula in the WAGE row or column would be HOURS × HOURLY RATE = WAGE.

Des argued that the headings should be titled HOURS and WAGE. The formula in the WAGE row or column would be HOURS × 12.55 = WAGE.

Which layout and formula is best for Helen's situation? Justify your answer.

Why was it helpful to create and use a spreadsheet to calculate Helen's wages at 'Coffee Too'? Explain.

Practice Exercise 2

1. Dainon has a money box that he uses for all his spare change. He wanted to know how much money he has. He opened the money box and sorted the coins into their different denominations. He counted the following coins:

54	5 cent pieces	13	50 cent pieces
65	10 cent pieces	42	$1 coins
73	20 cent pieces	37	$2 coins

He decided to record the results in a spreadsheet.

a) Open a new workbook and follow the steps outlined in Whole Class Activity 3 to make a spreadsheet for Dainon. Widen the columns so that all text can be read.

(HINT 1: You may wish to title column A: NUMBER OF COINS, column B: DENOMINATION and Column C: VALUE)

(HINT 2: Consider how you should enter the cent values if you want the program to calculate money. For example, enter 0.05 instead of 5 for 5 cents, 0.10 instead of 10 for 10 cents and so on)

b) Dainon entered the following formula to find the value of each denomination 'A3*B3' and pressed enter. The value of the 5 cent pieces did not appear. Why not?

c) Dainon then entered the following formula to find the value of each denomination '=A3×B3' and pressed enter. The value of the 5 cent pieces did not appear. Why not?

d) Enter the correct formula to find the value of each denomination. Complete the spreadsheet to find the total Dainon has in his money box.

e) Dainon made a mistake counting the coins. He really had 57 five cent pieces. Change this entry in the spreadsheet and note how all the calculations change. How much money does Dainon really have?

f) List the value of the coins from largest to smallest. Which denomination had the largest value? Discuss the different strategies you used to sort the value of the coins. You may wish to consider using the 'Sort' button in the toolbar of your worksheet.

g) Save, print and staple your spreadsheet to the side of this page.

h) Is this type of everyday problem best solved using a calculator or a spreadsheet? Justify your answer.

2. The Year 12's at North Lake Senior High School wish to hold an end of year film night that would cost $250 to run. They are not sure how many students will attend but estimate that it will be between 10 and 40. They decide to set up a spreadsheet to show how much they would need to charge per ticket to cover costs.

a) Open a new workbook and follow the steps outlined in Whole Class Activity 3 to make a spreadsheet for the film night.

(HINT: Use the following headings, 'NUMBER OF STUDENTS' and 'PRICE PER TICKET')

b) Circle the formula below that the Year 12's should use to calculate the price of tickets, so as to cover costs.

= 250 * number of people	= 250/number of people
= number of people + 250	= 250 – number of people

c) Use the spreadsheet to calculate the price per ticket for 10 students.

d) Use the spreadsheet to calculate the price per ticket for 11 students.

e) Use the spreadsheet to calculate the price per ticket for between 10 and 40 students.

f) Save, print and staple your spreadsheet to the side of this page.

g) The students decide to charge $15 per ticket. Is this reasonable? Comment on their decision.

Whole Class Activity 4

Think: How do we use the decision making flow chart to solve everyday problems?

When deciding how to solve problems, we can now choose between mental, calculator or spreadsheet strategies.

Match the following problems to these strategies.

Work as a class to complete the tables below to solve each problem.

Gilbert runs a free–range egg farm that supplies local supermarkets with eggs sold in dozens. He sells most of his eggs to local supermarkets and some at his weekend roadside stall.

Gilbert needs to solve the following problems concerning his business.

1. In March 2016, Gilberts 310 hens laid 1095 eggs. How many dozen eggs is this?

2. Gilbert wants to work out the number of dozen eggs per month he can consistently supply supermarkets in 2016. He recorded how many eggs his hens lay per month for 2015 and up to March 2016 in the table below:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2015	1197	998	1154	1032	997	993	953	901	887	930	968	1067
2016	1008	1103	1095									

How many dozen eggs can Gilbert consistently supply to supermarkets in 2016?

3. On Saturday, Gilbert sold 19 dozen eggs at his roadside stall. On the weekend in total, he sold 46 dozen. How many dozen eggs did Gilbert sell on Sunday?

MENTAL STRATEGY

Problem Number:
Circle: APPROXIMATE ANSWER or EXACT ANSWER?
Circle: ADDITION/SUBTRACTION or MULTIPLICATION/DIVISION
Write as a number sentence that reflects the problem:
Use a diagram to show the problem
Write as a number sentence to help solve the problem (ie WHICH OPERATION?)

STRATEGY and SOLUTION
IS THE ANSWER REASONABLE? What is the number referring to? Write the answer in a sentence using the words in the question.

CALCULATOR

Problem Number:
Circle: APPROXIMATE ANSWER or EXACT ANSWER?
Circle: ADDITION/SUBTRACTION or MULTIPLICATION/DIVISION
Write as a number sentence that reflects the problem:
Write as a number sentence to enter the calculator (ie WHICH OPERATION?)
SOLVE
IS THE ANSWER REASONABLE? What is the number referring to? Write the answer in a sentence using the words in the question.

SPREADSHEET

PROBLEM NUMBER:
Circle: APPROXIMATE ANSWER or EXACT ANSWER?
Circle: Which operation will be used in the formula for the spreadsheet? ADDITION, SUBTRACTION, MULTIPLICATION OR DIVISION
Write the formula that will be used to solve the problem in the spreadsheet:

Create a spreadsheet, print it and staple to the side of this page.
SOLVE
IS THE ANSWER REASONABLE? What is the number referring to? Write the answer in a sentence using the words in the question.

Practice Exercise 3

1. Use the decision making process to calculate the solutions to the following problems. Record any jottings, diagrams or spreadsheets in the workspace below.

WORKSPACE:

a) Jessie drives 32 km to pick up his friend Thomas and then a further 59 km to reach a music festival. How far does he drive altogether?

b) Marisa buys 6 kg of pears and it costs her $22.08. What was the price of the pears per kilogram?

c) Patrick wants to keep records of the difference in average temperature per month between Perth and Moscow. He records the following information:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Perth	31	31	29	25	22	19	18	19	20	23	26	29
Moscow	–4	–4	3	11	17	22	24	22	15	8	0	–3

d) Paddo stacks shelves at a supermarket. He stacks 168 jars of jam in columns of 8. How many rows of jars were stacked?

e) Lucia has 2 789 songs on her iPhone. Jack has 1 893 less. How many does Jack have?

f) Craig has saved $72.37 to go to Perth shopping. Rachael has saved 4 times more. How much has Rachael saved?

WORKSPACE:

Reflection on Learning

1. Joel runs a fundraising campaigns for children with heart conditions. He keeps the following records showing his income from fundraising and the expenses he incurs (advertising, raffle tickets etc.)

2015	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Income	1600	985	324	65	878	2150	9777	899	368	523	925	1076
Expenses	450	495	450	450	954	468	3200	450	512	450	1008	651

a) Draw a line connecting the problem Joel needs to solve with the best method of solving it.

A. The income from July 2015 was shared between 3 fundraising campaigns. How much did each of these campaigns earn?	• Addition using a calculator
B. Joel has plans for a fundraising campaign in January 2016 that should earn 3 times more than the income from January 2015. How much is the organisation expected to earn in January 2016	• Subtraction using a spreadsheet
C. Joel wants to know the profit or loss for each month so that he can plan for 2016	• Division using a calculator
D. What was the income for the first 4 months of 2015?	• Multiplication using mental strategies

Solve the problem that is best solved by 'subtraction using a spreadsheet'.

b) What was the overall profit/loss of the charity for 2015?

c) Save, print and staple your spreadsheet to the side of this page.

d) Joel reported to the board of the charity that he has had an extremely profitable 2015. Is this a reasonable statement? Discuss your viewpoint.

2. Write 5 things that you have learnt about spreadsheets.

-
-
-
-
-

OLNA Practice Questions

Use mental strategies, a calculator or a spreadsheet to solve the following problems:

1. 5 500 000 taxpayers gave to registered charities in 2016.

The average donation was $472 per taxpayer.

What was the total amount given to registered charities by these taxpayers in 2016?

A. $2 596 000   B. $259 600 000   C. $2 596 000 000   D. $25 960 000

2. Huu wants to use a spreadsheet to find the perimeter of any square. He sets up the following spreadsheet

	A	B	C	D
1	Perimeter Of Squares			
2	Length	Perimeter		
3	7	28		
4	7.1	28.4		
5	7.2			

What formula has Huu entered in cell B3 to calculate the perimeter?

A. B2 × 4   B. A3*4   C. =A3*4   D. =4*B1

3. Six workmates win $100 in the company raffle. They share EQUALLY as much of the $100 as they can. A small amount of money is left over.

Using Australian notes and coins, how much would each workmate receive?

A. $16.70   B. $16.67   C. $16.66   D. $16.65

Topic 4

Solving Everyday Multistep Problems

Mathematics Discussion

Many mathematical problems we encounter in our everyday lives require a number of calculations. Sometimes, we can use the same operation a number of times. For example, we have $20 and buy a drink for $3.50 and then later a hotdog for $5.50. The number sentence that reflects this problem is 20 – 3.50 – 5.50 and we calculate from left to right to find how much money left.

Sometimes we need a combination of the four operations. For example, if we have a square of paper with side length 9 cm and we cut a small square from the corner with sides of 3 cm, what is the area of the remaining paper? This involves multiplication to work out the two areas and subtraction to take the small area from the large area. A number sentence that reflects this problem is 9 × 9 – 3 × 3. We could do this problem a number of ways:

- We might calculate from left to right:

  9 × 9 = 81; 81 – 3 = 78; 78 × 3 = 234

- We might calculate the multiplication parts of the problem first:

  9 × 9 = 81; 3 × 3 = 9; 81 – 9 = 72.

- We might calculate the subtraction in the middle of the problem first:

  9 – 3 = 6; 9 × 6 × 3 = 162.

All these strategies result in a different answer. Clearly, we need a way to communicate the order in which to do a calculation so we can solve problems and get the same, correct answer. This 'Rule of Order' or an 'Order of Operations'. involves:

- using brackets to show which calculation to do first.
- then multiplication and division operations as they occur from left to right.
- then addition and subtraction as they occur from left to right.

In this topic, we will be solving problems that involve multi–steps using mental strategies with jottings if necessary, and digital devices such as calculators, phones and spreadsheets.

Whole Class Activity 1

Think: How do we write number sentences that will help solve everyday multistep problems?

Lauren was solving the following problems:

1. On work placement, George was asked to stack boxes of photocopy paper into two storage rooms. He put 40 boxes in the first room but the secretary took 5 boxes back to her office. George then stacked 3 piles of boxes, 4 boxes high, in the second room. How many boxes in total in both storage rooms?

2. George earned $40 per week, dog walking for Mrs Casper. Each week, George spent $5 on lollies and was given $3 pocket money from his grandmother. How much money would George have after 4 weeks?

Write a number sentence to match the '*action*' in each of the stories:

1. 2.

What do you notice?

Which operations (+, –, × or ÷) were used in these number sentences? What clues in the problems helped you to choose these operations?

Lauren thought she would solve the problems from left to right. Calculate the answer mentally. Does the answer make sense for all the problems?

Rewrite the number sentences for each of the problems:

1. 2.

Insert brackets into the number sentences where needed, in order to make sense of the '*action*' in those problems.

Calculate the answers to each of the problems now.

1. 2.

Check that the answers make sense in the context of the problems.

Explain in words how inserting brackets helps the number sentences, for some problems, make sense.

Practice Exercise 1

1. Circle the number sentence that correctly matches each of the following problems

a) $40 is shared between the Brown's 5 girls and 3 boys. How much does each child get?

A. $40 \div (5 + 3)$ B. $40 \div 5 + 3$ C. $(5 + 3) \times 40$ D. $40 - 5 - 3$

b) Jan cuts 2 metres from a 5.4 metre length of rope. She then cuts the remaining piece into 5 equal pieces. What is the size of each of the 5 pieces?

A. $5.4 - 2 - 5$ B. $5.4 - 2 \times 5$ C. $2 - 5.4 \div 5$ D. $(5.4 - 2) \div 5$

c) Ruby takes 4 tins of tuna from a stack of tuna tins with 15 rows of 8 tins. How many tins of tuna are left in the stack?

A. $4 - 15 \times 8$ B. $4 \times 15 - 8$ C. $15 \times 8 - 4$ D. $(4 - 15) \times 8$

d) Belle has $30. She bought 2 show bags at the Royal Show each worth $7. How much did she have left?

A. $(30 - 2) \times 7$ B. $30 - 2 - 7$ C. $2 \times 7 - 30$ D. $30 - (2 \times 7)$

e) On Thursday, John did 15 minutes of maths homework. On Friday, John did 12 minutes. On Saturday, John did 3 times as much as he did on Thursday and Friday combined. How much maths homework did John do on Saturday?

A. $(15 + 12) \div 3$ B. $(15 + 12) \times 3$ C. $15 + (12 \times 3)$ D. $15 \times 3 + 12$

f) Seymour weighed 102 kg. He lost 3 kg every week for 7 weeks. How much did Seymour weigh at the end of 7 weeks?

A. $(102 - 3) \times 7$ B. $102 - 3 \div 7$ C. $102 - (3 \times 7)$ D. $102 - 3 - 7$

2. Write a number sentence to reflect the following problems. Use brackets, if necessary, to show which operations to do first in order to get an answer that makes sense.

a) Jenny had $300. She bought 2 identical shirts for $55 each. How much money did she have left over?

b) Cara had a rectangular sheet of paper measuring 12 cm by 5 cm. She cut off a small rectangle measuring 3 cm by 4 cm. What area of paper was left?

c) In the Smith family there were 3 boys and 4 girls. They each received $25 to go to the movies. How much did this cost the Smith family?

d) Kate downloaded 30 movies onto her laptop. On the weekend, she deleted 4 of them and then downloaded 7 more. How many movies did she have on her laptop?

e) Bob had $600 in his bank account. He saved $40 each week for 10 weeks. How much did he have in his account after 10 weeks?

f) Wendy earned $350 for 5 days work. How much would she earn for 6 days work?

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Whole Class Activity 2

Think: How do we mentally solve everyday multistep problems?

Lauren and Jesse were solving the following problem:

Sarah waitresses at *Starving Jack's Burger Café*. She works 4 hours during the week and is paid \$8.50 /hour. She works 6 hours on the weekend and is paid \$10 /hour. How much does Sarah earn in the week?

LAUREN'S SOLUTION	JESSE'S SOLUTION
Decide: EXACT or APPROXIMATE EXACT	Decide: EXACT or APPROXIMATE EXACT
Decide: MENTAL CALCULATOR MENTAL	Decide: MENTAL CALCULATOR MENTAL
NUMBER SENTENCE TO REFLECT PROBLEM 4 × 8.50 + 6 × 10	NUMBER SENTENCE TO REFLECT PROBLEM 4 × 8.50 + 6 × 10
STRATEGY AND SOLUTION 4 × 8.50 (× 4 IS THE SAME AS DOUBLING AND DOUBLING AGAIN i.e. 8.50 × 2 × 2 = 34) 34 + 6 = 40 40 × 10 = 400 Sarah earns \$400 in the week	STRATEGY AND SOLUTION 4 × 8.50 (× 4 IS THE SAME AS DOUBLING AND DOUBLING AGAIN i.e. 8.50 × 2 × 2 = 34) 6 × 10 = 60 34 + 60 = 94 Sarah earns \$94 in the week
CHECK SOLUTION \$400 seems like too much for 10 hours work in this job. 400 ÷ 10 = 40. That's \$40 /hour which is too much	CHECK SOLUTION \$94 seems about the right amount for 10 hours work in this job. 94 rounded to the nearest 10 is 90 and 90 ÷ 10 = 9. That's \$9/hour which seems about the average rate per hour.

Which parts of the decision making process did Lauren and Jesse agree on?

Which parts of the decision making process did Lauren and Jesse disagree on?

How did Lauren solve the problem? Check her calculations.

How did Jesse solve the problem? Check his calculations.

Who is correct? Discuss.

How could brackets be inserted into the problem in order to ensure that the correct answer is calculated?

View Math Antics – Order of Operations

https://www.youtube.com/watch?v=dAgfnK528RA

In the space below, take notes on the order +, –, × and ÷ should be completed. Give examples to show your thinking.

How could the correct solution to Lauren and Jesse's problem be explained using the Order of Operations?

Practice Exercise 2

1. Solve these problems mentally or with jottings to decode the answer to the puzzle. The letter of the question goes with the box with the answer in it.

What time did the man go to the dentist?

T: $13 + 4 \div 2$	U: $10 \times (11 + 6)$	O: $50 \div 5 \times 12$
R: $36 \div 3^2$	T: $10 - 4 - (20 \div 10)^2$	T: $27 \times (11 - 4)$
O: $(15 - 2) \times (7 - 3)$	Y: $1000 - 20 \times 40$	H: $26 - 8 + 3$

2	120	52	15	21	21	170	4	189	200

2. The following problems all require an exact answer and are best solved using mental strategies.

- Draw a line to connect the problem with its matching number sentence.
- Insert any brackets into the number sentences in order for the problems to make sense.
- Draw a line to connect the number sentence with the correct answer.

PROBLEM	NUMBER SENTENCE	ANSWER
a) Dale did 50 push–ups on Monday. On Tuesday he did 9 less. On Wednesday, he did 3 times as many as he did on Tuesday. How many push–ups did Dale do on Wednesday?	• $50 + 9 - 3$	• 231
b) A rectangle has dimensions of 50 m by 3 m and a square has a side length of 9 m. What is the total area of the rectangle and the square?	• $50 + 9 \div 3$	• 600
c) Malcolm had $50 in the bank. He deposited $9 and then was charged $3 transaction fees. How much is in his account now?	• $9 + 3 \times 50$	• 36
d) David had 50 lollies of his own. He and his two brothers were then given a bag of 9 lollies, which they had to share. How many lollies did David have altogether?	• $50 - 9 \times 3$	• 56
e) On Monday at Starving Jack's burger cafe, Ben sold 9 hamburgers and Julie sold 3. On the weekend they sold 50 times more than this total. How many burgers did they sell on the weekend?	• $3^2 + 3 \times 9$	• 53
f) Ben bought tins of tomatoes in bulk. On one shelf of his pantry, he arranged 3 stacks of tins in columns of 3. On another shelf, he arranged 3 stacks of tins in columns of 9. How many tins of tomatoes were there?	• $50 \times 3 + 9^2$	• 123

2. Work with a partner to write a problem to match each number sentences. Solve your problem using mental calculations and/or jottings.
   Check your answer makes sense using the context of the problem. (HINT: Refer to Practice Exercise 1, Question 1, if you need help designing questions.)

Number Sentence	Problem	Strategy And Solution	Does It Make Sense?
200 – 2 × 70			
30 – 2 + 6			
(2 × 8) – (3 × 4)			
(9 + 4) × 6			

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Reflection and Discussion

PROBLEM: Ronald won $1000. He gave $20 to his Mum and shared the remainder between 6 friends. How much would each friend receive?

When solving this problem we first decide whether an exact or approximate answer is needed. In this case it is clear that we need an exact answer.

The decision making flow chart then tells us to decide whether to use a mental strategy or a digital resource like a calculator or spreadsheet. In this problem, the numbers are fairly 'friendly' so we would be tempted to say that it is best solved mentally. However, it is not until we write the number sentence that reflects the problem that we realise that a mental calculation is difficult.

Write a number sentence to reflect Ronald's problem. Insert brackets to show which calculation to perform first.

Why is this problem difficult to solve mentally?

How do we alter the decision making flow chart to make it easier to decide whether to solve multistep problems using mental strategies or digital technologies?

Whole Class Activity 3

Think: How do digital resources help us solve everyday multistep problems?

Lauren and Jesse decided to check their answers to the problem about Sarah's wage at *Starving Jack's Burger Café,* with a calculator.

Lauren used this calculator and entered 4 × 8.50 + 6 × 10 =

She got an answer of 400.

Jesse used this calculator and entered 4 × 8.50 + 6 × 10 =

He got an answer of 94.

How can Lauren and Jesse get different answers using a calculator? Explain.

They decided to both check the answer to 4 × 8.50 + 6 × 10 using their phones. What answer would you expect to get? Check using a phone. Did you get 400, 94 or something else?

Lauren decided to check the result using a spreadsheet. She opened a new spreadsheet workbook and entered this data:

	A	B	C	D
1		SARAH'S WAGE		
2	Weekday hours	Weekend hours	Weekly wage	
3	4	6		
4				

What formula would Lauren enter in cell C3?

What answer would you expect in cell C3? Justify your conclusion by setting up this small spreadsheet and calculating the value in C3.

What type of digital technology performs the order of operations correctly?

Practice Exercise 3

1. Mr & Mrs Brown and Jasper Brown work at a supermarket stacking shelves. They have 198 tins of tuna to stack and stack them in 16 columns of 12 tins high. How many tins of tuna did they have left over?

a) Write a number sentence(s) to reflect the problem.

b) Why is this problem best solved using a calculator?

c) The Brown family each used their own calculator to solve the problem. Mr Brown got 2 184 tins left over, Mrs Brown got 6 tins left over and Jasper got 2 976 tins left over. How did they all arrive at their answers?

d) Who is correct? Explain using order of operations and the context of the problem.

2. Use the decision making process in the table to solve the following problems:

a) PROBLEM: Mia wants to save $2 500 for a scooter. If she has saved $194.78 every fortnight for 12 fortnights, how much does she have left to save?

Circle: APPROXIMATE ANSWER or EXACT ANSWER?
Write a number sentence that reflects the problem:
Circle: MENTAL or DIGITAL RESOURCE?
STRATEGY and SOLUTION

IS THE ANSWER REASONABLE? What is the number referring to? Write the answer in a sentence using the words in the question.

b) PROBLEM: Jaxon wants to save $3 000 for a car. How much does he need to save each fortnight for two years to purchase the car?

Circle: APPROXIMATE ANSWER or EXACT ANSWER?
Write a number sentence that reflects the problem:
Circle: MENTAL or DIGITAL RESOURCE
STRATEGY and SOLUTION
IS THE ANSWER REASONABLE? What is the number referring to? Write the answer in a sentence using the words in the question.

c) PROBLEM: Jilly is saving for a $6 500 car. She has a $5 000 deposit and is planning to save $100 per month for a year. Will she have enough money after 1 year?

Circle: APPROXIMATE ANSWER or EXACT ANSWER?
Write a number sentence that reflects the problem:
Circle: MENTAL or DIGITAL RESOURCE
STRATEGY and SOLUTION
IS THE ANSWER REASONABLE? What is the number referring to? Write the answer in a sentence using the words in the question.

d) PROBLEM: Jackie saves $250 per month. In 8 months time, how much will she still need to save in order to buy a $3 299 bed suite?

Circle: APPROXIMATE ANSWER or EXACT ANSWER?
Write a number sentence that reflects the problem:
Circle: MENTAL or DIGITAL RESOURCE
STRATEGY and SOLUTION

IS THE ANSWER REASONABLE? What is the number referring to? Write the answer in a sentence using the words in the question.

3. The following questions relate to the problems in Question 2.

a) What tool did you use to solve the problems best solved by a digital resource? Circle:

BASIC CALCULATOR SCIENTIFIC CALCULATOR PHONE SPREADSHEET

b) Did you need to add brackets to the number sentences best solved by a digital resource in order for the problems to be solved correctly? Explain why or why not?

Whole Class Activity 4

Think: How do we use a spreadsheet to solve everyday multistep problems?

In May, Melba borrows $5 000 from her parents to buy a car. Each month they charge her $50 interest and each month she repays $500 on the amount owing. How long does it take Melba to repay the debt?

Why is this problem best solved using a spreadsheet? Discuss.

Open a new spreadsheet workbook and enter the following headings and data:

	A	B	C	D	E
1		AMOUNT OWING			
2	Month	Amount	Interest	Repayment	Owing
3		5000	50	500	
4					

Work through the following process:

a) Enter May in cell A3. Hold and scroll down from the black marker on the corner of cell A3 until A20

b) What formula would you enter in cell E3 to calculate how much Melba owes after one month?

c) Type in your formula in E3 and press enter. Check that your result matches your mental calculation.

d) What formula would you enter in cell B4 so that the opening balance of June is the same as the closing balance of May? Type in the formula and press enter.

e) Click in cell C4. Enter 50

f) Click in cell D4. Enter 500

g) Click in cell E3. Hold and scroll down from the black marker on the corner of cell E3 into E4.

What amount is owing at the end of June?

h) Highlight the row from cell B4 to cell E4. Click and scroll down from the black marker on the corner of E4, down the spreadsheet until you see a negative amount in the OWING column.

i) Save your worksheet giving it the name 'Melba's Car Loan', by selecting *Save As* from the *File* menu and entering the file name. Print and staple your spreadsheet to the side of this page.

What does the negative number in the OWING column mean?

What was Melba's last repayment?

How many months did it take Melba to pay off her loan?

How much interest did Melba pay in this time?

In July, Melba could afford to pay $1 000 off the loan. Change this on the spreadsheet. How did this alter the time it took to pay off the loan and the interest paid?

Would the totals in the OWING column be different if Melba made a $500 repayment first and then paid the $50 interest (ie swapped columns C and D)? Why or why not?

Practice Exercise 4

1. Terry buys a taxi license for $50 000. Each fortnight he pays $500 off the loan and each fortnight he is charged $300 interest. How much will Terry owe on the license after 1 year? Show any jottings or spreadsheets in the space below:

2. Review the formula for perimeter of a rectangle by reading the Mathematics Discussion on p248 of Unit 2 of the Foundation Mathematics textbook. Create a spreadsheet so you can enter the length and width of any rectangle and it will calculate the perimeter of that rectangle. Demonstrate with at least 8 examples of length and width. Print your spreadsheet and staple it to the side of this page.

Practice Exercise 5

1. Use the decision making process (exact or approximate answer; mental or digital strategy, and choosing the correct operation) to solve the following problems.

a) Bruce has a steel beam 22 metres long. He cuts off three, 6 metre lengths. How much of the steel beam does he have left?

b) Sann wants to save $10 000 for a car. He saves $215 per fortnight for a year. How much does he still need to save at the end of the year?

c) Dudley gave $75 to his only niece and $55 to each of his 8 nephews. How much did Dudley give away?

d) Kevin is the owner of a tyre–fitting store. He calculates the number of tyres he fits each day on motorcycles (2 tyres each) and cars (4 tyres each). He wants to see if there are any patterns in the number of tyres he fits in the first 6 months of the calendar year to make predictions for the second 6 months.

MONTH	JAN	FEB	MAR	APR	MAY	JUN
No of CARS	210	235	238	254	201	138
No of MOTORCYCLES	21	24	36	54	63	86

What month was the minimum number of tyres fitted? How many tyres were fitted in this month? What month was the maximum number of tyres fitted? How many tyres were fitted in this month? What trends can Kevin see from the data?

e) A 42 piece white chocolate bar was shared between 3 housemates. They also shared a 16 piece dark chocolate bar. How many pieces of chocolate did each of the housemates receive?

f) Neville saves $85.50 in the first week of saving and then for 7 weeks in a row saves $150 per week. In the 9th week, he takes out $60 from his savings. How much of his savings does Neville still have?

Reflection on Learning

Erin and Tegan play for the Swan View Cygnets U/18's women's basketball team. In the Friday night final, Erin scored 5 three pointers, 9 two pointers and 8 points from the free throw line (1 point each). Tegan scored a 3 pointer and 8 two pointers.

1. Circle the number sentence that matches Erin's score in blue.

Circle the number sentence that matches Tegan's score in red.

A. $(5 + 9 + 8) \times 2$	B. $3 + 8$	C. $5 \times 3 + 9 \times 2 + 8 \times 1$	D. $8 \times 2 \div 3 \times 1$
E. $(3 + 8) \times 2$	F. $(5 + 9 + 8) \div 2$	G. $3 \times 2 \times 1 \times (5 + 9 + 8)$	H. $3 + 8 \times 2$

2. Explain your choice of number sentence. Use words such as 'repeated equal amounts', 'combining' and 'total'.

3. Erin and Tegan wanted to find out how many points they had scored altogether. Calculate their points using mental strategies and jottings in the space below.

ERIN TEGAN

4. They decided to check their points using a digital device. Erin used a calculator. She said 'Wow, I scored 56 points!' Tegan used a phone. She said 'I scored a lot less than you. I only scored 19 points'. Were the girls' calculations correct? Explain their answers.

5. The Swan View Cygnets scorer uses a spreadsheet on her laptop to record the points each girl scored. Open a new spreadsheet workbook. Enter the following headings and data:

	A	B	C	D	E
1	SWC U18's Friday 11th Sept 2015				
2	NAME	3 POINTERS	2 POINTERS	1 POINTERS	TOTAL
3	Ruby	0	3	1	
4	Julie	4	7	2	
5	Erin	5	9	8	
6	Sarah	12	3	0	
7	Lauren	0	8	3	
8	Maddie	0	0	1	
9	Tegan	1	8	0	
10	Jordan	7	5	3	

6. What formula would you enter in cell E3 to find the total points each girl scored?

7. Complete the spreadsheet to find the total points each girl scored. Use the Σ button to find their total points for the game. Save and print your spreadsheet and staple it to the side of this page.

8. Check how many points Erin and Tegan scored on the spreadsheet. Are their total points calculated the same as when they used a mental strategy or a calculator? Discuss.

9. The opposing team scored 189 points. Which team won the game?

10. The scorer realised that she had entered Jordan's points in the wrong order. They should have been entered as 3 three pointers, 5 two pointers and 7 free throws. Does this incorrect entry affect the result of the game? Explain.

OLNA Practice Questions

1. The daily charges of a local Rent-a-car business are shown below

	1–6 days	7 or more days
Cost per day	\$48	\$45

Jaxon hires a car for 6 days. Brett hires a car for 7 days. Brett's bill is more than Jaxon's bill by:

A. \$48 B. \$14 832 C. \$29 D. \$27

2. Four pieces are cut from a 3.4 metre length of ribbon. Each piece is 0.8 metres long.

Which of the following would you use to calculate the approximate amount of ribbon left over?

A. 3.4 – 4 – 0.8 B. 3.4 – (4 × 0.8) C. 3.4 ÷ 4 – 0.8 D. (3.4 – 0.8) ÷ 4

3. James' Mowing company quotes \$150 to mow and weed Mrs Jim's lawn. The lawn has measurements 20 m long and 5 m wide. Assuming the company uses the same cost per square metre, what is the cost of mowing and weeding a lawn of dimensions 10m by 30m.

A. \$450 B. \$350 C. \$250 D. \$150

Section 2

The Four Operations – Fractions and Decimals

Content Focus

Mathematics Foundation	Australian Curriculum Link
3.3.1 Determine whether an accurate answer or an estimation is needed in everyday contexts involving fractions and decimals	ACMNA077 Investigate equivalent fractions used in contexts
3.3.2 Choose to add, subtract, multiply or divide fractions and decimals to solve a range of everyday problems involving fractions and decimals	ACMNA078 Count by quarters, halves and thirds, including with mixed numerals. Locate and represent these fractions on a number line
3.3.3 Choose between simple decimals and fraction equivalents to solve problems in practical contexts	ACMNA079 Recognise that the place value system can be extended to tenths and hundredths. Make connections between fractions and decimal notation
3.3.4 Choose between mental, calculator or spreadsheet to solve problems in practical contexts	ACMNA083 Use equivalent number sentences involving addition and subtraction to find unknown quantities
3.3.5 Mentally solve everyday problems with fractions • Add and subtract simple fractions mentally by visualising fractional parts and counting • Use links between everyday fractions and decimals to assist in mental calculations	ACMNA099 Use estimation and rounding to check the reasonableness of answers to calculations
3.3.6 Use links between everyday fractions and decimals with a calculator when more complex numbers are involved	ACMNA121 Use equivalent number sentences involving multiplication and division to find unknown quantities
3.3.7 Use a spreadsheet to solve everyday problems involving fractions or decimals	ACMNA126 Solve problems involving addition and subtraction of fractions with the same or related denominators
3.3.8 Use properties of operations to anticipate the effect of operations on fractions or decimals	ACMNA127 Find a simple fraction of a quantity where the result is a whole number, with and without digital technologies
3.3.9 Use estimation strategies, including rounding, when an accurate answer is not required	ACMNA128 Add and subtract decimals, with and without digital technologies, and use estimation and rounding to check the reasonableness of answers
3.3.10 Interpret decimal remainders from division calculations in relation to the context	ACMNA129 Multiply decimals by whole numbers and perform divisions by non–zero whole numbers where the results are terminating decimals, with and without digital technologies
3.3.11 Determine whether an answer is reasonable using properties of operations, estimation and the context of the problem	ACMNA130 Multiply and divide decimals by powers of 10
3.3.12 Communicate solutions using language and symbols consistent with the context	ACMNA153 Solve problems involving addition and subtraction of fractions, including those with unrelated denominators
	ACMNA154 Multiply and divide fractions and decimals using efficient written strategies and digital technologies
	ACMNA156 Round decimals to a specified number of decimal places
	ACMNA157 Connect fractions, decimals and percentages and carry out simple conversions

Topic 1

Choosing an Operation to Solve Everyday Problems

Mathematics Discussion

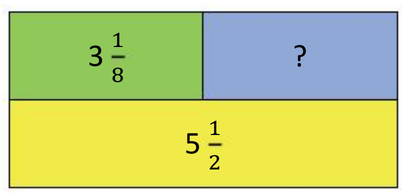
In this section, we focus on which operation: addition, subtraction, multiplication or division to choose, in order to solve everyday problems involving fractions and decimals.

Remember **Addition and Subtraction** problems can be recognised because they usually involve changing an amount by adding more or taking some away, thinking of an amount as a combination of two or more parts, comparing amounts or making two amounts equal.

In addition or subtraction problems, we use Part–Part Whole thinking to decide whether the 'Whole' is missing (addition) or a 'Part' is missing (subtraction). For example, 'In a 'Relay for Life' charity run, Sue and Kelly ran $5\frac{1}{2}$ km. If Sue ran $3\frac{1}{8}$ km, how far did Kelly run?'

$3\frac{1}{8}$ km is one part of the total run of $5\frac{1}{2}$ km. We can place these numbers in a diagram.

We can write a number sentence that reflects the problem $3\frac{1}{8} + ? = 5\frac{1}{2}$



We could think of this as *what needs to be added to $3\frac{1}{8}$ to get $5\frac{1}{2}$* or, as *a part is missing*, $5\frac{1}{2} - 3\frac{1}{8} = ?$

These are equivalent number sentences.

Multiplication problems can be recognised because they usually involve repeated equal quantities, arrays, 'times as many', rates, or measures (usually area or volume). **Division problems** involve the same situations, and sharing or grouping.

In multiplication and division problems we use arrays and our understanding that:

SIZE OF EACH GROUP × NUMBER OF GROUPS = TOTAL

- If the TOTAL is missing, we use MULTIPLICATION
- If the TOTAL is present, we use DIVISION

For example, 'Sue bought 1.3 kg of cashews. The cashews cost \$4.32. How much were the cashews per kilogram?'

The total cost is \$4.32 and the number of groups is 1.3. We can place these numbers in an array diagram. The diagram below shows that we do not know the size of one whole group i.e. the price of one kilogram.

SIZE OF A GROUP ($/kg)?

TOTAL $4.32	1.3 kg

We can write a number sentence to reflect how we think about the problem:
$1.3 \times \ ? = \$4.32$

As the TOTAL is present, we can use division. To solve this on a calculator we would enter $\$4.32 \div 0.3 = ?$

Having 'Parts' and 'Wholes' in addition or subtraction problems and 'Sizes of Groups', 'Number of Groups' or 'Totals' in multiplication or division problems that are fractions or decimals can be confusing, but we must remember that we choose the operation in the same way as problems with whole numbers.

Whole Class Activity 1

What key information in a problem involving fractions or decimals helps us choose between addition and subtraction?

The picture in Situation 1 and the table in Situation 2 are examples of where we see fractions and decimals.

SITUATION 1

Sam's Chocolate Mud Cakes at the Biko Cafe

SITUATION 2

The following table shows the penalties that will apply for a first offence of driving with a Blood Alcohol Content (BAC) of greater than or equal to 0.05 and less than 0.08 in Western Australia.

Blood Alcohol Content (g/100 ml)	Demerit Points
Greater than or equal to 0.05 but less than 0.06	3
Greater than or equal to 0.06 but less than 0.07	4
Greater than or equal to 0.07 but less than 0.08	5

Roberta, a class member, wrote the following problems relating to the diagrams and tables:

1. Sam sold $1\frac{1}{12}$ of a tart. How much tart was left?

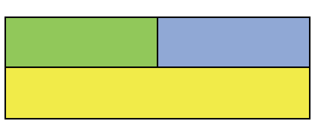
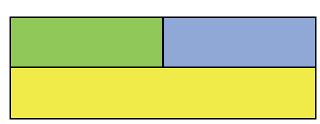
2. Tom blew a BAC of 0.062. Katie blew 0.05 less. What was Katie's BAC?

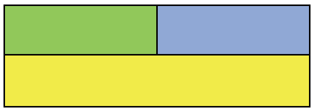
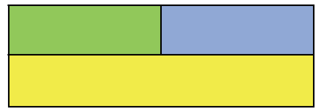
3. Stuart had his BAC tested and 2 hours later another test showed that it was 0.015 less. His BAC now read 0.04. What was Stuart's initial BAC reading?

4. Sam sold $\frac{3}{4}$ of a chocolate mud cake in the morning and $\frac{1}{2}$ in the afternoon. How much cake did Sam sell?

Write Roberta's problems in the correct part of the following table. Show your thinking of how to choose the correct operation in the table below.

Discuss your work with your class members.

Fraction Problem	Decimal Problem
Addition problem Number sentence to reflect problem: Part/part whole diagram:  Number sentence to find answer (this may be the same number sentence as above):	Addition problem Number sentence to reflect problem: Part/part whole diagram:  Number sentence to find answer (this may be the same number sentence as above):

Subtraction problem	Subtraction problem
Number sentence to reflect problem: Part/part whole diagram:  Number sentence to find answer (this may be the same number sentence as above):	Number sentence to reflect problem: Part/part whole diagram:  Number sentence to find answer (this may be the same number sentence as above):

Were there any problems that could be solved using either addition or subtraction? Discuss your thinking.

Using the chocolate mud cake diagram and the BAC table, write one addition and one subtraction problem in the table below that could be applied to each situation.

Remember, addition and subtraction problems usually involve changing an amount by adding more or taking some away, thinking of an amount as a combination of two or more parts or equalising or comparing amounts.

	Addition Problem	**Subtraction Problem**
Fraction		
Decimal		

Copy the above table onto a large class poster.

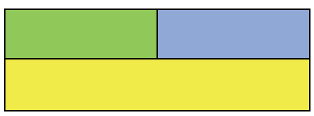
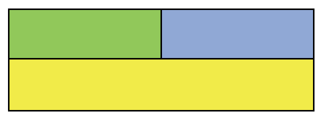
Write each of your problems in the class poster.

What are the characteristics of the ADDITION problems?

What are the characteristics of the SUBTRACTION problems?

Practice Exercise 1

1. Show your thinking about the following problems in the table below:

a) PROBLEM: Marika budgets $\frac{1}{2}$ of her pay to savings. Belinda budgets $\frac{1}{10}$ of her pay to savings. What fraction more does Marika budget than Belinda?	b) PROBLEM: Marika has a 2 kg lump of cookie dough. She bakes $\frac{3}{4}$ kg of dough. How much dough does she have left?
Number sentence to reflect problem: Part/part whole diagram:  Number sentence to find answer: Number sentence to enter in calculator:	Number sentence to reflect problem: Part/part whole diagram:  Number sentence to find answer: Number sentence to enter in calculator:

2. Justify which operation, addition or subtraction, best reflects the following problems, by stating whether the whole or a part is missing. The first problem has been completed for you.

a) Su–Lam is 0.19 m shorter than Francesca. If Francesca is 1.8 m tall, how tall is Su–Lam?

PART missing; Subtraction

b) Paul ran $\frac{1}{4}$ km and then walked $\frac{2}{3}$ km. What fraction of a kilometre has he covered?

c) Jason drank 0.75 L of water before a 10 km run and 1.3 L after the run. How much water had he drunk altogether?

d) In a men's javelin competition the winner's two throws totalled 178.4 m. If the first throw was 90.4 m, how long was the second throw?

e) Two spanners have sizes of $\frac{9}{16}$ inches and $\frac{3}{8}$ inches. What is the difference in these spanner sizes?

f) Jenny weighed 2.35 kg at birth. In the first week, she gained 0.8 kg. What was her weight at the end of the first week?

3. Write a number sentence to calculate the answers to the following problems:

a) Belle jumps 3.35 m in Long Jump at the Athletics Carnival and Paul jumps 2.64 m. How much longer does Paul's jump have to be to match Belle's?

b) Belle jumps $3\frac{3}{4}$ m and Paul jumps $2\frac{1}{2}$ m. What is their total jumping distance?

c) Paul jumps 2.23 m. If he jumps another 0.91 m, he will have jumped the same distance as Belle. How far did Belle jump?

d) Belle jumped $\frac{1}{4}$ m less on her second jump than her first. If she jumped $3\frac{3}{8}$ m on her second jump, how much did she jump on her first?

e) Belle jumps 3.45 m. If Paul jumps another 0.91 m on his second jump, his jump will be the same as Belle's. What was Paul's original jump?

f) Belle and Paul jumped a total of 6 m. If Belle jumped $3\frac{1}{8}$ m, how far did Paul jump?

Whole Class Activity 2

Think: What key information in a problem, involving fractions and decimals, helps us choose between multiplication and division?

The situations below are examples of where we see fractions and decimals in daily life.

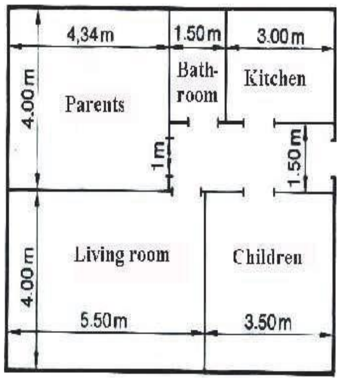
Roberta, a class member, wrote the following problems:

<table>
<tr><th>Situation</th><th>Problems</th></tr>
<tr><td>1.

</td><td>1. If I made a $\frac{1}{4}$ of the recipe, how much sugar would I need?

2. Jack uses $1\frac{1}{2}$ cups of Chocolate Chips. How many quantities of this recipe is Jack making?</td></tr>
</table>

<table>
<tr>
<td>
2.



</td>
<td>
3. What is the area of the parent’s room in the house floor plan?

4. If the kitchen, in the house floor plan, has an area of 5.25 cm^2 and its width is 3.00 m, what is its length?
</td>
</tr>
<tr>
<td>
3.

</td>
<td>
5. If the chicken costs $9.60 and Jack bought 0.519 kg, how much was the chicken per kilogram?

6. The chicken costs $18.49/kg, how much would 2.5 kg cost?
</td>
</tr>
</table>

Write Roberta’s problems in the correct part of the following table. Show your thinking of how to choose the correct operation in the table below. Discuss with your class members.

Multiplication Problems	**Division Problems**
Problem number: Array diagram Number sentence to reflect problem: Number sentence to find answer (this may be the same as above):	Problem number: Array diagram Number sentence to reflect problem: Number sentence to find answer (this may be the same as above):

Problem number: Array diagram Number sentence to reflect problem: Number sentence to find answer (this may be the same as above):	Problem number: Array diagram Number sentence to reflect problem: Number sentence to find answer (this may be the same as above):
Problem number: Array diagram Number sentence to reflect problem: Number sentence to find answer (this may be the same as above):	Problem number: Array diagram Number sentence to reflect problem: Number sentence to find answer (this may be the same as above):

Two students were discussing which column to put question 1 in.

One student said it was multiplication because they thought the *Number sentence to find answer* would be $\frac{3}{4} \times \frac{1}{4}$ = ? The other student said it was division because they thought the *Number sentence to find answer* would be $\frac{3}{4} \div 4$ = ? Who is correct? Discuss your thinking.

Using the recipe, the house floor plan or the meat tray price ticket, write one multiplication and one division problem in the table below.

	Multiplication Problem	**Division Problem**
Fraction		
Decimal		

Copy the above table onto a large class poster and write each of your problems into it.

What are the characteristics of the MULTIPLICATION problems?

What are the characteristics of the DIVISION problems?

Practice Exercise 2

1. Show your thinking about the following problems in the table below:

a) Josie earns \$450 per week. Ruby earns $\frac{4}{5}$ of this amount. How much does Ruby earn?	b) A bus travels 13.24 km to school. There are 11 bus stops evenly placed along this route. How far apart are the bus stops?
Number sentence to reflect problem: Array diagram: Number sentence to find answer (this may be the same as above): Number sentence to enter in calculator:	Number sentence to reflect problem: Array diagram: Number sentence to find answer (this may be the same as above): Number sentence to enter in calculator

2. Max made some array sketches that represent multiplication or division problems. Write a problem for each array and complete the required number sentences.

a) Problem:

Array diagram

$6.25/kg

Total cost?

3.75 kg

Number sentence to reflect problem:

Number sentence to find answer (this may be the same as above):

b) Problem:

Array diagram

$1.40/L

Total cost $3.50

? L

Number sentence to reflect problem:

Number sentence to find answer (this may be the same as above):

c) Problem:

Array diagram

$/kg?

Total cost $6.40

0.4 kg

Number sentence to reflect problem:

Number sentence to find answer (this may be the same as above):

d) Problem:

Array diagram

Amount per person?

Total pizza 6 ½

3 people

Number sentence to reflect problem:

Number sentence to find answer (this may be the same as above):

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3. a) Katie is selling oranges at a local farmer's market. She charges \$6.25 per kilogram. Circle the operation she would key into her calculator as she weighed each of these amounts of oranges:

- 4 kg

  6.25 + 4   6.25 × 4   6.25 ÷ 4   6.25 – 4

- $4\frac{3}{4}$ kg

  6.25 – 4.75   6.25 ÷ 4.75   6.25 × 4.75   6.25 + 4.75

- 1.25 kg

  6.25 ÷ 1.25   6.25 + 1.25   6.25 – 1.25   6.25 × 1.25

- 0.75 kg

  6.25 × 0.75   6.25 – 0.75   6.25 + 0.75   6.25 ÷ 0.75

b) Explain your choice of operation in the above problems.

4. a) Katie has 135.6 kg of oranges. Circle the operation she would key into her calculator to work out how many bags she would make up if each bag weighed:

- 4 kg

  135.6 + 4   135.6 × 4   135.6 ÷ 4   135.6 – 4

- $2\frac{1}{2}$kg

  135.6 – 2.5   135.6 ÷ 2.5   135.6 × 2.5   135.6 + 2.5

- $\frac{3}{4}$ kg

  135.6 ÷ 0.75   135.6 + 0.75   135.6 – 3 + 4   135.6 × 0.75

- 0.625 kg

  135.6 × 0.625   135.6 – 0.625   135.6 + 0.625   135.6 ÷ 0.625

b) Explain your choice of operation in the above problems.

5. Choose between multiplication or division to solve the following problems by stating what is missing – the TOTAL (×), the SIZE OF EACH GROUP or the NUMBER OF GROUPS (÷).

The first problem has been done for you.

a) Frank's pace rate is 1.3 paces per metre. How many paces will he take if he walks 100 m?

TOTAL present; Division

b) Indoor netball games take $\frac{3}{4}$ of an hour. How many games could be played in 3 hours?

c) The scale on a map is 1 cm = 10 km. The distance on the map between towns A and B is

$8\frac{1}{4}$ cm. How far apart are the towns?

d) Each person at a sports event will drink 0.75 litres of juice from a 22 litre container. How many people will get a drink?

e) A recipe requires $\frac{1}{3}$ cup of butter. How much butter is needed if the recipe is tripled?

f) Belinda cuts an 8.4 m length of rope into 0.6 m pieces. How many pieces will there be?

6. Write a number sentence to calculate the answers to the following problems:

a) An Olympic pool has 8 lanes for competitors and one extra lane on each side. All lanes are $2\frac{1}{2}$ m wide. How wide is an Olympic Pool?

b) The area of one lane of the pool is 125 m^2. If the width of the lane is 2.5 m, what is the length?

c) A 'warm–up pool' is one quarter the length of a 50 m Olympic Pool. How long is a 'warm–up pool'?

d) Grant Hackett, Olympic Medallist, swims 100 m in 58.3 seconds in long distance events. How long would it take him to swim one 50 m lap of the pool?

e) Denis Pankratov, from Russia, can swim the 50 m Butterfly in 23.68 seconds. Sophie, from the Belmont Swim Club, takes $2\frac{3}{4}$ times longer. How long does Sophie take?

f) Lane lines in pools are wire cables covered with small plastic "floats" that separate each lane. If the floats are 1.8 m apart, how many sections of cable are there between the floats in one lane line in a 50 m pool?

Practice Exercise 3

1. Circle the addition and subtraction problems in **blue**. Write whether a 'PART is missing; SUBTRACTION' or a 'WHOLE is missing; ADDITION', next to the problem.

Circle the multiplication and division problems in **red**. Write whether the 'TOTAL is missing; MULTIPLICATION' or 'TOTAL is present; DIVISION', next to the problem.

a) A bike weighs 9.3 kg. How much would 4 of the same bikes weigh?

b) The average standing jump of a 10 year old boy is 145.5 cm. Billy can jump 2.7 cm longer. How far can Billy jump?

c) A bottle of soft drink is $\frac{3}{4}$ litre. How many litres would 19 of these bottles contain?

d) 84.3 kg of sugar is poured into bags which hold 1.5 kg each. How many bags can be filled?

e) Jan has a bag of lollies weighing $\frac{7}{8}$ kg. Keryn's bag weighs $\frac{1}{2}$ kg. How much more does Jan's bag weigh than Keryn's?

f) Bec pours $3\frac{1}{2}$ litres of tea into $\frac{1}{4}$ litre cups. How many cups can she pour?

2. Match the word problems with one of the following number sentences:

a) A. $\frac{3}{4}+\frac{1}{2}$ B. $\frac{3}{4}-\frac{1}{2}$ C. $\frac{3}{4}\times\frac{1}{2}$ D. $\frac{3}{4}\div\frac{1}{2}$

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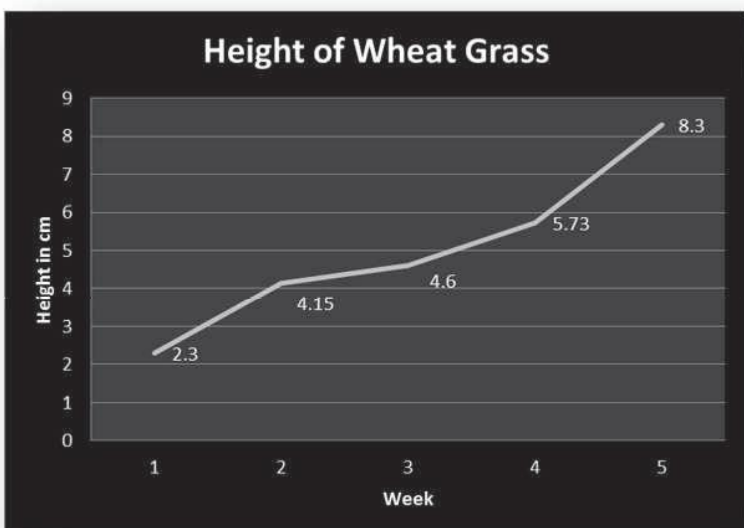
- $\frac{3}{4}$ of a pizza was leftover from a party. Stephanie ate $\frac{1}{2}$ of that amount. What fraction of a pizza did Stephanie eat?
- Peter ate $\frac{1}{2}$ a pizza. Rebecca ate $\frac{3}{4}$ of a pizza. How much pizza did they eat altogether?
- $\frac{3}{4}$ of a pizza was leftover from a party. Ronald ate some and a half was left. How much did Ronald eat?
- $\frac{1}{2}$ of a pizza is considered, by a pizza company, as one serve. How many serves would $\frac{3}{4}$ of a pizza be?
- Mary cut $\frac{3}{4}$ of a pizza in half. What is the size of the halved piece?

b) A. 32.35 + 1.4 B. 32.35 – 1.4 C. 32.35 × 1.4 D. 32.35 ÷ 1.4

- Daniel paid $32.35 for petrol. If petrol cost $1.40 per litre, how many litres did Daniel buy?
- Daniel filled his car with 32.35 litres of petrol. He used 1.4 litres of petrol driving to the shops. How much petrol did Daniel have left in his car?
- Daniel bought 32.35 litres of petrol costing $1.40 per litre. How much did this cost?
- Daniel bought 32.35 litres of petrol for his car and 1.4 litres for his lawnmower. How much petrol did Daniel buy?
- Daniel bought a 32.35 L large container full of petrol and poured it into smaller 1.4 L containers. How many smaller containers were there?

3. The following graph shows the 'Height of Wheat Grass' as it grows over a 5 week period. Write a number sentence next to each question that could be used to calculate the answer.



a) How much did the wheat grass grow between weeks 4 and 5?

b) How many times taller was the wheat grass in the third week than the first?

c) How many times smaller was the wheat grass in the second week than the fifth?

d) The wheat grass grew 1.5 times its size from week 5 to week 6. How tall was it in week 6?

e) The wheat grass grew 1.13 cm from weeks 3 to 4. True or false? Justify your answer.

Reflection on Learning

1. For the following problems decide:

- Between addition/subtraction and multiplication/division
- For addition/subtraction problems whether the 'Part' is missing (subtraction) or the 'Whole' is missing (addition)
- For multiplication/division problems whether the 'Total' is present (division) or the 'Total' is missing (multiplication)

Try to do the thinking mentally. Use jottings and diagrams to help if needed.

a) Sandra buys 0.7 kg of apples. It costs $4.73. How much are the apples per kilogram?

b) Corey buys $\frac{3}{4}$ kg of apricots. Stacey buys $1\frac{1}{2}$ kg more. How much does Stacey buy?

c) Peter buys 1.4 kg of bananas at $8.99/kg. How much does this cost?

d) Bronte buys $\frac{1}{4}$ kg of oranges. Peter buys $\frac{3}{8}$ kg oranges. How much do they buy altogether?

e) Jen buys $\frac{3}{4}$ kg of peaches and shares them evenly with John. How much do they each get?

f) Kristen separates 10.5 kg of kiwifruit into 1.5 kg bags. How many bags will she make up?

2. In the puzzle below, circle the correct number sentence used to calculate the answers to each of the problems above. Delete all incorrect number sentences and their corresponding letters. You will be left with the answer to the following joke:

What did the hamburger name his daughter?

W	A	Y	P	C	O	A	L
4.73 × 0.7	$1\frac{1}{2} - \frac{3}{4}$	10.5 × 1.5	4.73 ÷ 0.7	$1\frac{1}{2} \div \frac{3}{4}$	$\frac{3}{4} \times 2$	1.4 × 8.99	10.5 + 1.5
T	**T**	**S**	**I**	**V**	**R**	**M**	**E**
$\frac{3}{4} + 1\frac{1}{2}$	$\frac{1}{4} + \frac{3}{8}$	8.99 ÷ 1.4	10.5 ÷ 1.5	$\frac{3}{4} - 2$	$\frac{1}{4} \times \frac{3}{8}$	$\frac{1}{4} - \frac{3}{8}$	$\frac{3}{4} \div 2$

OLNA Practice Questions

1. Mary weighs 1.25 kg more than Michelle. If Michelle weighs 68.35 kg, how much does Mary weigh? Which operation should be used to find the answer to this problem?

A. ADDITION B. SUBTRACTION C. MULTIPLICATION D. DIVISION

2. Harry buys 2.5 kg of plums and it costs $17.46. The number sentence Harry would key into his calculator to find the price of plums per kilogram would be:

A. 17.46 + 2.5 B. 17.46 ÷ 2.5 C. 17.46 – 2.5 D. 17.46 × 2.5

3. Harry buys 0.3 kg oranges at $6.25/kg. The number sentence Harry would key into his calculator to find the amount he needs to pay would be:

A. 6.25 + 0.3 B. 6.25 ÷ 0.3 C. 6.25 – 0.3 D. 6.25 × 0.3

Topic 2

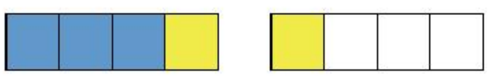
Using Mental Strategies to Solve Problems Involving Fractions

Mathematics Discussion

In Unit 2, we learnt about partitioning fractions, equivalent fractions and counting forwards and backwards by unit fractions on a number line.

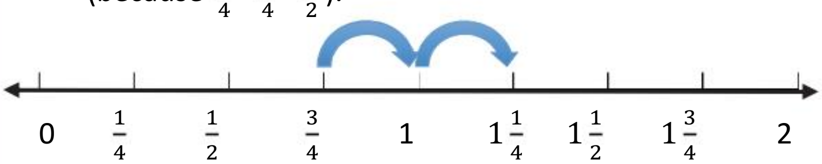
We can extend this thinking to be able to solve problems involving **addition** and **subtraction** of fractions. For example, we can solve a problem like $\frac{3}{4} + \frac{1}{2}$ by visualising:

1. A shape, such as a circle or rectangle, with $\frac{3}{4}$ shaded. Adding $\frac{1}{4}$ to it and then $\frac{1}{4}$ more (because adding $\frac{2}{4}$ is equivalent to adding $\frac{1}{2}$).

   We can then see that $\frac{3}{4} + \frac{1}{2} = 1\frac{1}{4}$

2. A number line. We can start at $\frac{3}{4}$ and then count $\frac{1}{4}$ forward and then $\frac{1}{4}$ more (because $\frac{1}{4} + \frac{1}{4} = \frac{1}{2}$).



We can use the same visualisation of diagrams and number lines for problems involving subtraction of fractions.

In Unit 2 we learnt to partition the whole into parts in order to compare fractions. We can extend this thinking to help us solve problems involving **multiplication**.

For example, we can solve a problem like $\frac{2}{3} \times 9$ by drawing 9 objects.

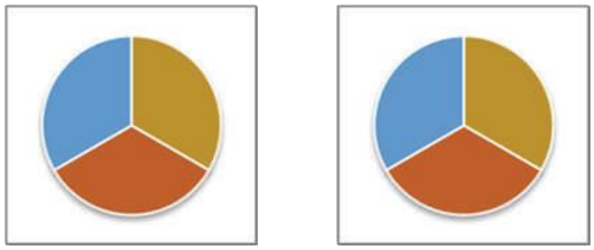
☺☺☺☺☺☺☺☺☺

We can partition these into 3 groups because finding $\frac{1}{3}$ of an amount is the same as dividing by 3.

☺☺☺ ☺☺☺ ☺☺☺

We can solve a problem like $\frac{1}{2} \times \frac{1}{2}$ by visualizing shapes such as circles or rectangles with $\frac{1}{2}$ shaded and then dividing this half into two equal pieces to get $\frac{1}{4}$.

We can solve **division** problems by thinking of division as grouping. For example, when solving $2 \div \frac{1}{3}$, we can think of this as 'how many thirds in 2?' We can draw a diagram to represent 2 wholes and partition the wholes into thirds. We can then count how many thirds in 2 wholes.

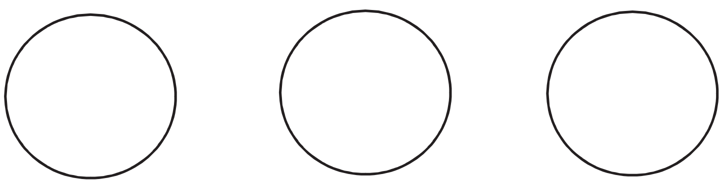


$2 \div \frac{1}{3} = 6$

Whole Class Activity 1

Think: How can we mentally add and subtract fractions?

PART A. Partition the following circles into quarters:



Shade a quarter in the first circle red. The amount shaded is shown in the fraction sequence below.

Shade another quarter in the first circle in blue. We have now shaded $\frac{1}{4} + \frac{1}{4}$ which is the same as $\frac{1}{2}$. The amount shaded is shown in the sequence below.

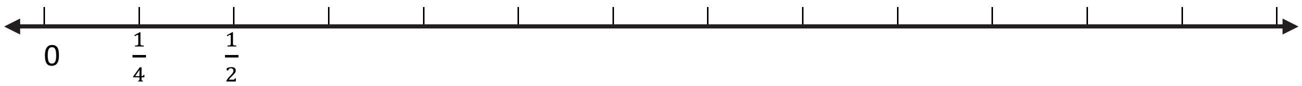
Shade another quarter in the first circle in **black**. We have now shaded $\frac{1}{2} + \frac{1}{4}$ which is the same as $\frac{3}{4}$. Write how much of the circle is shaded in the sequence below.

Shade another quarter in the first circle in green. We have now shaded $\frac{3}{4} + \frac{1}{4}$ which is the same as $\frac{4}{4}$ or 1. Write how much of the circle is shaded in the sequence below.

Continue shading to complete the fraction sequence for 3 wholes.

$\mathbf{\frac{1}{4}}$, $\mathbf{\frac{1}{2}}$, ______ , ______ , ______ , ______ , ______ , ______ , ______ , ______ , ______ , ______ .

This sequence can also be shown on a number line. Complete the number line.

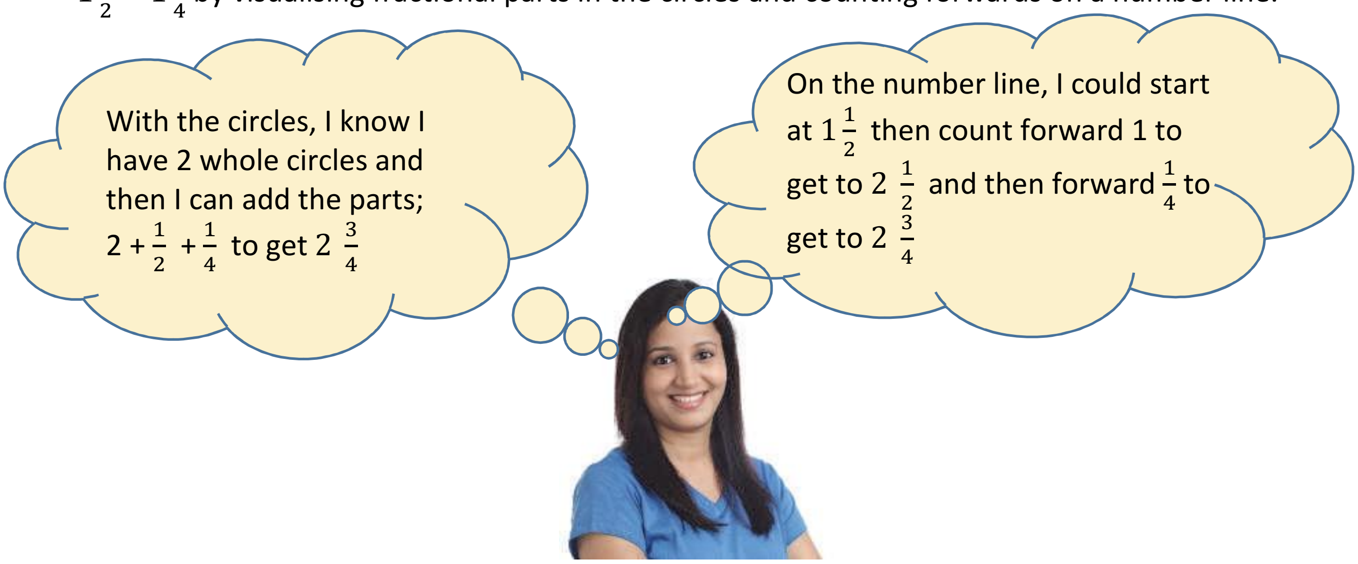


Why is $\frac{2}{4} = \frac{1}{2}$? Explain using the circles or the number line.

Why is $\frac{6}{4} = 1\frac{1}{2}$? Explain using the circles or the number line.

Nancy, who worked on fractions in Unit 2, thought she could now solve a problem like

$1\frac{1}{2} + 1\frac{1}{4}$ by visualising fractional parts in the circles and counting forwards on a number line.



Nancy wondered whether she could solve subtraction problems such $2\frac{1}{4} - \frac{1}{2}$ in a similar way.

Explain how Nancy could solve this problem by visualizing the circles.

Explain how Nancy could solve this problem by counting backwards on the number line.

Work with a partner and use your understanding of the number line and the partitioned circles to explain the answers to:

a) $\frac{1}{4} + \frac{1}{2}$ b) $1\frac{3}{4} + \frac{3}{4}$ c) $1\frac{1}{4} + 1\frac{1}{2}$ d) $\frac{3}{4} - \frac{1}{2}$ e) $1\frac{1}{4} - \frac{1}{2}$

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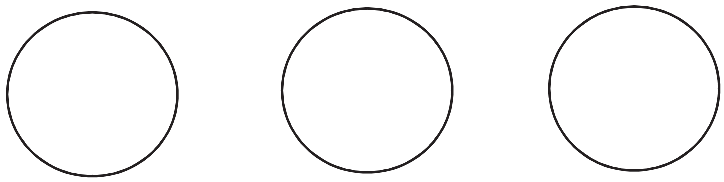
PART B. Partition the following circles into sixths:



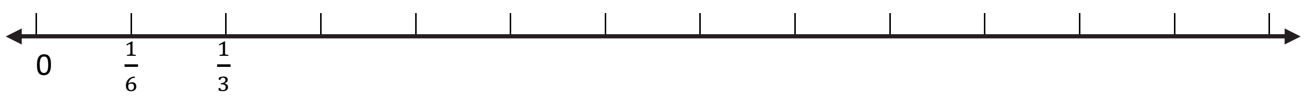
Shade the first sixth in the first circle red. The amount shaded is shown in the sequence below.

Shade another sixth in the first circle in blue. We have now shaded $\frac{1}{6}+\frac{1}{6}$ which is the same as $\frac{2}{6}$ or $\frac{1}{3}$. The amount shaded is shown in the sequence.

Continue the shading to complete the fraction sequence.

$\mathbf{\frac{1}{6}}$, $\mathbf{\frac{1}{3}}$, ______ , ______ , ______ , ______ , ______ , ______ , ______ , ______ , ______ .

This sequence can also be shown on a number line. Complete the number line.



Why is $\frac{2}{6}=\frac{1}{3}$? Explain using the circles or the number line.

Why is $\frac{5}{3}=1\frac{2}{3}$? Explain using the circles or the number line.

Nancy thought she could solve subtraction problems such $2\frac{1}{6}-\frac{2}{3}$ in a similar way.

Explain how Nancy could solve this problem by visualizing the circles.

Explain how Nancy could solve this problem by counting backwards on the number line.

Work with a partner and use your understanding of the number line and the partitioned circles to explain the answers to:

a) $\frac{5}{6}+\frac{1}{3}$ b) $1\frac{1}{6}+\frac{1}{3}$ c) $1\frac{5}{6}+1\frac{1}{2}$ d) $\frac{2}{3}-\frac{1}{2}$ e) $1\frac{1}{6}-\frac{2}{3}$

PART C. How could you solve a problem like $\frac{7}{10} + \frac{1}{2}$? Explain your thinking.

Practice Exercise 1

1. Solve the following addition problems. Use a number line or diagrams to help if necessary.

a) $\frac{1}{4} + 1\frac{1}{2}$

b) $\frac{1}{6} + \frac{1}{3}$

c) $2\frac{1}{4} + \frac{1}{2} + 1$

d) $1\frac{1}{2} + \frac{5}{6}$

e) $\frac{2}{3} + 2\frac{1}{2}$

f) $\frac{3}{10} + 2\frac{1}{2} + \frac{1}{10}$

2. Solve the following subtraction problems. Use a number line or diagrams to help if necessary.

a) $2\frac{1}{4} - \frac{1}{2}$

b) $\frac{5}{6} - \frac{1}{3}$

c) $3\frac{1}{4} - 1\frac{1}{2}$

d) $\frac{2}{3} - \frac{1}{2}$

e) $1\frac{1}{2} - \frac{5}{6} - \frac{1}{6}$

f) $2\frac{7}{10} - 1\frac{1}{10} + \frac{1}{2}$

Reflection and Discussion

Nancy's friend Kaleb, solved some easily visualised fractions by thinking of them as decimals. How would Kaleb solve $\frac{1}{4} + 1\frac{1}{2}$ and $2\frac{7}{10} - 1\frac{1}{2}$? Use jottings to show his thinking.

What are the answers to these problems in (i) decimals and (ii) fractions?

What would be the best form to write these answers in? Circle DECIMALS or FRACTIONS. Explain your thinking.

Which of the problems in PRACTICE EXERCISE 1, numbers 1 and 2 could be solved using Kaleb's method?

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3. The following table has 4 incorrect number sentences. Cross out the incorrect problems.

$1\frac{1}{4} - \frac{1}{2} = \frac{3}{4}$	$\frac{5}{6} + \frac{1}{3} = 1\frac{1}{6}$	$\frac{9}{10} + 2\frac{1}{2} = 2\frac{10}{12}$	$\frac{9}{10} - \frac{1}{10} = \frac{4}{5}$	$\frac{2}{3} + 1\frac{1}{2} = 1\frac{1}{6}$
$3\frac{1}{4} - \frac{1}{2} = 3\frac{3}{4}$	$\frac{2}{3} + \frac{1}{2} = 1\frac{1}{6}$	$\frac{1}{10} + 2\frac{1}{2} = 3\frac{1}{10}$	$2\frac{3}{4} - \frac{1}{2} = 2\frac{1}{4}$	$\frac{7}{10} - \frac{1}{2} = \frac{1}{5}$
$\frac{3}{4} + 3\frac{1}{2} = 4\frac{1}{4}$	$2\frac{3}{10} + \frac{1}{2} = 2\frac{4}{5}$	$1\frac{9}{10} + \frac{1}{2} = 2\frac{2}{5}$	$2\frac{1}{2} - \frac{1}{6} = 2\frac{1}{3}$	$\frac{1}{5} + 2\frac{1}{10} = 2\frac{3}{10}$

4. Solve the following problems.

a) If John loses $\frac{1}{2}$ kg more, he will weigh the same as Peter who weighs $79\frac{3}{4}$ kg. How much does John weigh?

b) Bob the butcher uses $3\frac{1}{2}$ kg of mince to make hamburgers on Friday and $\frac{5}{6}$ kg less for the hamburgers on Saturday. How many kilograms of hamburger does he make on Saturday?

c) John runs for $1\frac{1}{10}$ hours. If Riccardo had run half an hour more, he would have run the same as John. How long did Riccardo run for?

d) Julie teaches ballet for $2\frac{3}{4}$ hours on a Wednesday, $1\frac{1}{2}$ hours on a Saturday and $\frac{1}{2}$ hour on a Sunday. How many hours does she teach ballet altogether?

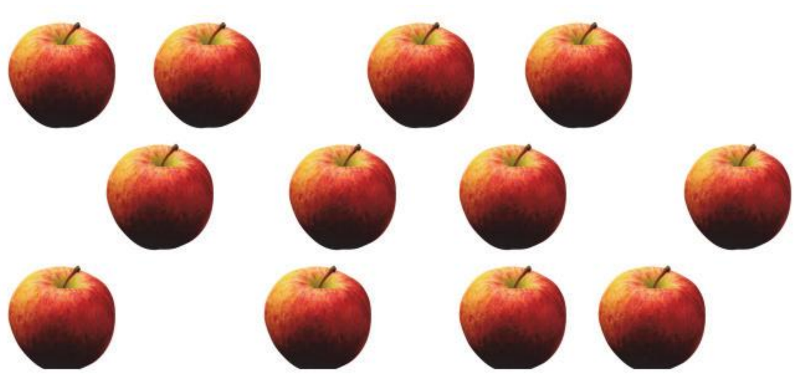
e) Chef Nellie uses $1\frac{1}{4}$ cups of milk for her scones and $\frac{3}{4}$ cup less for her biscuits. How much milk does she use for her biscuits?

f) Laurie cuts off one $2\frac{3}{4}$ m piece and one $\frac{1}{2}$ m piece from a 6 m length of rope. How much rope does Laurie have left?

Whole Class Activity 2

Think: How can we mentally multiply with fractions?

Nancy had a bag of 12 apples.



She wanted to know what $\frac{1}{4}$ of 12 apples was ($\frac{1}{4} \times 12$). Nancy shared the apples into 4 equal groups. Draw circles around the apples to show how she did this.

How many apples is $\frac{1}{4}$ of the bag?

To find $\frac{3}{4}$ of the apples, Nancy calculated how many apples were in 3 of the circled groups. How many apples are $\frac{3}{4}$ of the bag ($\frac{3}{4} \times 12$)?

Next Nancy wanted to know how many apples is $\frac{1}{3}$ of the bag ($\frac{1}{3} \times 12$). She shared the apples into 3 equal groups. Use a different colour and draw circles around the apples to show how she did this.

How many apples is $\frac{1}{3}$ of the bag?

How many apples are $\frac{2}{3}$ of the bag ($\frac{2}{3} \times 12$)?

Draw a collection of 16 items, eg, flowers, balloons, emojis.

Use the items to find answers to:

1. $\frac{3}{4} \times 16$
2. $\frac{5}{8} \times 16$
3. $1\frac{1}{4} \times 16$

Explain to a partner how you would you calculate $\frac{3}{10} \times 210$? $\frac{4}{5} \times 150$? $1\frac{1}{2} \times 10$? Solve the problems. What jottings (if any) did you use to help you?

Nancy cut an apple in half. She wants to find $\mathbf{\frac{1}{4}}$ of $\mathbf{\frac{1}{2}}$ ($\mathbf{\frac{1}{4} \times \frac{1}{2}}$).

She draws a full circle to represent an apple and shades half. She then draws lines in the half to divide it into quarters. She knows how to partition the whole apple in order to say how much of an apple is $\mathbf{\frac{1}{4}}$ of $\mathbf{\frac{1}{2}}$.

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How much apple is $\frac{1}{4}$ of $\frac{1}{2}$?

Use diagrams to find how much apple is:

1. $\frac{1}{2}$ of $\frac{1}{2}$ 2. $\frac{1}{3} \times \frac{1}{2}$ 3. $\frac{1}{4} \times \frac{1}{3}$

Explain to a partner how you would you calculate $\frac{1}{2} \times \frac{1}{5}$? $\frac{1}{4}$ x $\frac{1}{4}$? $6\frac{1}{2} \times \frac{1}{2}$?

Solve the problems. What jottings (if any) did you use to help you?

Practice Exercise 2

1. Solve the following problems

a) $\frac{1}{5} \times 25$

b) $\frac{3}{5} \times 25$

c) $\frac{3}{4} \times 84$

d) $\frac{7}{10} \times 220$

e) $16 \times 2\frac{1}{2}$

f) $1\frac{1}{4} \times 240$

2. Solve the following problems

a) $\frac{1}{2} \times \frac{1}{4}$

b) $\frac{1}{3} \times \frac{1}{4}$

c) $\frac{1}{2} \times \frac{3}{4}$

d) $\frac{1}{2} \times \frac{2}{3}$

e) $\frac{1}{2} \times 1\frac{1}{2}$

f) $10\frac{1}{2} \times 1\frac{1}{2}$

3. Solve the following everyday problems.

a) Kerry earns \$440 per week. She budgets $\frac{3}{4}$ of this on expenses. What are Kerry's expenses each week?

b) Pia has a 120 m reel of copper. She uses $\frac{2}{3}$ of it on an art project. How much copper does Pia use?

c) Bob works $1\frac{1}{2}$ hours each week for 18 weeks. How many hours does Bob work in total?

d) A mixture for making playdough needs $2\frac{1}{2}$ cups of salt. Patricia wants to make $\frac{1}{2}$ of this recipe. How much salt does she need?

e) Nick pours $\frac{2}{5}$ of a 250 mL cup of milk into a bowl. He then adds another 50 mL. How much milk does he pour?

f) Shanna is making a salad dressing but she wants to make half of the recipe. The recipe uses $\frac{2}{3}$ cup of oil and $\frac{1}{4}$ cup vinegar. How much oil does she need? How much vinegar?

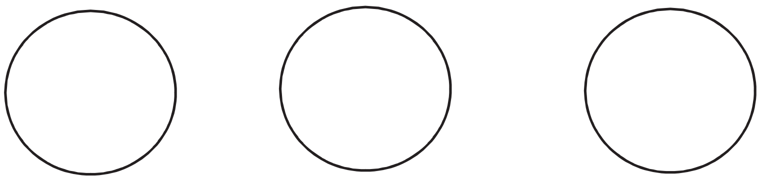
Whole Class Activity 3

Think: How can we mentally divide with fractions?

When solving problems like $3 \div \frac{1}{4}$, we can think of it as ‘how many quarters in 3?’

Work with a partner to show how many quarters in 3 using:

A. Circles to represent 3 whole values:



B. A number line:

Now draw (i) 6 circles to represent 6 wholes (ii) a number line from 0 to 6.

Use the diagrams to find answers to:

1. $6 \div \frac{1}{2}$ 2. $6 \div \frac{3}{4}$ 3. $6 \div 1\frac{1}{2}$

Explain to a partner how you would you calculate: $7 \div \frac{1}{3}$? $6\frac{1}{2} \div \frac{1}{4}$? Solve the problems. What jottings (if any) did you use to help you?

Practice Exercise 3

1. Solve the following division problems. Use a diagram or number line to help if necessary.

a) $4 \div \frac{1}{2}$

b) $5 \div \frac{1}{4}$

c) $6 \div \frac{1}{3}$

d) $3 \div \frac{3}{4}$

e) $2\frac{1}{5} \div \frac{1}{5}$

f) $12 \div 1\frac{1}{2}$

2. Solve the following everyday problems.

a) Bruce cuts a 7 m long piece of rope into $\frac{1}{3}$ m lengths. How many pieces did he cut?

b) A rectangle has an area of 15 cm^2. If its width is $\frac{3}{4}$ cm, what is its length?

c) If Chef Jake packaged 18 kg of meat into $1\frac{1}{2}$ kg bags, how many bags of meat would he have?

d) In the American money system, 25c is called a quarter. How many quarters are in $2?

e) Travis buys $1\frac{1}{2}$ kg of nuts for $9. What is the price of the nuts per kilogram?

f) How many 50 cents are in $7.50? (HINT: It may help to think of 50c as $\frac{1}{2}$ dollar and $7.50 as $7\frac{1}{2}$).

Reflection on Learning

1. Use a diagram, number line or other jottings to solve the following problems.

$1\frac{3}{8} - \frac{1}{2}$	$\frac{2}{3} \times 21$	$4 \div \frac{1}{5}$	$3\frac{3}{4} + \frac{1}{2}$
$11\frac{1}{2} \div \frac{1}{2}$	$\frac{1}{8} \times \frac{1}{2}$	$2\frac{1}{3} - 1\frac{2}{3} + \frac{1}{6}$	$1\frac{1}{2} \times 6$

2. Solve the following everyday problems.

a) Sophie has a mobile phone plan. The plan costs $60 per month. Sophie pays $\frac{3}{4}$ of the bill and her Mum pays the rest. How much does Sophie pay?

b) Sophie makes $\frac{2}{3}$ of her phone calls between 9 am and noon. She makes $\frac{1}{6}$ of the calls between noon and 3 pm. What fraction of her calls is made between 9 am and 3 pm? What fraction is made between 3 pm and 9 am?

c) Sophie talks to Ella on her mobile for $5\frac{3}{4}$ mins. She talks to Paul for $4\frac{1}{2}$ mins. How much longer did she talk to Ella than Paul? Sophie talks to Ella for twice as long the next day. How long was this phone call?

d) Sophie is voting for 'The Y Factor' winner on her mobile phone. Each vote takes $\frac{1}{2}$ min to record. How many votes can Sophie make continuously in 10 minutes?

OLNA Practice Questions

1. Last year, the number of people that went to the 'Groove in the South' music festival was 14 000. The number of people who went to the music festival this year was $\frac{5}{7}$ of last year's figure. How many people went to the festival this year?

A. 2000 B. 10 000 C. 9 500 D. 12 000

2. What is the number exactly halfway between $2\frac{3}{4}$ and $3\frac{3}{4}$?

Topic 3

Using Mental Strategies to Solve Problems Involving Decimals

Mathematics Discussion

In Units 1 and 2 of the Foundations Mathematics course, we used mental strategies such as place value, partitioning and our knowledge of basic facts to solve problems involving whole numbers, money and the four operations. We used written jottings to perform calculations we could not completely store in our heads. These jottings included diagrams, number lines or number calculations. For problems involving ‘difficult’ numbers, we used a calculator.

In this topic, we will work through exactly the same decision making, except we are now extending our work with whole numbers to include problems involving decimals.

Whole Class Activity 1

Think: What mental strategies can we use to solve addition problems involving decimals?

Jalen's Strategy for Adding Decimals

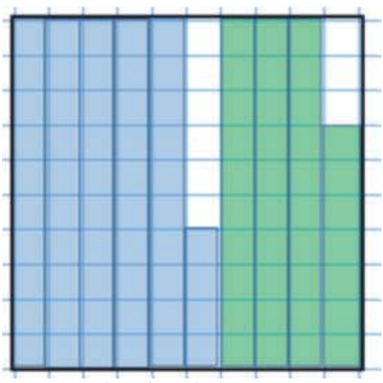
Jalen partitioned a whole square into 100 parts so he could use it to solve 0.54 + 0.37

He used place value to partition the numbers.

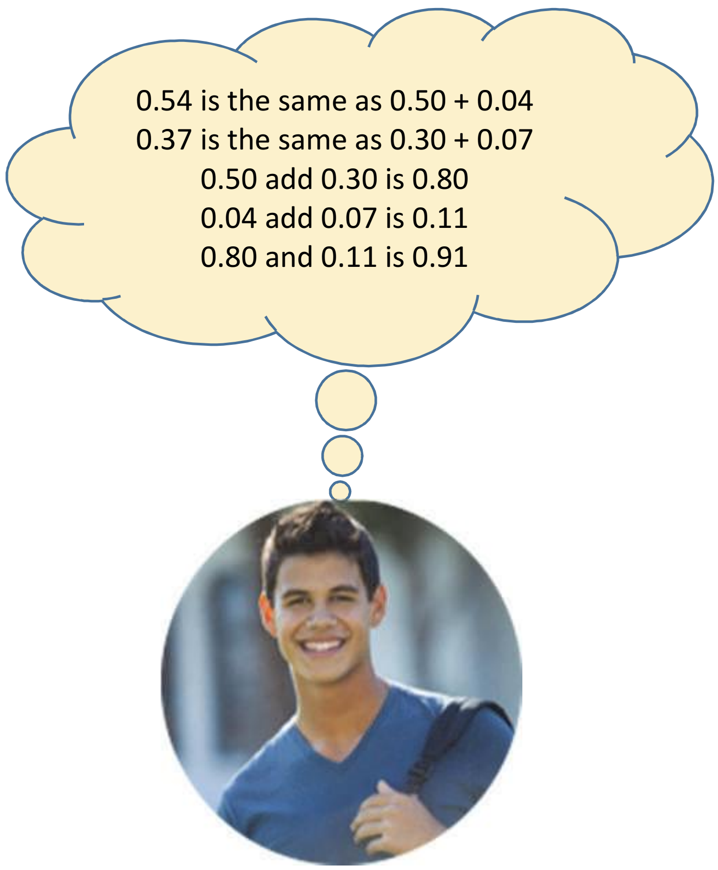
He coloured in blue, 5 tenths and 4 hundredths.

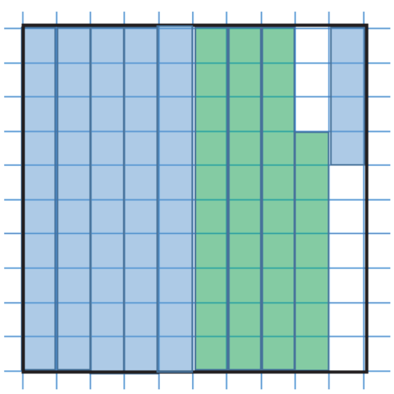
He coloured in green, 3 tenths and 7 hundredths.

He adds the tenths first and then the hundredths.



0.54 + 0.37





0.5+ 0.3 add 0.07+0.04

Jalen could see that the 5 tenths and 3 tenths equals 8 tenths. He could see that the 4 hundredths and 7 hundredths equals 11 hundredths, which is the same as 1 tenth and 1 hundredth. 8 tenths added to 1 tenth and 1 hundredth equals 9 tenths and 1 hundredth in total (i.e. 0.91)

1. Use Jalen's thinking and grid paper to solve the following problems.

a) 1.2 + 0.3

b) 1.3 + 0.48

c) 2.4 + 1.7

d) 0.64 + 0.72

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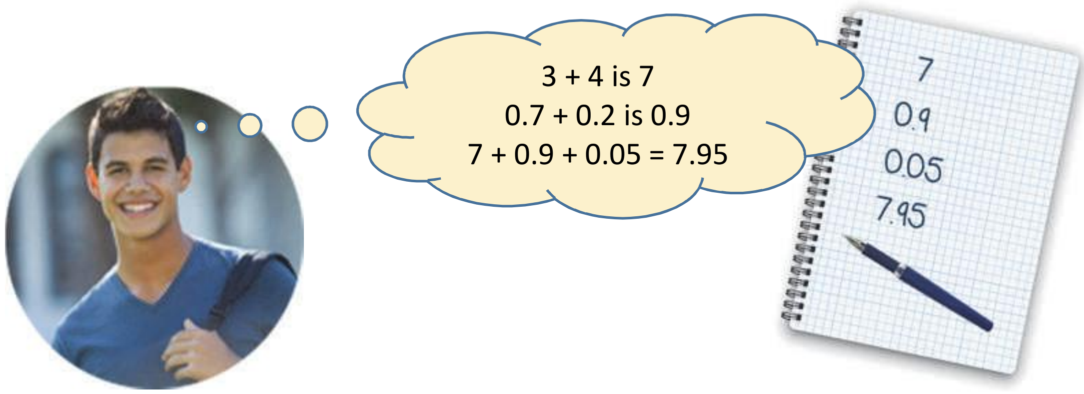
Jalen decided he could solve problems like these mentally, by visualizing the whole numbers, tenths and hundredths on grid paper.

However, he found he sometimes needed to write down a few numbers to keep track of where he was up to.

To solve a problem like 3.7 + 4.25, Jalen thought and wrote the following:



2. Use Jalen's method to mentally solve by visualizing the grid paper. Use jottings to help if necessary.

a) 3.3 + 4.2

b) 0.5 + 2.8 + 0.1

c) 47.1 + 32.8

d) 0.63 + 0.18

e) 1.86 + 0.05 + 2

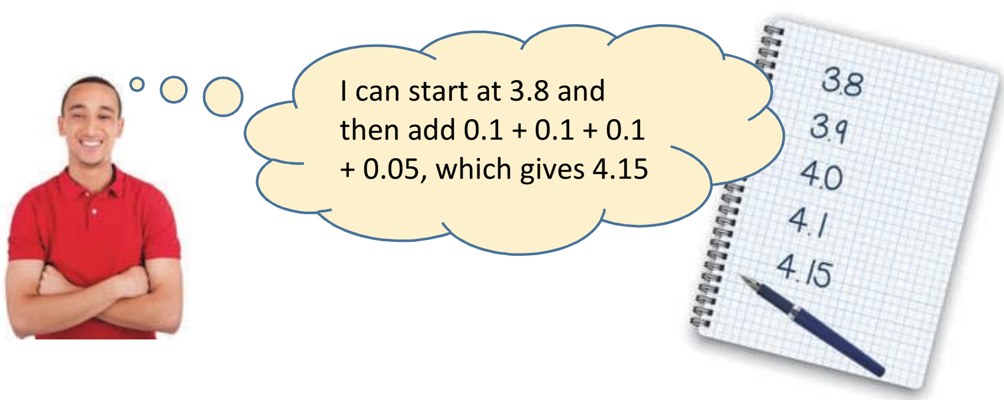
f) 5.4 + 2.92

Casey and Paddo's Strategies for Adding Decimals

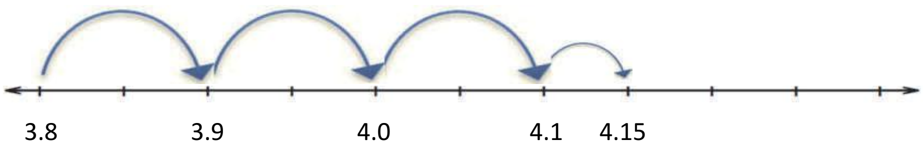
Casey and Paddo were solving 3.8 + 0.35.

Casey realized that he could solve this decimal problem by counting forward, just as he did with adding whole numbers. He broke up 0.35 into tenths and hundredths. He then started at 3.8, added each of the tenths and then added the hundredths.

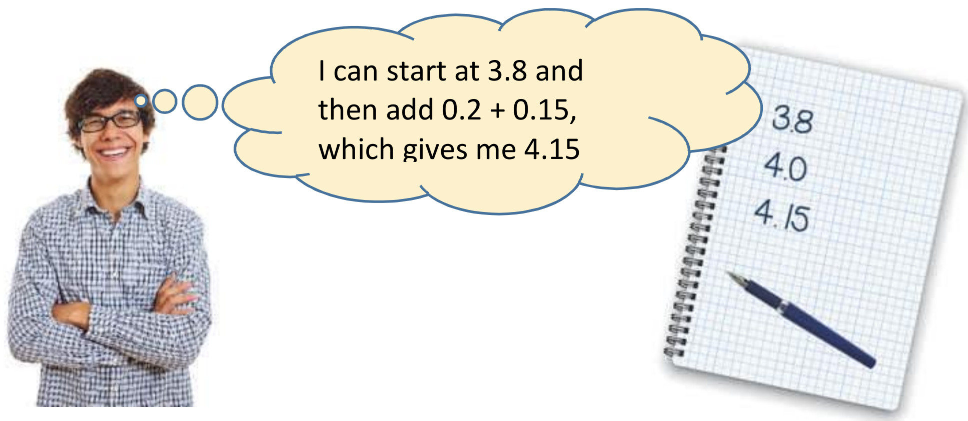
To solve a problem like 3.8 + 0.35, Casey thought and wrote the following:



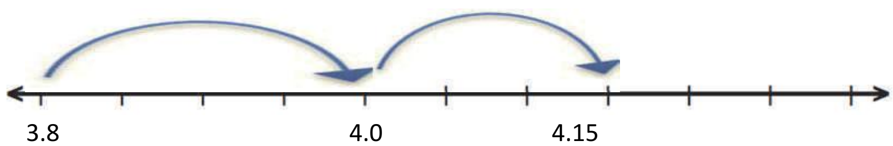
This can also be shown on a number line.



Paddo decided he could solve this problem just as he did whole numbers, by partitioning decimals and leaping along a number line. He started at 3.8. He split 0.35 into 0.2 and 0.15. He added 0.2 to 3.8 to get 4 and then finally added 0.15 to get 4. 15



Paddo jotted down the following number line and made the leaps as shown:



3. Use Casey's thinking of counting forward or Paddo's partitioning and leaping along a number line to solve the following problems

a) 2.8 + 0.4	
b) 3.7 + 1.5 + 0.2	
c) 70.5 + 3.92	
d) 45.8 + 2.6	

4. Use Casey or Paddo's methods to mentally solve the following problems by visualizing counting forward or partitioning and leaping along a number line. Use jottings or diagrams to help if necessary.

a) 4.8 + 0.8

b) 16.3 + 1.54

c) 7.4 + 1 + 4.8

d) 3.43 + 0.41

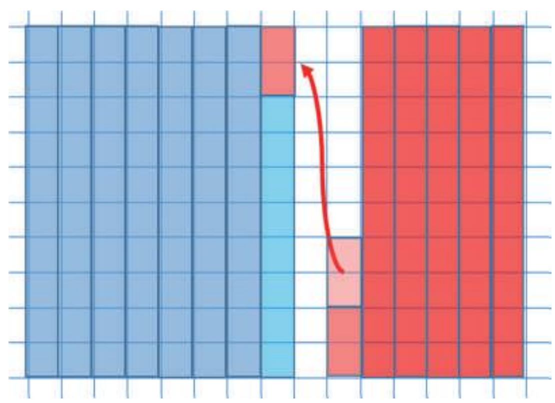
e) 0.5 + 4.66

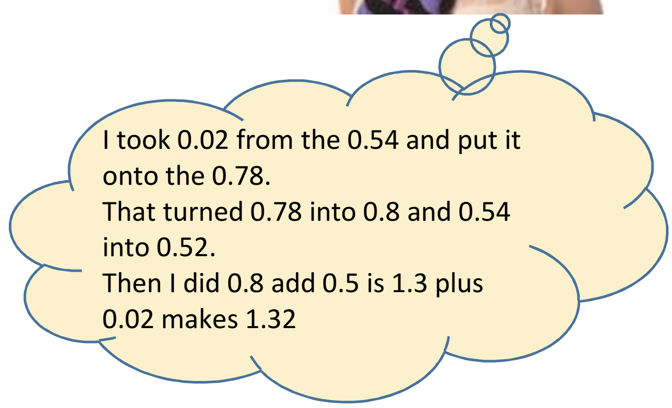
f) 7 + 0.01 + 9.9

Sarah's Strategy for Adding Decimals

Sarah thought of 0.78 + 0.54 as being 0.8 + 0.52 = 1.32

She first coloured in 0.78 and 0.54. She then took off 0.02 from the 0.54 and attached it to the 0.78 to make 0.8 add 0.52.





When Sarah calculated 2.7 + 0.45, she jotted down 3 + 0.15.
Can you see what Sarah did to these two numbers? Explain her thinking.

5. Use grid paper and Sarah's thinking to help solve the following problems

a) 1.9 + 0.4

b) 0.9 + 1.7

c) 0.8 + 0.35

d) 2.5 + 2.9

6. Use Sarah's method of subtracting a decimal amount from one number and adding it to the other, to mentally solve the following problems. Use jottings or diagrams to help if necessary.

a) 2.8 + 0.4

b) 5.9 + 1.3 + 2

c) 12.4 + 6.8

d) 8.99 + 1.32

e) 1.77 + 1 + 0.9

f) 2.31 + 1.9

Revision: The Best Strategy

Choose the most suitable strategy to solve the following problems. Try to do the problems mentally. If this is difficult, use jottings to help keep track

a) 0.53 + 0.32	d) 9.4 + 2.7
b) 0.99 + 0.21	e) 21.65 + 10.2
c) 1.75 + 0.3 + 0.2	f) 0.95 + 2.35

Whole Class Activity 2

Think: What mental strategies can we use to solve subtraction problems involving decimals?

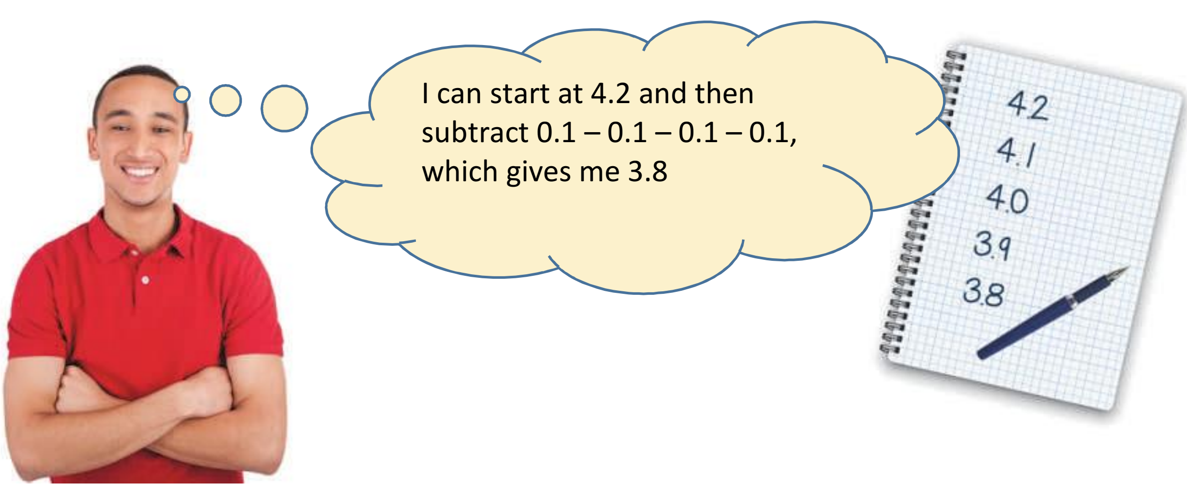
Casey and Paddo's Strategies for Subtracting Decimals

Casey and Paddo wondered whether they could use their number line thinking to do subtraction problems with decimals.

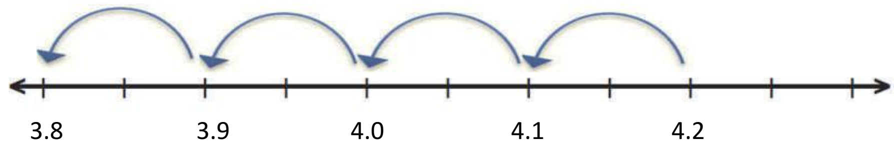
They were solving 4.2 – 0.4.

Casey thought he could solve this decimal problem by counting backward, just as he did with subtracting whole numbers. He broke up 0.4 into tenths. He then started at 4.2 and subtracted backwards in tenths.

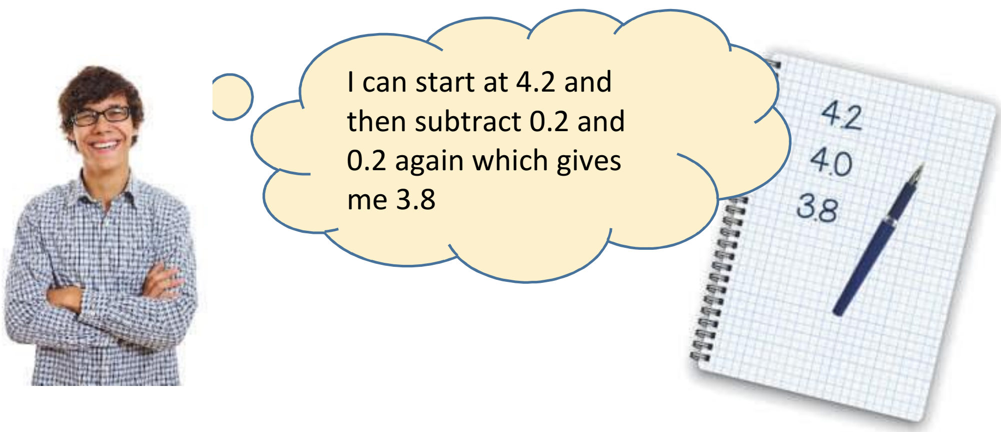
To solve a problem like 4.2 – 0.4, Casey thought and wrote the following:



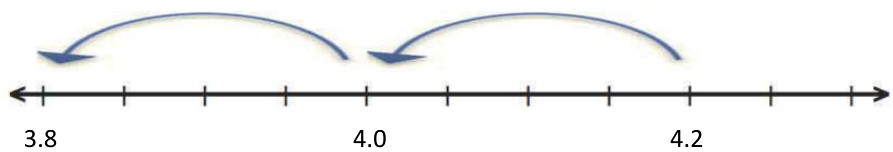
This can be shown on the following number line.



Paddo started at 4.2 on a number line. He partitioned 0.4 into 0.2 and 0.2 and then subtracted 0.2 from 4.2 to get 4 and then subtracted 0.2 again to get 3.8



Paddo jotted down the following number line and made the leaps as shown:



7. Use Casey's thinking of counting backward or Paddo's partitioning and leaping back along a number line to solve the following problems

a) 4.3 – 0.5	
b) 5.7 – 3.3	
c) 0.7 – 0.51	
d) 12.7 – 0.75	

8. Use Casey or Paddo's methods to mentally solve the following problems by visualizing counting backwards or partitioning and leaping back along a number line. Use jottings or diagrams to help if necessary.

a) 2.4 – 0.7

b) 15.1 – 0.3

c) 2.1 – 0.15

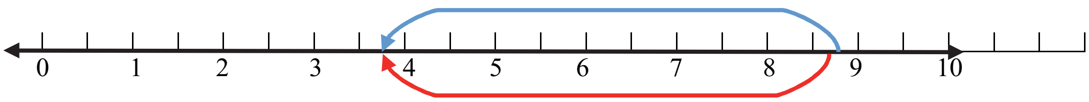
d) 13.75 – 13.69

e) 0.5 – 0.47 – 0.01

f) 1.01 – 0.05

Lauren's Strategy for Subtracting Decimals

To solve 8.7 – 4.9, Lauren used a number line too. However, she added 0.1 to each of the numbers, changing 8.7 – 4.9 into 8.8 – 5. This works because the difference between 8.7 and 4.9 is the same as the difference between 8.8 and 5. She started at 8.8 on the number line and jumped back 5.



Similarly, when Lauren calculated 9 – 1.01, she jotted down 8.99 – 1.
Can you see what Lauren did to these two numbers? Explain her thinking.

Adding or subtracting the same decimal to each number in a subtraction problem is a way of making it easier to calculate mentally.

9. Use Lauren's strategy to calculate the following on a number line. Write the new calculation under the existing one.

a) 4.6 – 0.9	
b) 8.2 – 5.8	
c) 5 – 1.95	
d) 21 – 1.01	

10. Use Lauren's method of adding or subtracting a decimal from both parts of the question to mentally solve the following problems. Use jottings or diagrams to help if necessary.

a) 3.15 – 0.95

d) 4.1 – 3.95

b) 3.6 – 0.9

c) 6 – 0.99

e) 3.05 – 2.98

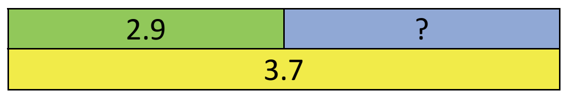
f) 3.1 – 1.2

Jessie's Strategy for Subtracting Decimals

Jessie uses the Part–Part Whole model to help solve a variety of subtraction problems.

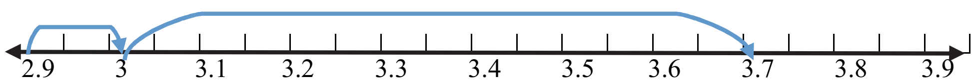
When solving a problem such as 3.7 – 2.9, Jessie used the model to change the problem from a subtraction into an addition.

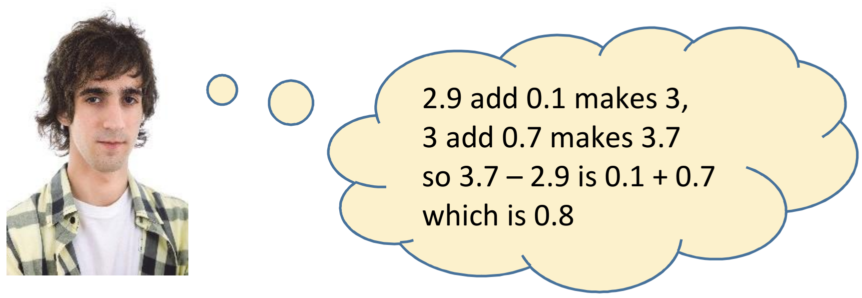
Jessie placed the numbers into the Part–Part Whole diagram as follows:



He then wrote the number sentence: 2.9 + ? = 3.7

Jessie then counted forward using jottings on a number line to solve the problem by addition



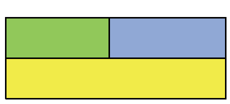
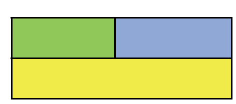
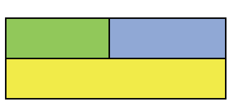
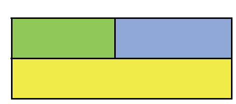


Sometimes Jessie didn't use this strategy. It depended on the size of the numbers in the problem.

If the numbers were 6.7 – 2.8, Jessie would think of this as subtraction and solve it using either Paddo's or Lauren's method.

Why would it be easier to solve 3.7 – 2.9 as an addition (2.9 + ? = 3.7) and 6.7 – 2.8 as a subtraction?

11. Use Jessie's strategy of placing the numbers in the Part–Part Whole diagram and counting forward to calculate the following:

a) 2.7 – 2.4		c) 1.15 – 0.9	
b) 3.6 – 2.9		d) 4 – 2.9	

12. Use Jessie's method of changing a subtraction into an addition to solve the following problems. Use jottings or diagrams to help if necessary.

a) 5.1 – 4.8
b) 2.3 – 1.7
c) 11.7 – 10.9
d) 12.1 – 11.94
e) 6.1 – 5.95
f) 4.05 – 3.96

Revision: The Best Strategy

Choose the most suitable strategy to solve the following problems mentally. Use jottings to help keep track.

a) 3.4 – 1.9	d) 34.7 – 23.3
b) 15.15 – 14.85	e) 8.3 – 7.8
c) 1.2 – 0.3 – 0.1	f) 6 – 1.8 – 0.2

Practice Exercise 1

1. PUZZLE:

'What did Cinderella wear at the beach?'

Complete these questions mentally to decode the answer to this joke.

S: 5.1 – 4.8
!: 3.2 + 1.6 + 4
I: 6.2 – 0.9
L: 0.54 + 1.6
G: 0.95 + 1.35
P: 8 – 0.8 – 0.8
F: 4.95 – 3.75
A: 5.68 + 0.4 – 0.01
P: 14.2 – 0.4
R: 1.99 + 2.06
E: 17.1 – 0.35
S: 23.4 + 2.85

2.3	2.14	6.07	0.3	26.25	1.25	2.14
5.3	6.4	13.8	16.75	4.05	26.25	8.8

2. For the following problems:

- Write the number sentence to reflect the situation and the number sentence to calculate the answer (these may be the same)
- Show the strategy chosen for solving the problem
- Find the answer
- Think about your answer. Does it make sense?

a) Austria recycles 49.7% of its waste. Switzerland recycles 52.1%. How much more does Switzerland recycle than Austria?

Number Sentence(s)	Strategy	Answer	Does it make sense?

b) The amount of recycling by each Australian increased from 0.08 tonnes per person in 1997 to 0.75 tonnes in 2003. By what tonnage had the recycling increased in this period?

Number Sentence(s)	Strategy	Answer	Does it make sense?

c) Taiwan's recycling industry was worth 0.8 billion dollars in 2005. In a decade, it rose 1.7 billion dollars. How much was it worth in 2015?

Number Sentence(s)	Strategy	Answer	Does it make sense?

d) Between 1997 and 2011, Taiwan slashed daily household waste per person from 1.15 kg to 0.45 kg. How much had the daily household waste decreased?

Number Sentence(s)	Strategy	Answer	Does it make sense?

e) In 1997, the yearly waste generated by Australians was 1.23 tonnes. This grew by 0.4 tonnes over the next 6 years. How much waste was each Australian generating in 2003?

Number Sentence(s)	Strategy	Answer	Does it make sense?

f) Switzerland recycles 52.1% of its waste. The U.S recycles 9.5% less. What percentage does the U.S recycle?

Number Sentence(s)	Strategy	Answer	Does it make sense?

Whole Class Activity 3

Think: What mental strategies can we use to solve multiplication problems involving decimals?

Dylan's Array Strategy for Multiplying Decimals

Dylan uses an array diagram to solve some multiplication of decimal problems. For example, to solve 4 × 0.3 he placed the numbers in the array diagram.

Size of each group (0.3)

Total ?

Number of groups (4)

He started at 0.3 and counted forwards by 0.3, four times. He was thinking of the problem as 0.3 + 0.3 + 0.3 + 0.3 which equals 1.2.

1. Use your knowledge of arrays and repeated equal quantities to solve the following problems. Use jottings or diagrams to help if necessary.

a) 0.2 x 4

b) 3 x 0.12

c) 7 x 0.2

d) 0.5 x 9

e) 1.2 x 6

f) 0.27 x 3

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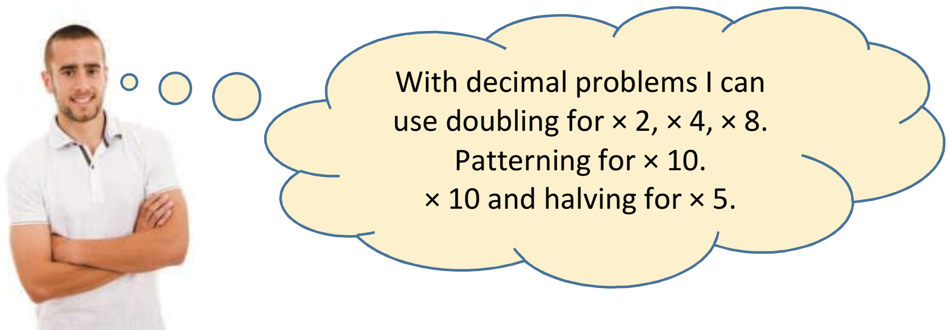
Tom's Strategy for Multiplying Decimals

Tom knows he can extend the strategies he developed in Multiplication of Basic Facts (Unit 2) to solve multiplication problems involving decimals.



Using doubling for × 2, × 4 and × 8

We can extend the doubling we used for whole numbers to mentally solve decimal problems involving x 2, x 4 x 8. For example,

To solve 2.25 x 2 we can double 2.25 to get 4.5.

To solve 2.25 x 4 we can double 4.5 to get 9

To solve 2.25 x 8 we can double 9 to get 18

2. Use Tom's strategy of doubling to calculate the following. Use jottings or diagrams to help if necessary.

a) 4.5 x 2

b) 4 x 3.12

c) 8 x 1.25

d) 3.34 x 2

e) 4 x 10.5

f) 2 x 11.6

Using Patterning and Place Value for × 10

We can use the Place Value Chart and Patterning to solve x 10 decimal problems mentally. For example, to solve 2.45 x 10 we can place 2.45 in the chart with the 2 in the Ones column, the 4 in the Tenths column and the 5 in the Hundredths column.

Multiplying by 10 makes the number 10 times larger. Every number moves one place to the left on the chart. Therefore, 2.45 x 10 = 24.5.

If we were to multiply 2.45 by 100, every number in 2.45 would be 100 times larger and it would move two places to the left on the chart. (i.e. 245)

	THOUSANDS			ONES			DECIMALS	
	Hundreds	Tens	Ones	Hundreds	Tens	Ones	Tenths	Hundredths
EXAMPLES						2	4	5
2.45 x 10					2	4	5	
2.45 x 100				2	4	5		

	THOUSANDS			ONES			DECIMALS	

3. Use Tom's strategy of using the Place Value Chart to calculate the following. Use the chart to help.

a) 1.4 x 10

b) 0.36 x 10

c) 100 x 0.25

d) 10 x 0.5

e) 100 x 0.03

f) 21.8 x 100

Using × 10 and halving for × 5

We can extend the × 10 and halving to calculate × 5 strategy, that we used for whole numbers to solve decimal x 5 problems. For example,

To solve 2.45 x 5 mentally, we can find 2.45 x 10 and halve it.

If we needed jottings to help, we could write down:

2.45 x 10 = 24.5 and half of 24.5 is 12.25.

4. Use Tom's strategy of × 10 and halving to calculate the following × 5 problems. Use jottings to help if necessary.

a) 0.4 x 5

b) 2.6 x 5

c) 5 x 0.84

d) 5 x 0.25

e) 5 x 1.5

f) 10.3 x 5

Katie's Strategy for Multiplying Decimals

Katie knows she can use the partitioning strategy she used when multiplying whole numbers to break up decimal numbers and multiply the parts in the same way. For example, to solve 12.15 x 3, Katie can split 12.15 into 12, and 1 tenth and 5 hundredths and multiply each of these parts by 3.

I can partition 12.15 into
12 + 0.1 + 0.05
12 x 3 = 36
0.1 x 3 = 0.3
0.05 x 3 = 0.15
36 + 0.3 + 0.15 = 36.45

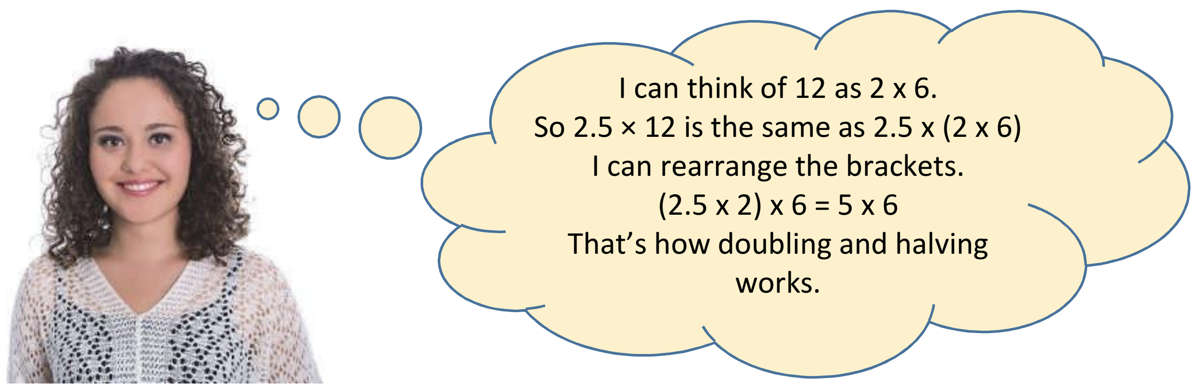
5. Use Katie’s strategy of partitioning numbers to solve these problems. Use jottings to help.

a) 1.1 x 3	d) 7 x 4.2
b) 2.3 x 4	e) 9 x 1.5
c) 6 x 0.12	f) 10.4 x 6

Penny’s Strategy for Multiplying Decimals

In some multiplication of decimal problems, Penny can double one of the numbers and halve the other to make the mental calculation easier. For example,

To solve 2.5 × 12, she can double 2.5 and halve 12 i.e. 2.5 × 12 = 5 × 6



Penny said ‘I can solve 0.6 x 0.5 by halving 0.6 and doubling 0.5 but I wouldn’t choose that method to solve 0.3 x 0.7.’

What types of multiplication of decimal problems are best suited to Penny’s method?

6. Use Penny’s strategy of doubling one number and halving the other to solve the following problems. Use jottings to help if necessary.

a) 1.5 x 4

b) 2.5 x 18

c) 6 x 11.5

d) 3.5 x 12

e) 0.8 x 1.5

f) 0.5 x 0.7

Reflection and Discussion

Sometimes, it is easier to solve a multiplying decimals problem by thinking of the fraction equivalent of a decimal within the problem. For example, it is easier to solve:

- 0.5 x 4 by thinking of it as $\frac{1}{2}$ of 4 which is 2.
- 0.25 x 6 by thinking of it as $\frac{1}{4}$ of 6 i.e. halving 6 and halving it again which is 1.5

Calculate the answers to all these problems. Circle the problems where it was easier to think of a decimal as a fraction.

1. 0.5 x 12.6
2. 31.7 x 100
3. 16 x 0.25
4. 0.1 x 17.2
5. 8 x 1.5

Justify your answers and circled problems with a partner. Did you agree? Why? Why not?

NOTE: Most people tend to use written jottings to help keep track of multiplication calculations that cannot be completely stored in their heads. For problems involving 'difficult' numbers a calculator should be used.

Revision: The Best Strategy

Choose the most suitable strategy to solve the following problems. Try to do the problems mentally. If this is difficult, use jottings to help keep track

a) 0.2 x 6	d) 5 x 16.6
b) 0.17 x 3	e) 0.15 x 8
c) 4 x 2.6	f) 100 x 6.8

Whole Class Activity 4

Think: What mental strategies can we use to solve division problems involving decimals?

Dylan's Array Strategy for Dividing Decimals

Dylan used the array model to help solve division problems.

a) To solve 2.4 ÷ 0.8, he decided that it made sense to think 'how many groups of 0.8 in 2.4' rather than '2.4 shared between 0.8'.

He placed the numbers into an array diagram. He did not yet know the number of groups.

Size of each group (0.8)

Total 2.4	Number of Groups (?)

He thought of the problem as ? x 0.8 = 2.4

To work it out he started at 0.8 and counted forward by 0.8 until he got to 2.4. That is, 0.8 + 0.8 + 0.8 = 2.4. He worked out there was 3 groups of 0.8 in 2.4.

b) To solve 1.5 ÷ 5, Dylan decided it was easier to think of it as 'sharing or partitioning 1.5 into 5 equal parts'

He represented the problem as an array

Size of each group (?)

Total 1.5	Number of Groups (5)

He thought of this problem as 5 x ? = 1.5.

He knew 5 x 3 = 15. That was ten times bigger than he needed. He thought that 1.5 shared into 5 equal parts would be 0.3. He tested that idea using multiplication and decided he was correct.

1. Use your knowledge of arrays and repeated equal quantities to solve the following problems. Use jottings or diagrams to help if necessary.

a) 2.5 ÷ 5

b) 12.3 ÷ 3

c) 5.5 ÷ 1.1

d) 6 ÷ 0.25

e) 0.21 ÷ 7

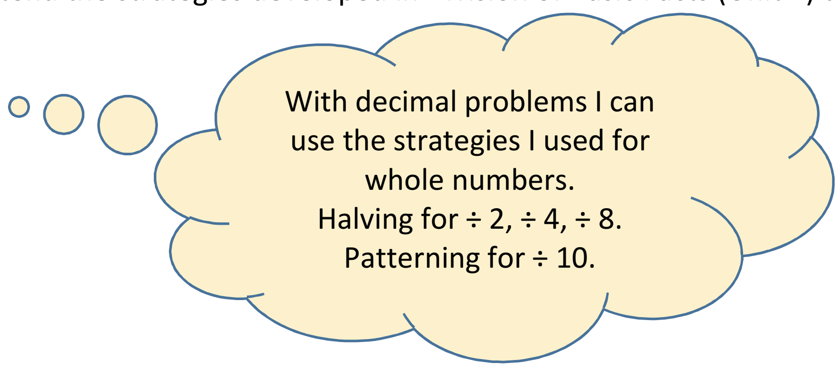
f) 15 ÷ 0.5

Which problems were easier to work out as sharing problems?

Which problems were easier to work out as grouping problems, i.e., ‘how many groups of’?

Tom’s Strategy for Dividing Decimals

Tom knows he can extend the strategies developed in Division of Basic Facts (Unit 2) to solve decimal problems.



Using halving for ÷ 2, ÷ 4 and ÷ 8

We can extend the halving we used for whole numbers to solve decimal ÷ 2, ÷ 4, ÷ 8 problems mentally. For example,

To solve 14.4 ÷ 2 we can halve 14.4 to get 7.2.

To solve 14.4 ÷ 4 we can halve 14.4 to get 7.2 and halve it again to get 3.6.

To solve 14.4 ÷ 8 we can halve 14.4 to get 7.2, halve it again to get 3.6 and halve it again to get 1.8.

2. Use Tom’s strategy of halving to calculate the following. Use jottings or diagrams to help if necessary.

a) 3.2 ÷ 2

b) 4.44 ÷ 4

c) 0.48 ÷ 8

d) 36.5 ÷ 2

e) 0.6 ÷ 4

f) 3 ÷ 4

Using Patterning and Place Value for ÷ 10

We can use the Place Value Chart and patterning to solve ÷ 10 decimal problems mentally. For example, to solve 12.7 ÷ 10 we can place 12.7 in the chart with the 1 in the Tens column, 2 in the Ones column and 7 in the Tenths column.

Dividing by 10 makes the number 10 times smaller. Every digit in 12.7 moves one place to the right. Therefore, 12.7 ÷ 10 = 1.27

If we were to divide 12.7 by 100, every digit in 12.7 would be 100 times smaller and it would move two places to the right. Therefore,12.7 ÷ 100 = 0.127.

	THOUSANDS			ONES			DECIMALS		
	Hundred	Ten	One	Hundred	Ten	One	Tenth	Hundredth	Thousandth
EXAMPLES					1	2	7		
12.7 ÷ 10						1	2	7	
12.7 ÷ 100							1	2	7

3. Use Tom's strategy of using the Place Value Chart to calculate the following. Use the spaces in the chart to help if necessary.

a) 1.5 ÷ 10

b) 0.2 ÷ 10

c) 21.3 ÷ 100

d) 0.78 ÷ 100

e) 574.6 ÷ 10

f) 3.62 ÷ 100

NOTE: Most people use written jottings to help keep track of division calculations that cannot be completely stored in their heads. For problems involving 'difficult' numbers, a calculator should be used.

Revision: The Best Strategy

Choose the most suitable strategy to solve the following problems. Try to do the problems mentally. If this is difficult, use jottings to help keep track

a) 6 ÷ 1.5	d) 234.7 ÷ 100
b) 3.5 ÷ 0.5	e) 1.25 ÷ 0.25
c) 0.68 ÷ 4	f) 3.1 ÷ 10

Practice Exercises 2

1. PUZZLE:

'What's Green and Stands in a Corner?'

Complete these questions to decode the answer to this joke.

G: 0.65 ÷ 10
T: 0.5 x 3 x 2
A: 0.65 x 4
A: 2 ÷ 8

R: 2.14 x 7
G: 3 ÷ 0.25
H: 0.3 x 9
O: 24.4 ÷ 4

F: 15 ÷ 2.5
U: 0.2 x 10 x 10
N: 3.39 ÷ 3
Y: 14.2 x 10 ÷ 2

0.25	1.13	2.6	20	12	2.7
3	71	6	14.98	6.1	0.065

2. For the following problems:

- Write the number sentence to reflect the situation.
- Write the number sentence to calculate the answer (this may be the same as above.
- Show the strategy chosen for solving the problem.
- Find the answer.
- Think about your answer. Does it make sense?

a) Americans use an average of 300.6 L of water per day per person. How much is used per person over 5 days?

Number Sentence(s)	Strategy	Answer	Does it make sense?

b) A washing machine uses 39.6 Litres of water. A more water–wise machine uses 3 times less. How much water does the water wise machine use?

Number Sentence(s)	Strategy	Answer	Does it make sense?

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c) In the U.S, baths account for 2.7% of household water usage. Showers account for 4 times more. What percentage of the household water usage do showers use?

Number Sentence(s)	Strategy	Answer	Does it make sense?

d) A dishwasher uses 4.3 litres of water in 2 washes. How much water is used per wash?

Number Sentence(s)	Strategy	Answer	Does it make sense?

e) An average toilet uses 5.5 litres of water in every flush. How many litres of water will it use in 12 flushes?

Number Sentence(s)	Strategy	Answer	Does it make sense?

f) A low water flow AAA rated showerhead uses 7.5 litres of water every minute. How many litres will an 8 minute shower use?

Number Sentence(s)	Strategy	Answer	Does it make sense?

Reflection on Learning

1. Calculate the answers to the following problems mentally. Use jottings and diagrams to help. Draw a line to connect the question with the correct answer.

PROBLEM	ANSWER	PROBLEM	ANSWER
a) 7.5 × 4	0.85	g) 1.4 + 27.8	0.6
b) 4.2 + 5 – 0.1	40	h) 4.8 ÷ 8	9.47
c) 10 ÷ 0.25	6	i) 4.3 – 0.5	0.7
d) 7.8 – 6.95	70	j) 288.2 ÷ 10	29.2

e) 1000 × 0.7 ÷ 10	30	k) 8.97 + 0.5	3.8
f) 24 × 0.25	9.1	l) 4.4 – 3.7	28.82

2. a) Circle in **blue**, any problems where your strategy involved thinking of a number line.

b) Circle in red, any problems where your strategy involved doubling, halving or both.

c) Circle in **green**, any problems where you thought of the Place Value Chart and patterning.

d) Circle in black, any problems where it was easier to calculate using the fractional equivalent of the decimal.

Check with a partner. Did you circle with the same colours? Justify your thinking.

3. Solve the following problems

a) Australia's average temperature has increased by 0.9° since 1950. If the average temperature was 21.7° in 1950, what is it today?

b) Australia accounts for 1.48% of global greenhouse gas emissions. This is 4 times higher than the average greenhouse gas emissions of all countries across the world. What is the world average?

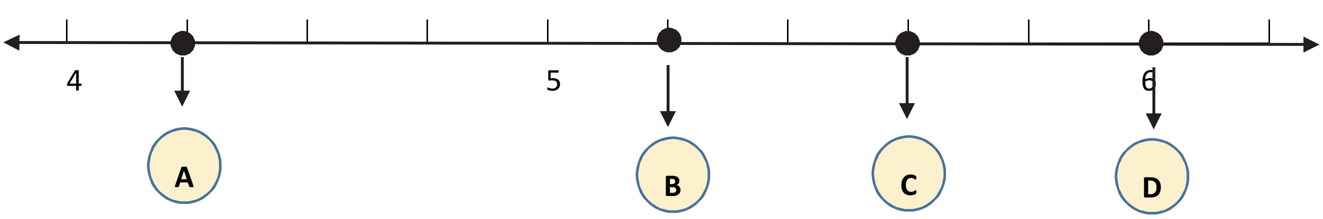
c) In 1990 Australia's greenhouse gas emissions were 547.7 million tonnes. In 2007 they totalled 597.2 million tonnes. How much have they increased in this time?

d) Biogas accounts for 0.3% of Australia's electricity generation. Hydroelectricity accounts for 7 times this amount. What percentage of electricity generation is hydro?

OLNA Practice Questions

1. 4.7 + 0.5 = ?

Which dot on the number line best represents this amount?



2. Melba divided 72.9 by a number. She got 0.729 as the answer. What number did Melba divide by?

3. The population of Australia in 1950 was 8.27 million.
The population of Australia in 2015 was 23.9 million.
What is the difference between these two populations?

_____________________ million

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Topic 4

Using a Calculator or Spreadsheet to Solve Everyday Problems

Mathematics Discussion

When solving everyday problems involving fractions and decimals, we decide:

- whether an approximate or exact solution is required
- whether to solve the problem mentally or with a digital resource such as a calculator, phone or spreadsheet
- the number sentences that reflect the problem and help us calculate the answer
- the strategy for finding the answer
- whether the answer is reasonable

In this section, we will be focussing on choosing between mental, calculator or spreadsheet strategies to solve problems involving fractions and decimals.

We tend to use mental strategies for one step or simple multistep problems involving easily visualized fractions and simple decimals. Examples of such problems include those with number sentences like $\frac{3}{4} + 1\frac{1}{2} - \frac{1}{4}$ and 1.2 × 3.

We tend to use calculators when the numbers are more difficult, such as $1\frac{5}{7} + 10\frac{1}{3}$ and 3.72 ÷ 0.5 × 1.23 but the problem is still limited to either one or a few steps. We can solve fraction problems on a calculator with careful use of the division (÷) button and brackets on a basic calculator, or by using the fraction 'A b/c' button on a scientific calculator.

We tend to use a spreadsheet when we need to calculate a lot of data or data that sometimes needs to be changed or added to. When entering fractions into a spreadsheet formula we use, for example 3/7 for $\frac{3}{7}$ and 2 3/7 for $2\frac{3}{7}$.

Whole Class Activity 1

Think: How do I choose between using mental strategies or a calculator when solving fraction and decimal problems?

Below is a range of fraction and decimal problems involving the four operations.

0.26×1.73	$1\frac{1}{4} - \frac{3}{4} + \frac{1}{2}$	$3.5 \div 0.5$	$\frac{5}{7} + \frac{11}{12}$	$\frac{3}{4} \times 16$	$23.1 \div 3.65$	$8 \div \frac{1}{3}$
$3\frac{3}{10} \div 1\frac{1}{2}$	$3\frac{3}{5} - 1\frac{7}{11}$	$3.4 + 0.7$	$\frac{5}{6} + \frac{1}{3}$	0.25×24	$3.05 + 1.762$	$1\frac{1}{4} \times 20$
$6\frac{1}{4} \times 3\ 187$	$2.3 - 1.9$	$3\frac{1}{2} \div \frac{1}{2}$	$23.1 \div 3 + 1.2$	$\frac{1}{2} \times \frac{1}{2}$	1.8×0.5	$\frac{3}{4} - \frac{1}{10}$

Working with a partner:

a) Circle, in **blue**, the problems that are best solved mentally, with jottings.

b) Circle, in **red**, the problems that are best solved with a calculator.

c) How did you choose which decimal problems were best solved using mental strategies and which were best solved using a calculator?

d) How did you choose which fraction problems were best solved using mental strategies and which were best solved using a calculator?

e) Tegan and Sann had the decimal problems 3.5 ÷ 0.5, 0.25 × 24 and 1.8 × 0.5 circled in different colours. Tegan solved these using a calculator. Sann used mental by thinking of the decimals as fractions. Use jottings to show how Sann changed decimals into equivalent fractions to make the calculations easier.

f) Tegan and Sann also had $\frac{3}{4} - \frac{1}{10}$ circled in different colours. Tegan used a calculator. Sann said 'It's easy to calculate mentally. Just think of the fractions as decimals.' Use jottings to show how Sann changed fractions into equivalent decimals to make the mental calculations easier.

g) Solve the problems circled in **blue**, in the space below.

h) Tegan and Sann timed how long it took them to mentally solve the problems in (g). Tegan took 7 minutes and 39 seconds to solve the mental problems. Sann took 2 minutes and 8 seconds longer. How long did Sann take?

Write a number sentence to (i) reflect the problem and (ii) calculate the answer (these may be the same) for this situation.

Circle the best way of finding the answer to this problem:

MENTAL/JOTTINGS or CALCULATOR

Practice Exercise 1

1. Write a number sentence to (i) reflect the problem and (ii) calculate the answer (these may be the same) for each of the following situations. Circle MENTAL/JOTTINGS or CALCULATOR, as the best way of finding the answer.

a) One Australian dollar is worth 0.824 US dollars. How many US dollars would 55 Australian dollars be?

NUMBER SENTENCE(S): MENTAL/JOTTINGS or CALCULATOR

b) A rectangular table has an area of $4\frac{1}{2}$ m^2. If its width is $1\frac{1}{2}$ m, what is its length?

NUMBER SENTENCE(S): MENTAL/JOTTINGS or CALCULATOR

c) How many days are there in $5\frac{1}{2}$ years?

NUMBER SENTENCE(S): MENTAL/JOTTINGS or CALCULATOR

d) Usain Bolt holds the 100 m sprint world record of 9.58 seconds. His previous best time was 9.69 seconds. How much did Usain Bolt improve upon his previous time to get the new World Record?

NUMBER SENTENCE(S): MENTAL/JOTTINGS or CALCULATOR

e) A biscuit recipe lists $\frac{3}{4}$ cup of milk. Jackie estimates she only has $\frac{3}{10}$ cup of milk in her fridge. How much milk will Jackie need to borrow from a neighbour to complete her recipe?

NUMBER SENTENCE(S): MENTAL/JOTTINGS or CALCULATOR

f) From a 6.5 m length of skirting board, Bruce cut off pieces measuring 0.9 m and 1.4 m. How much skirting board did he have left?

NUMBER SENTENCE(S): MENTAL/JOTTINGS or CALCULATOR

g) Two stroke fuel mix for lawnmowers is comprised of $\frac{1}{50}$ oil and $\frac{49}{50}$ unleaded petrol. How much oil would be in 3 764 mL of two stroke mix?

NUMBER SENTENCE(S): MENTAL/JOTTINGS or CALCULATOR

h) Milly wants to budget 0.25 of her weekly income on clothes. If she earns \$480 per week, how much does she want to spend on clothes?

NUMBER SENTENCE(S): MENTAL/JOTTINGS or CALCULATOR

Whole Class Activity 2

Think: How do we use a calculator to solve everyday problems involving fractions and decimals?

Tegan and Sann recognised that problems like $\frac{5}{7} + \frac{11}{12}$ and $3\frac{3}{5} - 1\frac{7}{11}$ are best solved using a calculator but they were both unsure about which buttons to press.

PART A

In Unit 2, they learnt that the vinculum (fraction line) in a fraction can be thought of as a division symbol. By dividing the numerator by the denominator, they would be converting a fraction into a decimal. Hence $\frac{5}{7}$ can be changed into a decimal by pressing 5 ÷ 7 on a calculator.

What buttons would Tegan need to press to solve $\frac{5}{7} + \frac{11}{12}$ on a basic calculator?

To solve $\frac{5}{7} + \frac{11}{12}$ Tegan entered 5 ÷ 7 + 11 ÷ 12 into this basic calculator.

She got an answer of 1.059

To solve $\frac{5}{7} + \frac{11}{12}$ Sann entered 5 ÷ 7 + 11 ÷ 12 into this scientific calculator.

He got an answer of 0.797

Try $\frac{5}{7} + \frac{11}{12}$ on a basic and scientific calculator. What is the correct answer?

How can you use brackets to make sure the correct answer is calculated?

Use a scientific calculator to find the answer to $3\frac{3}{5} - 1\frac{7}{11}$ using the division button.

Circle the form that the answer is given in when using the division button on a calculator to solve fraction problems:

DECIMAL FRACTION

PART B

Sann knows his calculator has a fraction function but he has lost his instruction booklet and does not know how to calculate answers to fraction problems using this function.

Use a search engine such as Google to find a 'YouTube' clip that explains how to use the fraction button on *your* scientific calculator. View the clip you have found or watch the following clip, which is suitable for many scientific calculators.

Calculator Fractions – YouTube 4:25 www.youtube.com/watch?v=jrTnz37AboE

How can you calculate solutions to $\frac{5}{7} + \frac{11}{12}$ and $3\frac{3}{5} - 1\frac{7}{11}$ using the fraction 'A b/c' button on your scientific calculator? Record the steps in the space below.

How do other class members solve fraction problems on their scientific calculators? Demonstrate to other class members how the fraction button works on your calculator.

Circle the form that the answer to fraction problems is given in when using the fraction button on a calculator:

DECIMAL FRACTION

In this activity, the answer to $3\frac{3}{5} - 1\frac{7}{11}$ has been written in both decimal and fraction form. Using your scientific calculator, investigate how to convert an answer given in decimal form to a fraction form and vice versa. Outline the steps taken to perform these conversions on your calculator in the space below. Use $3\frac{3}{10} \div 1\frac{1}{2}$ as an example.

Does your phone have a fraction function button? Investigate. Write down the best method for calculating fraction problems using the calculator on your phone?

PART C

Solve the problems circled in red from Whole Class Activity 1 using a basic calculator, scientific calculator or phone.

Practice Exercise 2

1. Solve the following using a calculator. Write your answers in fractional form.

a) $\frac{7}{9} + \frac{11}{12}$

b) $\frac{8}{13} - \frac{1}{16}$

c) $3\frac{1}{2} \times 12\,397$

d) $1\frac{3}{4} \div \frac{5}{9}$

e) $2\frac{1}{3} + 3\frac{1}{14}$

f) $2\frac{1}{2} \times 3\frac{1}{4}$

2. Solve the following problems using the decision making process to guide your thinking.

PROBLEM			WHICH OPERATION? Number Sentences	STRATEGY AND SOLUTION	Is your answer reasonable? Yes or No
a) If you cut $13\frac{1}{7}$ m of string into $\frac{5}{7}$ m pieces, how many pieces would you have?					
					
b) Malcom swims 1.625 km each day. How many kilometres would he swim in a week?					
					
c) How many quarters in $4 US?					
					
d) Jim has $1\frac{3}{4}$ litres of juice. He divides it evenly into 3 beakers. How much juice is in each beaker?					
					

3. Find the answers to the problems from PRACTICE EXERCISE 1, QUESTION 1. Write your solutions in the space below:

a)

b)

c)

d)

e)

f)

4. The following is a recipe for White Chocolate and Raspberry Muffins. Choose the quickest and most efficient way of solving the following problems.

DRY INGREDIENTS	**WET INGREDIENTS**
$2\frac{1}{4}$ cups plain flour	$1\frac{1}{3}$ cups milk
$\frac{3}{4}$ cup sugar	$\frac{2}{7}$ cup oil
$\frac{1}{2}$ teaspoon salt	2 eggs
$1\frac{1}{4}$ teaspoons baking powder	
$\frac{2}{3}$ cup white chocolate chips	
$\frac{2}{3}$ cup raspberries	

a) How much more milk is needed than oil?

b) Matilda wants to make the recipe using 2 cups of raspberries. How many more times the original recipe will she be making?

c) How many cups of plain flour and sugar combined are needed?

d) Max wants to make $\frac{1}{4}$ the size of the recipe. How much flour will he need?

e) Ignoring the salt and baking powder, how many cups of dry ingredients are needed?

f) How much more flour is needed than milk and oil combined?

Whole Class Activity 3

Think: How do we use a spreadsheet to solve everyday problems involving fractions and decimals?

Sherry the plumber, charges a fixed call out rate of \$70. She then charges \$80 for every hour of work. Sherry wants to set up a spreadsheet to calculate her invoices for a week's job list.

E J Whittby	$\frac{3}{4}$ hours	Mrs Lewis	$8\frac{1}{3}$ hours
Mr & Mrs Fisher	$9\frac{1}{2}$ hours	Peter Kemp	$2\frac{3}{4}$ hours
Mary Jones	$6\frac{2}{3}$ hours	Mr Dry	$5\frac{1}{4}$ hours

a) Open a new spreadsheet workbook. Determine a suitable title for the spreadsheet. Enter this into the workbook.

b) Discuss the layout of the workbook with classmates. Decide upon suitable headings for the spreadsheet. Enter these into the worksheet.
(HINT: You may wish to use 'JOB', 'HOURS' and 'INVOICE AMOUNT')

c) Enter the job names and the number of hours spent at each job. To input $\frac{3}{4}$, enter 3/4. To input $9\frac{1}{2}$, enter 9 1/2 ensuring a space between the 9 and the 1/2.

d) Rupert, a class member, thought it would be just as easy to enter the hours as decimals. What decimals would Rupert enter for each of the clients?

e) Work with your class to determine the formula you would enter to calculate the INVOICE AMOUNT. Write the formula in the space below.

f) Enter the formula into the spreadsheet and use it to calculate the amounts Sherry should invoice her clients. (You may have to go to the 'Home' tab or choose 'edit', depending on your computer, and change the 'Number' from 'Fraction' into 'Currency' to ensure that each profit is not shown as a fraction and is rounded to 2 decimal places for cents)

g) Calculate the total that Sherry invoices for the week using the Σ button.

h) Save your worksheet by selecting *Save As* from the *File* menu and entering the file name. Print and staple your spreadsheet to the side of this page.

i) Why is a spreadsheet the best way of calculating the amount Sherry invoices in a week?

Practice Exercise 3

1. A chocolate company asks John to design a cardboard cube to package their chocolate. They want to use the minimum amount of cardboard in each of the boxes. John decides to set up a spreadsheet to show the chocolate company the surface area of cube boxes of various dimensions, so they can determine the best package.

John entered the following into a new spreadsheet:

	A	B	C
1	SURFACE AREA OF CUBES		
2	LENGTH	SURFACE AREA	
3			

a) The chocolate company wants the box to have a length between 12 cm and 14 cm. John thought he would calculate the surface area of the cube starting at a side length of 12 cm and going up by either 0.1 cm, 0.2 cm or 0.5 cm. Discuss with a partner which is the best increment and enter these lengths into the spreadsheet.

b) John knows that each face of a cube is a square that has an area of Length × Length or L^2. He knows that 6 square faces make up a cube. He enters the following formula into cell B3 '=6*A3^2'. Explain this formula.

c) Complete the spreadsheet. Save, print and staple your spreadsheet to the side of this page.

d) The chocolate company decides that the cube that is most cost efficient has a surface area of 1 000 cm^2. Use the spreadsheet to find what side length the cube should be.

2. Ayesha, Lilly and Nat are in partnership in a café. They each work part–time with Ayesha working 4 days, Lilly 2 days and Nat 1 day. They decide to share the profits according to how much they work each week.

In their first week of trading, the following profits were made on each day:

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
\$472	\$588	\$251	\$492	\$734	\$854	\$803

a) What fraction of the week does Ayesha work?

What fraction of the week does Lilly work?

What fraction of the week does Nat work?

b) Set up a new spreadsheet workbook. Enter an appropriate title and headings.

Use 'DAY', 'PROFIT', 'AYESHA'S SHARE OF PROFIT', 'LILLY'S SHARE OF PROFIT' and 'NAT'S SHARE OF PROFIT' as the titles of your columns.

c) What is the most efficient way of entering the days of the week into a spreadsheet? Discuss with your classmates and enter the days into your workbook.

d) Enter the profits for their first week of trading.

e) What formula would you enter to calculate Ayesha's share of the profits? Enter it into the spreadsheet.

f) Enter the formula for both Lilly and Nat's shares into the spreadsheet.

g) Calculate each partner's daily profit over the 7 days. (You may have to choose 'edit' and change the 'Number' from 'General' into 'Currency' to ensure that each profit is rounded to 2 decimal places for cents)

h) Use the Σ button to calculate each partner's total profit for the week.

i) Save, print and staple your spreadsheet to the side of this page.

j) Why is a spreadsheet the most appropriate way of recording earnings for the partners?

k) How could you alter the spreadsheet so as to record profits over months rather than weeks?

l) Was the partner's system a fair way of distributing profits? Explain your thinking.

Reflection on Learning

Katie designs ceramic tiles for a bathrooms and kitchens. She is designing a new triangular range of tiles that must have a height of 18 cm in order to match existing square tiles.

Katie knows that the formula for area of a triangle is: $\frac{1}{2}$ × BASE LENGTH × HEIGHT. She wants to investigate the area of triangles with a minimum BASE LENGTH of 16 cm and a maximum BASE LENGTH of 18 cm so as to create the most effective tile.

Katie needs to solve many mathematical problems as she designs the tiles.

A. Draw a line connecting the problem with the best method of solving it.

a) Katie decides to investigate the area of triangles that have varying base lengths but a fixed height of 18 cm. She starts with a base length of 16.1 cm, then 16.2 cm up to 18 cm. Which triangle has an area of 148.5 cm^2?	• MENTAL
b) Katie really likes two tiles. One that has a base length of $16\frac{3}{8}$ cm and one that is $1\frac{1}{7}$ cm longer than the base length of the first. What is the base length of the second tile?	• SPREADSHEET
c) How much longer is a tile with a base length of 16.8 cm compared to one that is 17.3 cm?	• CALCULATOR

B. Solve the problems above using the strategy you selected. Work through the decision making process for each strategy, as outlined below:

MENTAL STRATEGY PROBLEM

1. Circle: APPROXIMATE ANSWER or EXACT ANSWER?
2. Write as a number sentence that reflects the problem:
3. Write as a number sentence to solve the problem
4. Solution:
5. IS THE ANSWER REASONABLE? What is the number referring to? Write the answer in a sentence using the words in the question.

CALCULATOR STRATEGY PROBLEM

1. Circle: APPROXIMATE ANSWER or EXACT ANSWER?
2. Write as a number sentence that reflects the problem:
3. Write as a number sentence to solve the problem
4. Solution:
5. IS THE ANSWER REASONABLE? What is the number referring to? Write the answer in a sentence using the words in the question

SPREADSHEET STRATEGY PROBLEM

1. Circle: APPROXIMATE ANSWER or EXACT ANSWER?
2. Write the formula that will be used to solve the problem in the spreadsheet:

3. Open a new spreadsheet workbook and enter Katie's data. Save, print and staple your spreadsheet to the side of this page'

4. Solution:

5. IS THE ANSWER REASONABLE? What is the number referring to? Write the answer in a sentence using the words in the question

OLNA Practice Questions

1. Penny cuts six $2\frac{2}{9}$ m pieces of rope from a $17\frac{1}{3}$ m length of rope. How much rope is left?

A. $15\frac{1}{9}$ m B. 4 m C. $11\frac{1}{3}$ m D. 3.79 m

2. Tom wants to use a spreadsheet to find the volume of a square based pyramid. He knows the formula for a square based pyramid is $\frac{1}{3}$ × BASE LENGTH^2 × HEIGHT

	A	B	C	D
1	VOLUME OF SQUARE PYRAMID			
2	BASE LENGTH	HEIGHT	VOLUME	
3	5	8	66.6666666666	

What formula has Tom entered in cell C3 to calculate the volume?

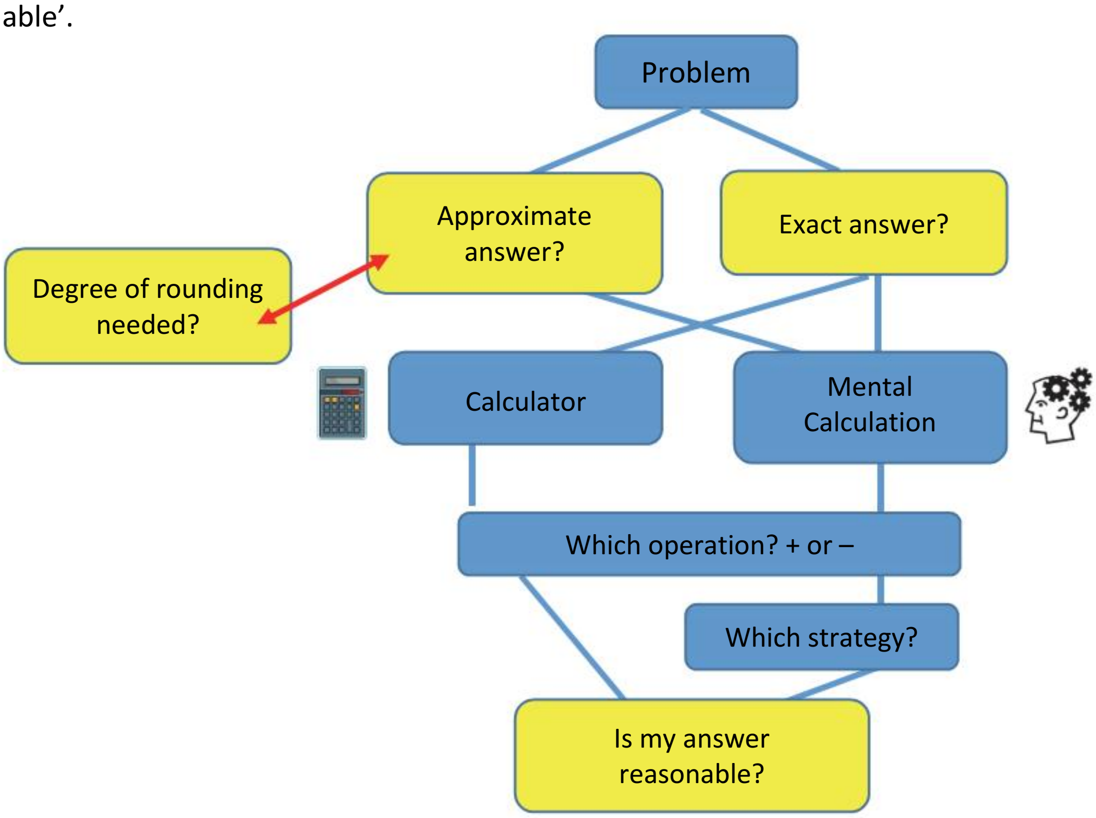
A. $\frac{1}{3}$ *A3^2*B2 B. =1/3× A3^2 × B2 C. =1/3A3^2B2 D. =1/3*A3^2*B2

Topic 5

Using Estimation for Solving Problems and Checking Reasonableness of Answers

Mathematics Discussion

In this section we will be focussing on the section of the flow chart; ‘Do we need an exact answer or an approximate answer?’ and the last section of the flow chart; ‘Is my answer reasonable’.



Many real life situations require an exact answer, but many require an approximate answer.

If we decide that the situation requires an exact answer, we solve the problem using mental strategies, jottings or a calculator.

If we decide the situation requires an approximate answer, we use estimation strategies, such as rounding, to simplify the problem. We then use mental strategies or jottings to approximate a solution. When indicating an answer to is an approximation, we use the symbol ≈.

When we round, we must decide how accurate our rounding needs to be and whether we need to round up or down. For example, 6.238 could be rounded to 5, 6, 6.2, 6.24, 7 or 10 and $7\frac{3}{8}$ could be rounded to 7, $7\frac{1}{4}$, $7\frac{1}{2}$ or 8, depending on the situation. Mostly we tend to round up to ensure that we have enough food, money, building supplies etc.

The last decision in the flow chart is 'Is my answer reasonable?' We make judgements as to whether an answer is reasonable based on:

- Properties of numbers
- Estimation strategies
- The context of the problem

In this section we will be focussing on whether an exact or an approximate answer is needed, using estimation strategies and deciding whether answers are reasonable, for problems involving all four operations with fractions and decimals.

Whole Class Activity 1

Think: When should I choose to use an approximate answer instead of an exact answer?

1. Discuss each of these scenarios and decide whether an approximation or an exact answer is needed in the following everyday situations. Justify your decision.

Scenario	Circle One	Justification
Bananas cost \$7.95 kg. Riley bought 0.53 kg. Would \$5 be enough to pay for it?	Approximation Exact answer	
It takes Luke $\frac{3}{4}$ hour to walk to school. Yagan can start about $\frac{1}{4}$ hour later than Luke but arrive at school at the same time. How long does it take Yagan to get to school?	Approximation Exact answer	
Painting the 3.8 m by 2.9 m ceiling of your bedroom and wondering if one tin of paint that covers 12 square metres is enough.	Approximation Exact answer	

Buying a 20 m length of rope, chopping off 2 lengths of $6\frac{3}{4}$ m and $4\frac{7}{8}$ m and wondering whether you have the $8\frac{1}{4}$ m left over that your neighbour wants to borrow.	Approximation Exact answer	
How much pizza does each person get if 5 pizzas are shared between 11 people?	Approximation Exact answer	
When saving $5 000 for an overseas trip, how much would you need to budget per fortnight if the trip is $1\frac{1}{4}$ years away?	Approximation Exact answer	

Practice Exercise 1

1. For the following problems:

Circle the problems in **blue** where an approximate calculation is the best solution.

Circle the problems in **red** where an exact calculation is the best solution.

a) Share 27 cookies between 5 people. How much does each person receive?

b) How much change from $50 when purchasing $2\frac{1}{2}$ kg prawns which cost $19.95 per kilogram?

c) Carry–on luggage on 'Go Fast' domestic airlines is restricted to 12.5 kg. Peter's bag contains a computer weighing 3.8 kg, documents weighing 6.9 kg, a spare change of clothes weighing 1.95 kg and toiletries weighing 1.3 kg. Will he need to pay for excess weight?

d) Miranda needs to leave for work at 7.45. Her alarm doesn't go off and she wakes at 7.18. It takes her $8\frac{1}{2}$ minutes to shower, $10\frac{3}{4}$ minutes to dress, 5 minutes to eat breakfast and $1\frac{1}{2}$ minutes to brush her teeth. Can Miranda leave for work on time?

e) Melanie runs at 8.4 km/h. How long will it take her to run 16 km?

f) Rory buys 18 m of skirting board. He fits the skirting board in a square room that has a length of 4.35 m. Does Rory have enough skirting board?

Reflection and Discussion – Underestimate or Overestimate?

An underestimation means our approximation is less than the accurate answer. An overestimation means our approximation is more than the accurate answer. In most cases it is best to get an overestimation of the answer to ensure we have enough food, money, time etc.

For each of the problems in Practice Exercise 1 where an approximate answer was selected, write next to each question whether it should be an overestimate or an underestimate. Discuss with the class.

When should you use an overestimate?

When should you use an underestimate?

Whole Class Activity 2

Underestimating and Overestimating with the Four Operations

Think: How does rounding up or down affect the result of addition, subtraction, multiplication and division calculations involving fractions and decimals?

PART A:

Complete the following table:

- Write the rounded number sentence in each column
- Use different colours to highlight the overestimations, underestimations and the estimations that are closest to the exact answer.

The first has been completed for you.

Problem	Round each number DOWN to nearest whole number and solve	Round each number UP to nearest whole number and solve	Round one number UP and one number DOWN and solve	Exact Answer Using a Calculator
$17\frac{73}{100} + 3\frac{1}{10}$	17 + 3 = 20	18 + 4 = 22	18 + 3 = 21	20.83
$23\frac{2}{5} + 47\frac{1}{8}$				
5.37 + 3.76				
$1\frac{14}{19} \times 3\frac{9}{10}$				
2.34 × 7.92				

Complete the following table:

Problem	Round each number DOWN to nearest whole number and solve	Round each number UP to nearest whole number and solve	Exact Answer Using a Calculator
$9\frac{24}{25} - 7\frac{1}{9}$			
$16\frac{4}{5} - 11\frac{8}{13}$			
24.13 – 5.19			
112.78 – 11.56			

Compare the rounded answers to the exact answers. Melva said ‘When I round either both numbers down or both numbers up in subtraction problems, I get an answer that is close to the exact answer’. Is this true? Explain using the examples in the table and Lauren’s thinking on subtraction from Section 3.3 Topic 3.

Melva continued her thinking. ‘When I round one number up and one number down in a subtraction problem, I get an answer that is not as close to the exact answer as either rounding both numbers down or both numbers up’.

Use $16\frac{4}{5} - 11\frac{1}{9}$ and 24.13 – 5.19 to show this thinking:

Melva wondered what type of rounding in subtraction problems results in an overestimation or an underestimation. Using $16\frac{4}{5} - 11\frac{1}{9}$ and 24.13 – 5.19 as examples:

Round the first number in the problems UP and the second number DOWN. Does this rounding in a subtraction problem result in an overestimation or an underestimation?

Round the first number in the problem DOWN and the second number UP. Does this rounding in a subtraction problem result in an overestimation or an underestimation?

Reflection and Discussion

Working with a partner, summarise your thinking from this Whole Class Activity by completing the following statements.

What rounding results in the most accurate estimation for problems involving:

ADDITION:

MULTIPLICATION:

DIVISION:

SUBTRACTION:

What rounding results in an overestimation for problems involving:

ADDITION:

MULTIPLICATION:

DIVISION:

SUBTRACTION:

What rounding results in an underestimation for problems involving:

ADDITION:

MULTIPLICATION:

DIVISION:

SUBTRACTION

Use what you learnt from the discussion and design a chart titled “My Rounding Rules” that provides an easy reference when you are making estimating decisions.

PART B:

Melva is making a frame for her artwork. The frame is to have a width of 53.72 cm and a length of 75.14 cm. Melva wonders about how much wood she will need to build the frame.

Will Melva need an exact answer or an approximation to be able to work that out? Justify your thinking.

What operation(s) would you use to solve this problem? How do you know?

Write the exact number sentence to find the amount of wooden framing Melva will need.

Round the numbers in the number sentence so as to get the MOST ACCURATE estimation. Write the rounded number sentence and use mental strategies and jottings to solve.

When estimating the amount of wood Melva would need for her framing, would she be best to overestimate or underestimate? Justify your answer. Find the estimation of wood needed based on this decision.

If Melva were to estimate the amount of wood required using 53 cm and 74 cm as her rounded numbers, what would be the outcome of her framing project? Explain.

Practice Exercise 2

1. Choose the rounding to calculate the closest approximate solution to the following problems. Solve the approximation mentally with jottings to help if necessary.

a) $5.95 \div 0.45$

b) $\frac{3}{4} \times 12.12$

c) $2\frac{2}{7} + 3\frac{7}{9}$

d) $0.22 \times ? = 11.2$

e) 0.12×0.53

f) $5\frac{2}{11} - ? = 3\frac{2}{3}$

2. Choose the rounding to calculate an overestimation to the following problems. Solve the approximation mentally with jottings to help if necessary.

a) $16.78 \div 4.155$

b) $2\frac{1}{4} \times 53.65$

c) $11\frac{2}{5} + 17\frac{8}{9}$

d) 13.12×1.73

e) $1\frac{2}{3} + ? = 5\frac{3}{5}$

f) $0.54 \times ? = 11.2$

3. For the problems below:

Circle the problems in blue where it is best to overestimate.

Circle the problems in red where it is best to underestimate.

Circle the problems in black where it is best to get an answer as close to the accurate answer as possible.

a) Find the perimeter of a square room with a wall length of $3\frac{8}{9}$ m so as to install a picture rail around all four walls.

b) At a school camp 157 mini pizzas were shared between 37 students. How many pizzas would each student get?

c) Tom made a short film for a 15 minute short film competition. He had recorded 17.88 minutes of footage but then deleted a 1.92 minute scene. Does Tom's film now fit within the 15 minute criteria?

d) If you cut a 15.78 m ribbon into 1.78 m lengths, how many 1.78 m lengths would you have?

e) Robert's office trolley can handle a weight up to 32 kg. He wonders whether he could carry boxes of documents weighing $9\frac{7}{9}$ kg, $12\frac{2}{3}$ kg and $11\frac{1}{4}$ kg.

f) If you weighed 9.73 kg of mince into 0.48 kg bags, how many bags of mince would you have?

4a) Using the problems above as a guide, in what situations is it best to overestimate? Why?

b) Using the problems above as a guide, in what situations is it best to underestimate? Why?

5. For each of the problems above, write a rounded number sentence and solve mentally using jottings to help if necessary.

a)

b)

c)

d)

e)

f)

6. Use the rounding that best suits each context, to find an approximate answer to the following:

a) Rasi had 727.36 minutes of songs on his computer. He deleted 168.7 mins. Approximately, how many minutes of music does he have left?

b) How long would it take to pack 18 pallets of soft drink onto a delivery truck if each pallet takes 7.72 minutes to pack?

c) How much does 2.15 kg of strawberries cost at $8.79 per kg?

d) Approximate the difference in temperature between Serbia at 17.34° and Beijing at 15.18°.

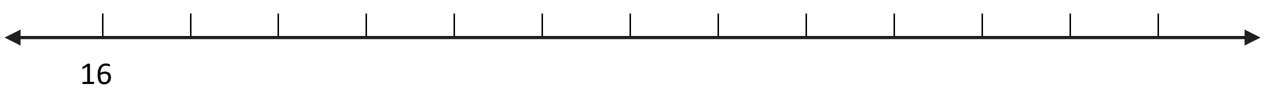
e) Twins Tia and Sarah when born weigh $2\frac{5}{8}$ kg and $3\frac{1}{7}$ kg respectively. Estimate the total weight of both twins.

f) How many people will 16 pizzas feed if each person says they eat between $1\frac{1}{2}$ and 2 pizzas each?

Whole Class Activity 3

Think: How do I round fractions and decimals?

On the following number line, start at 16 and count and label forward by $\frac{1}{12}$



Find $16\frac{7}{12}$ on the number line. Work as a class to:

Round this fraction UP to the nearest whole number

Round this fraction DOWN to the nearest whole number

Round this fraction UP to the nearest $\frac{1}{2}$

Round this fraction DOWN to the nearest $\frac{1}{2}$

Round this fraction UP to the nearest $\frac{1}{4}$

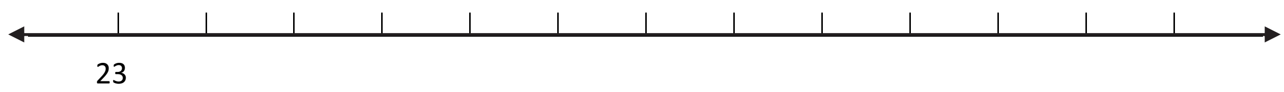
Round this fraction DOWN to the nearest $\frac{1}{4}$

Repeat with $16\frac{1}{3}$

Estimate and mark where $16\frac{1}{10}$ and $16\frac{4}{5}$ are on the same number line. How did you decide where to place them?

Complete the same set of rounding questions for $16\frac{1}{10}$ and $16\frac{4}{5}$ as you did for $16\frac{7}{12}$.

On the following number line, start at 23 and count and label forward by 0.1



Find 23.4 on the number line. Work as a class to:

Round this decimal UP to the nearest whole number

Round this decimal DOWN to the nearest whole number

Round this decimal UP to the nearest 0.5

Round this decimal DOWN to the nearest 0.5

Round this decimal UP to the nearest 0.25

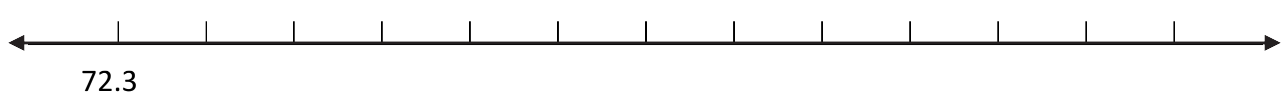
Round this decimal DOWN to the nearest 0.25

Repeat with 23.7

Estimate and mark where 23.35 and 23.82 are on the number line. How did you decide where to place them?

Complete the same set of rounding questions for 23.35 and 23.82 as you did for 23.4

On the following number line, start at 72.3 and count and label forward by 0.01



Find 72.36 on the number line. Work as a class to:

Round this decimal UP to the nearest whole number

Round this decimal DOWN to the nearest whole number

Round this decimal UP to the nearest 0.1

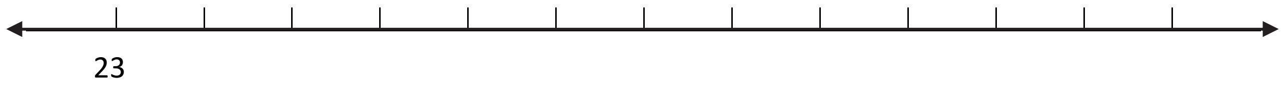
Round this decimal DOWN to the nearest 0.1

Round this decimal UP to the nearest 0.05

Round this decimal DOWN to the nearest 0.05

Repeat with 72.39

On the following number line, start at 23 and count and label forward by 0.1



Find 23.4 on the number line. Work as a class to:

Round this decimal UP to the nearest whole number

Round this decimal DOWN to the nearest whole number

Round this decimal UP to the nearest 0.5

Round this decimal DOWN to the nearest 0.5

Round this decimal UP to the nearest 0.25

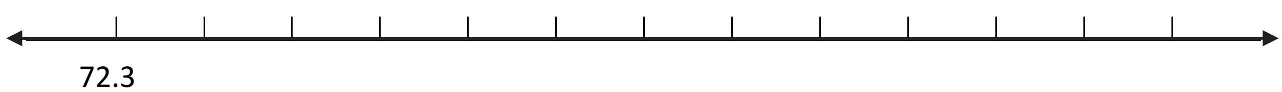
Round this decimal DOWN to the nearest 0.25

Repeat with 23.7

Estimate and mark where 23.35 and 23.82 are on the number line. How did you decide where to place them?

Complete the same set of rounding questions for 23.35 and 23.82 as you did for 23.4

On the following number line, start at 72.3 and count and label forward by 0.01



Find 72.36 on the number line. Work as a class to:

Round this decimal UP to the nearest whole number

Round this decimal DOWN to the nearest whole number

Round this decimal UP to the nearest 0.1

Round this decimal DOWN to the nearest 0.1

Round this decimal UP to the nearest 0.05

Round this decimal DOWN to the nearest 0.05

Repeat with 72.39

Practice Exercise 3

1. Round the following numbers according to the instructions in the table:

Number	Round UP to the nearest whole number	Round DOWN to the nearest whole number	Round UP to the nearest $\frac{1}{2}$ OR 0.5	Round DOWN to the nearest $\frac{1}{2}$ OR 0.5	Round UP to the nearest $\frac{1}{4}$ OR 0.25	Round DOWN to the nearest $\frac{1}{4}$ OR 0.25
$2\frac{7}{8}$						
1.3						
$12\frac{2}{3}$						
7.8						
$4\frac{3}{4}$						
21.85						
$29\frac{1}{5}$						
118.13						
$107\frac{1}{3}$						
64.62						
98.88						
$65\frac{4}{5}$						

2. For the problems, round the numbers to get the most accurate estimation. Carry out the calculation mentally. You may need to refer to your Rounding Rules Chart.

Problem	Problem written as a rounded number sentence	Approximate Solution
a) 0.24×12.12		
b) $8\frac{4}{7} + 11\frac{7}{9}$		
c) $7.95 \div 0.45$		
d) $\frac{3}{4} \times 44.38$		
e) $55.73 - 35.248$		
f) $83\frac{7}{8} - 2\frac{4}{11}$		

Whole Class Activity 4

Think: When I estimate, how accurate should I be?

The accuracy of our estimation depends upon the types of numbers, the difficulty of the mental calculation and the context of the problem.

How close does your estimation need to be in the following situations?

1. Sam at the Biko Café, wants to make the optimal number of chocolate mud cakes to have enough to sell but also to reduce wastage. He calculates they sell an average of $4\frac{5}{12}$ cakes per day. How many cakes should Sam bake if he bakes all cakes on Monday and freezes them for a week?

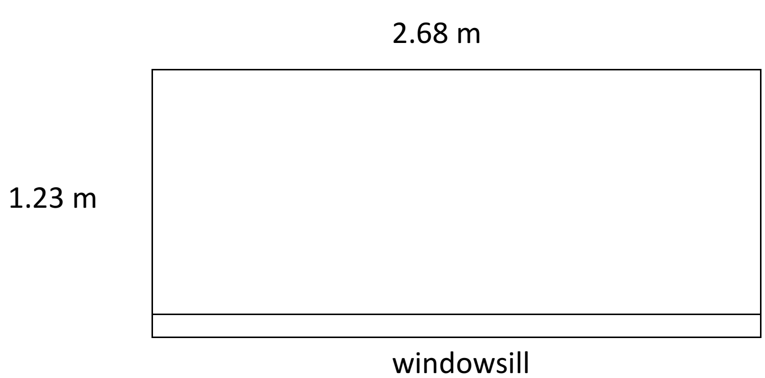
Sam knows he is calculating $7 \times 4\frac{5}{12}$. Should he round the average number of cakes down to the nearest whole number, up to the nearest whole number or to the nearest $\frac{1}{2}$ or $\frac{1}{4}$ cake? Justify your answer.

Round the numbers to calculate the estimation mentally or with jottings. Write number sentences and solve.

How do the numbers and the context of this problem affect the choice of rounding?

Describe the level of accuracy needed in this problem. Use words such as overestimation, underestimation, rounding, cost, waste and error.

2. Matthew is putting wooden window frames around the two sides and the top of the window and a windowsill along the bottom of his living room window. He draws a plan as follows:



How much window frame around the two sides and the top of the window does he need? Should the answer be within 5 m, 1 m, 0.5 m, 0.1 m or 0.01 m?

Round the numbers in the problems to calculate the estimation mentally or with jottings. Write number sentences and solve.

How do the numbers and the context of this problem affect the choice of rounding?

Describe the level of accuracy needed in this problem. Use words such as overestimation, underestimation, rounding, cost, waste and error.

If the window frame costs \$19.74 m and the windowsill costs \$27.95 m, estimate the cost of the window trimming.

Firstly, write a number sentence with the exact numbers and then round the numbers in the problem to calculate the estimation mentally or with jottings. Write a rounded number sentence and solve.

How do the numbers and the context of this problem affect the choice of rounding?

Describe the level of accuracy needed in this problem. Use words such as overestimation, underestimation, rounding, cost, waste and error.

Practice Exercise 4

1. Circle the most appropriate degree of accuracy to use for each problem.

a) A bedroom has ceiling dimensions of 5.74 m by 3.27 m. What is the area of the ceiling so as to buy enough paint to paint the ceiling?

Round the length and width to the nearest:

1 metre 0.5 m 0.1 m 0.01 m

Circle whether it is best to OVERESTIMATE or UNDERESTIMATE?

b) Bec is ordering home delivery pizzas for herself and 3 friends. She wants to know how much pizza to order. Lilly says "I'll eat $\frac{3}{4}$ of a pizza", Milly says "I'll eat 1 slice ($\frac{1}{8}$) of a pizza", Molly says "I'll eat one and a bit pizzas", and Bec thinks she'll eat most of one pizza.

Round each person's pizza order to the nearest:

1 pizza $\frac{3}{4}$ pizza $\frac{1}{2}$ pizza $\frac{1}{4}$ pizza

Circle whether it is best to OVERESTIMATE or UNDERESTIMATE?

c) Liam works at the local sushi restaurant. He works 3 hours and 12 minutes on Monday, 4 hours and 37 minutes on Tuesday and 1 hour and 50 minutes on Wednesday

When recording his time on his work timesheet Liam should record his hours to the nearest:

1 hour $\qquad$ $\frac{1}{2}$ hour $\qquad$ $\frac{1}{3}$ hour $\qquad$ $\frac{1}{4}$ hour $\qquad$ minute

Circle whether it is best to OVERESTIMATE or UNDERESTIMATE?

d) Huu purchases 0.26 kg of kale chips and it costs him $4.43. Huu thinks he has been charged too much and wants to work out the price per kilogram.

Round the weight to the nearest:

1 kg $\qquad$ 0.5 kg $\qquad$ 0.25 kg $\qquad$ 0.1 kg $\qquad$ 0.05 kg

Round the cost of the chips to the nearest:

\$10 $\qquad$ \$1 $\qquad$ \$0.50 $\qquad$ \$0.10 $\qquad$ \$0.05

Circle whether it is best to OVERESTIMATE or UNDERESTIMATE?

2. Choose the best degree of accuracy based on the numbers and your mental skills to estimate the solutions to the following problems.

Problem	Written as a rounded number sentence	Approximate Solution
a) 2.92 kg of pears cost $21.68. What is the cost of 1kg?		
b) Barbara runs for $2\frac{2}{3}$ hours. Jane runs for 27 minutes less. How long does Jane run for?		
c) If you divide 7.47 kg of meat into 0.45 kg bags, how many bags will you have?		
d) From an 11.36 m length of high visibility tape, Rob cuts off 3.87 m. How much tape is left?		
e) Anthony studies for $2\frac{3}{4}$ hours on Monday, $1\frac{1}{12}$ on Tuesday, $3\frac{3}{10}$ on Wednesday and $2\frac{1}{4}$ on Thursday. How much study does Anthony do over the week?		
f) David bought 0.73 ha of land at $799 999 per hectare. How much did David's land cost?		

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Whole Class Activity 5

Think: How do I know whether an answer to a problem is reasonable?

We make judgements as to whether an answer is reasonable based on the context of the problem and:

- Estimation strategies (as shown in the previous Whole Class Activities)
- Properties of numbers

USING PROPERTIES OF NUMBERS TO CHECK REASONABLENESS OF RESULT

PART A:

Work with your classmates to decide what happens to a number when you add a number that is either bigger or smaller than 1. Use 7.6 + 1.5 and $\frac{1}{4} + 6\frac{3}{5}$ as examples.

Work with your classmates to decide what happens to a number when you subtract a number that is either bigger or smaller than 1. Use 7.6 – 1.5 and $6\frac{3}{5} - \frac{1}{4}$ as examples.

Formalize your thinking by inserting 'MORE' or 'LESS' into the statements below:

When we add a number to another number the answer is ______________ than the original number.

When we subtract a number from another number the answer is ______________ than the original number.

Michael cut a 0.26 m length of wire off a 20 m reel. How much wire would he have left on the reel? Michael got an answer of 20.26 m. Explain why this answer could not be correct using your knowledge of operations and the context of the problem.

Michael had two lengths of wire. One was $9\frac{3}{10}$ m long and the other was $2\frac{1}{4}$ m long. Michael thought he had $6\frac{3}{5}$ m of wire combined. Explain why this answer could not be correct using your knowledge of operations and the context of the problem.

PART B:

Work with your classmates to decide what happens to a number when you multiply it by a number that is either bigger or smaller than 1.

Play the following game to help with your conclusions.

Game: Multiplication Target

AIM

To multiply any number by any other number to get as close to 80 as possible

EQUIPMENT

One calculator or phone

RULES OF THE GAME

1. Player 1 enters any number into a calculator or phone
2. Player 2 hands Player 1 the device and multiplies this number by another number so that the answer will be as close to 80 as possible.
3. Player 1 multiplies this new number, trying to get closer to 80.
4. The players take turns until one player hits the target by getting 80. _ _ _.
5. Play 'Multiplication Target 4 more times.

Formalize your thinking from playing this game by inserting 'MORE' or 'LESS' into the statements below:

When we multiply a number by a number that is more than 1, the answer is

______________ than the original number.

When we multiply a number by a number that is between 0 and 1, the answer is

______________ than the original number.

Michael cut off lengths of wire measuring 0.75 m for each length. He cut 9 lengths. Michael thought he would have cut 16 m of wire in total. Explain why this answer could not be correct using your knowledge of operations and the context of the problem.

PART C

Work with your classmates to decide what happens to a number when you divide it by a number that is either bigger or smaller than 1.

Play the following game to help with your conclusions.

Game: Division Target

AIM

To divide any number by any other number to get as close to 20 as possible

EQUIPMENT

One calculator or phone

RULES OF THE GAME

1. Player 1 enters any number into a calculator or phone
2. Player 2 takes the device and divides this number by another number so that the answer will be as close to 20 as possible.
3. Player 1 divides this new number, trying to get closer to 20.
4. The players take turns until one player hits the target by getting 20. _ _ _.

Formalize your thinking from playing this game by inserting 'MORE' or 'LESS' into the statements below:

When we divide a number by a number that is more than 1, the answer is _______________

than the original number.

When we divide a number by a number that is between 0 and 1, the answer is

_______________ than the original number.

Michael cut a 9 m length of wire into $\frac{3}{4}$ m length pieces. Michael thought he would have 6 pieces. Explain why this answer could not be correct using your knowledge of operations and the context of the problem.

Practice Exercise 5

1. Mentally decide True or False for the following number sentences. Justify your answer using your knowledge of properties of numbers and estimation.

a) $\frac{2}{3} + \frac{1}{2} = 1\frac{1}{6}$

b) $3.3 \times 4 = 1.32$

c) $2.25 \div 0.4 = 5.625$

d) $0.5 \times 0.2 = 1.0$

e) $3\frac{3}{4} \div \frac{1}{4} = 15$

f) $5 - 0.45 = 5.45$

2. ' > 1' means greater than 1, '< 1' means less than 1. Use your mental strategies, and knowledge of properties of numbers and estimation to circle the correct response:

a) $3\frac{3}{4} - 2\frac{1}{8}$ > 1 or < 1

b) $4.1 \div 12$ > 1 or < 1

c) 2.2×0.2 > 1 or < 1

d) $4.2 \div 0.2$ > 1 or < 1

e) $2\frac{1}{8} \div \frac{1}{8}$ > 1 or < 1

f) $0.42 + 0.59$ > 1 or < 1

3. Use properties of numbers, estimation strategies and the context of the problem to determine if the conclusions to the following situations are reasonable. Justify your answer.

a) Sarah, a dance student, needed $1\frac{7}{8}$ m of ribbon for her point shoes and $\frac{3}{7}$ m for her tap shoes. She did a mental calculation and estimated the length of ribbon to be $1\frac{10}{15}$. How did Sarah get this answer? Is it reasonable?

b) Ms Lucas, a kindergarten teacher at Butler PS, made 35 cupcakes to share between 22 students. She thought each student would get $1\frac{1}{2}$ cupcakes. How did Ms Lucas get this answer? Is it reasonable?

c) Magali bought 0.65 kg of cashews at $17.99/kg. She thought this would be roughly $27. How did Magali get this answer? Is it reasonable?

d) Mildred weighed 82.1 kg. Shirley told Mildred she weighed 17.87 kg less. Mildred estimated Shirley to weigh 64 kg. How did Mildred get this answer? Is it reasonable?

e) Max estimated the area of a 67.4 cm by 70.8 cm tile to be roughly 490 000 cm^2. How did Max make this calculation? Is it reasonable?

f) Paul chopped a $6\frac{2}{3}$ m piece of wood into $\frac{1}{3}$ m pieces. He estimated he would have 20 pieces. How did Paul make this calculation? Is it reasonable?

Reflection on Learning 1

1. Working with a partner, draw a large number line from 0 to 4. Decide and mark an appropriate scale on the number line using either fractions or decimals. Randomly place points A, B, C and D between 0 and 4.

Estimate what numbers A, B, C, and D could represent:

A: B: C: D:

Work out the approximate solutions to:

a) A + B

b) D – A

c) B × D

d) D ÷ A

e) B + C + D

f) $\frac{1}{3}$ + B

g) 4 ÷ C

h) 0.5 of A

i) $\frac{3}{4}$ × D

j) (D + C) × 0.3

What strategies did you use to complete this task?

Reflection on Learning 2

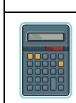
Solve the following problems using the decision making table below.

1. Michael was building a playhouse for his two small children. He got some wooden posts from the salvage yard to build the rectangular frame for the cement pad for the floor of the playhouse. They were lengths of $2\frac{3}{7}$ m, $1\frac{5}{9}$ m, $2\frac{7}{8}$ m and $2\frac{1}{4}$ m. He needed 9 m of post. Did he have enough?

2. Michael cut a 7.47 m piece of recycled galvanized iron roofing into sheets of length 1.48 m. How many pieces would Michael have?

3. Michael bought 3 bags of cement for the pad of the playhouse at $7.47 per bag. How much change would he get from $50.

4. From the $2\frac{3}{7}$ m wooden support post, Michael cut off $1\frac{5}{8}$ m. Would he have at least $\frac{3}{4}$ m of post left over for another job?

EXACT OR APPROXIMATE CALCULATION?	MENTAL OR CALCULATOR?		WHICH OPERATION? EXACT NUMBER SENTENCE AND ROUNDED NUMBER SENTENCE	STRATEGY AND SOLUTION	IS YOUR ANSWER REASONABLE? JUSTIFY.
1.					
					
2.					
					
3.					
					
4.					
					

OLNA Practice Questions

1. A recipe requires $1\frac{7}{8}$ cups of milk. Susan makes triple the recipe. Approximately, how many cups of milk does she use?

A. $\frac{1}{2}$ B. $3\frac{5}{8}$ C. $2\frac{3}{4}$ D. 6

2. Five pieces are cut from a 4.65 m length of timber. Each piece is 0.82 m long.

Which is the best approximation of the amount of timber left over?

A. 5 – (5 × 1) B. 5 – (5 × 0.8) C. 5 – 4.6 – 0.82 D. 4.7 – (5 × 0.9

Section Three

Percentages Linked with Fractions and Decimals

Content Focus

Mathematics Foundation	Australian Curriculum Link
3.2.1 Identify and describe the purpose of percentages in various texts and media from everyday life and work 3.2.2 Recognise that percentages are a special form of fraction used to represent a proportion, and that 100% denotes the 'whole' 3.2.3 Read, write, use and interpret common percentages; for example, 10%, 50%, 25%, 20% 3.2.4 Make connections between everyday fractions, decimals and percentages to interpret and compare quantities 3.2.5 Use the links between percentage, fractions and division to mentally solve simple percentage problems 3.2.6 Use the % button efficiently on a calculator to work out a percentage of a quantity 3.2.7 Use a spreadsheet to solve common percentage problems, such as bank interest 3.2.8 Determine whether an answer to a percentage problem is reasonable by using estimation and the context of the problem communicate solutions (oral and written), using language and symbols consistent with the context 3.2.9 Communicate solutions (oral and written), using language and symbols consistent with the context	ACMNA131 Make connections between equivalent fractions, decimals and percentages ACMNA132 Investigate and calculate percentage discounts of 10%, 25% and 50% on sale items, with and without digital technologies ACMNA157 Connect fractions, decimals and percentages and carry out simple conversions ACMNA158 Find percentages of quantities and express one quantity as a percentage of another, with and without digital technologies. ACMNA187 Solve problems involving the use of percentages, including percentage increases and decreases, with and without digital technologies ACMNA211Solve problems involving simple interest ACMNA229 Connect the compound interest formula to repeated applications of simple interest using appropriate digital technologies

Topic 1

Linking Percentages, Fractions and Decimals

Mathematics Discussion

Percentages, such as 25%, are numbers that we see often in our everyday life. We see them when shops discount an item by a percentage, when banks charge a percentage to lend money or when describing a sports player's scoring statistics.

A percentage is actually a special fraction with a denominator of 100. Percent (%) means out of 100. When you read or say 20%, it means 20 out of 100 or $\frac{20}{100}$ or 0.20.

Percentages, fractions and decimals are three different ways we use to write the same number.

As equivalent percentages, fractions and decimals represent exactly the same number, they can all be placed in the same position on a number line. For example, 0.4, $\frac{2}{5}$ and 40% all sit in exactly the same place, between 0 and 1 and just below 0.5 on a number line. We can use our knowledge of converting between percentages, fractions and decimals and their placement on a number line to compare quantities. For example, when comparing which is larger, 55% or $\frac{1}{3}$, we can convert them both to decimals or percentages to compare, or place them in their correct position on a number line to see which number is furthest to the right.

It is important to be able to convert numbers to their percentage, fraction or decimal forms to assist us in calculating answers to problems involving these types of numbers.

Whole Class Activity 1

Think: Where do we see percentages used in everyday life?

Look at each of the pictures and statements below and label how the percentage has been used in each situation

<table>
<tr><th>Example of Percentage</th><th>Describe how the percentage is being used.</th></tr>
<tr><td>

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ANZ Progress Saver

Interest rates

Amount	Base Rate	Bonus Rate	Total
$1 - $499	0.01% p.a.	2.70% p.a.	2.71% p.a.
$500 - $2,999	0.01% p.a.	2.70% p.a.	2.71% p.a.
$3,000-$4,999	0.01% p.a.	2.70% p.a.	2.71% p.a.
$5,000-$9,999	0.01% p.a.	2.70% p.a.	2.71% p.a.
$10,000-$19,999	0.01% p.a.	2.70% p.a.	2.71% p.a.

</td><td></td></tr>
</table>

Where have you seen or heard of percentages being used? Find examples in newspapers, magazines, the media and online. Staple your list and examples to the side of this page. Share with another student. Record their additional examples that you did not have.

How are the examples you found similar to any of the percentage examples shown in the table above?

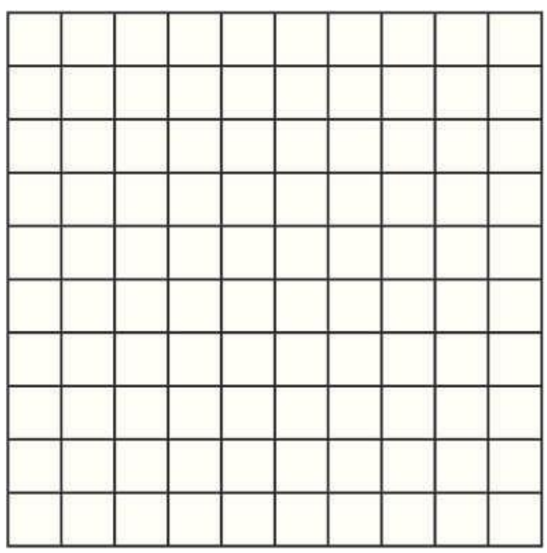
How are the examples you found different to any of the percentage examples above?

Whole Class Activity 2

Think: How are fractions and percentages linked?

A part of a whole can be expressed as both a fraction and also as a percentage. A percentage is a fraction with a denominator of 100. For example, the fraction $\frac{75}{100}$ can also be written as 75%. A ppercentage describes the number of parts in each hundred.

This whole square has been partitioned into smaller squares. How many squares make up the whole?



Colour the square according to the following rules.

$\frac{25}{100}$ red	= 25%	$\frac{10}{100}$ green	=
$\frac{50}{100}$ blue	=	$\frac{1}{100}$ black	=

What fraction of the whole square is shaded? What percentage of the whole square is shaded?

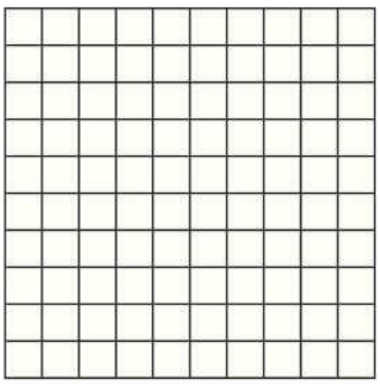
What fraction of the whole square is unshaded? What percentage of the whole square is unshaded?

What percentage is the whole square?

Practice Exercise 1

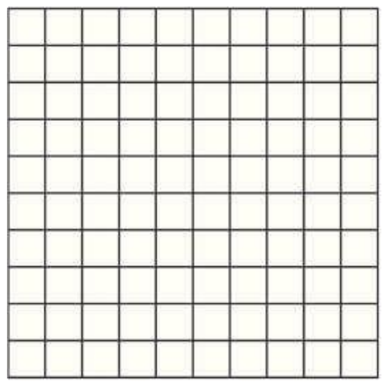
1. Colour each grid below to match the fraction or percentage.

a)



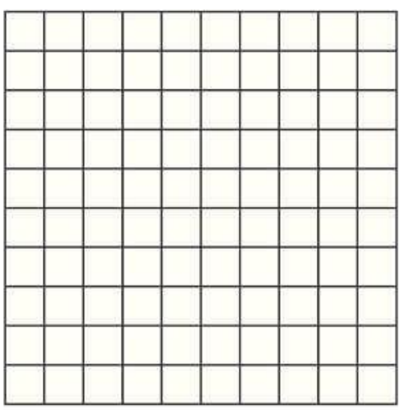
80%

e)



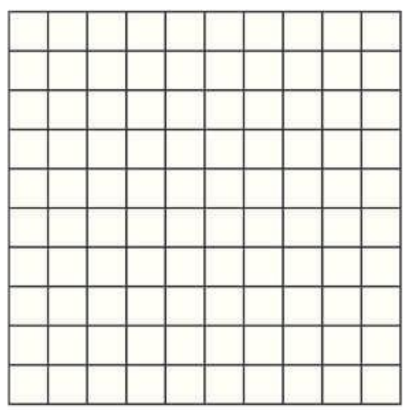
$\frac{35}{100}$

b)



15%

f)



$\frac{3}{100}$

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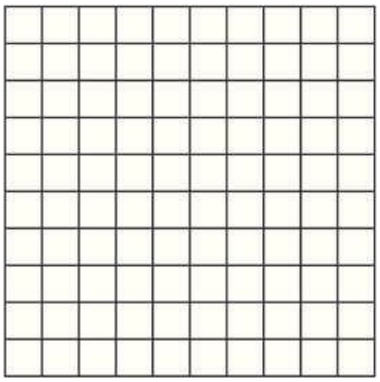
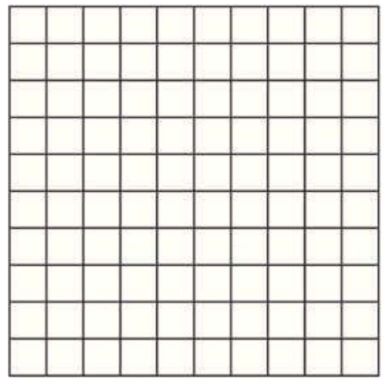
c)



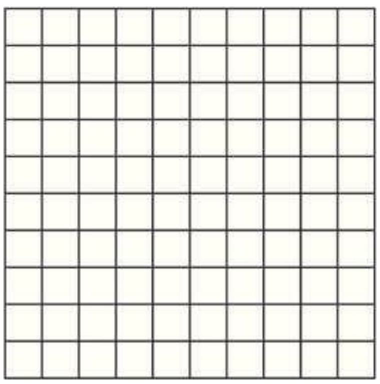
33%

g)



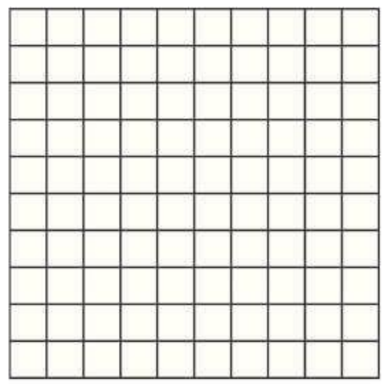
$\frac{17}{100}$

d)



12%

h)



$\frac{92}{100}$

2. Convert each fraction to a percentage.

a) $\frac{12}{100}$ = %

b) $\frac{9}{100}$ = %

c) $\frac{45}{100}$ = %

d) $\frac{91}{100}$ = %

e) $\frac{66}{100}$ = %

f) $\frac{1}{100}$ = %

g) $\frac{51}{100}$ = %

h) $\frac{97}{100}$ = %

3. Convert each percentage to a fraction with a denominator of 100.

a) 10%

b) 23%

c) 1%

d) 50%

e) 75%

f) 62%

g) 5%

h) 38%

Whole Class Activity 3

Think: How do you change a fraction that does not have a denominator of 100 to a percentage?

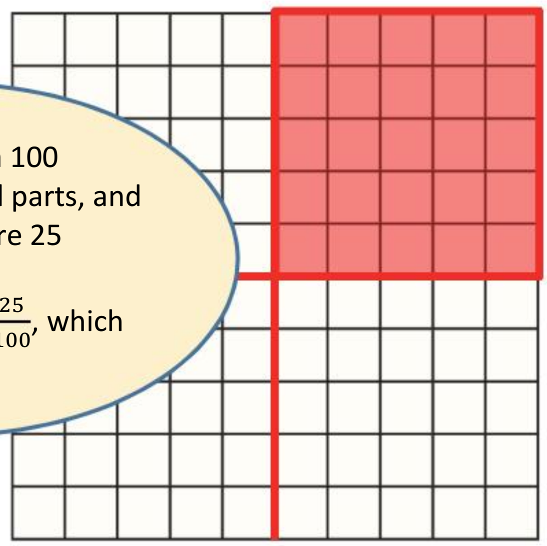
Fractional amounts can be converted to percentages using our knowledge of equivalent fractions.

Alice and Jenna used different strategies to convert $\frac{1}{4}$ to an equivalent fraction with a denominator of 100, in order to work out the percentage.

Alice used a whole square partitioned into 100. She divided the whole square into four parts. She then shaded one of the quarters and found it had 25 squares out of the 100.

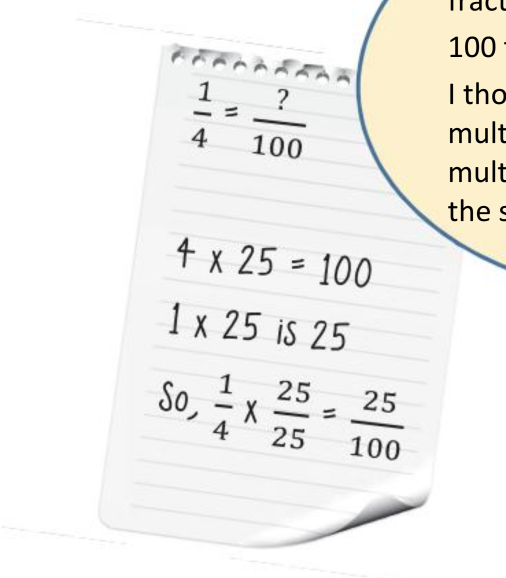
So, she knew that $\frac{1}{4}$ was the same as 25 %.

I can evenly divide a 100 squares into 4 equal parts, and in each part there are 25 squares.
As a fraction this is $\frac{25}{100}$, which is equal to 25%



Jenna worked with numbers alone. She used her knowledge of equivalent fractions to find a fraction with a denominator of 100. Jenna knew she could multiply the numerator and denominator of $\frac{1}{4}$ by the same number to work out the equivalent fraction. She worked out that $\frac{1}{4}$ is 25%.

She wrote:



I needed to work out the fraction with a denominator of 100 that is equal to $\frac{1}{4}$.
I thought about what to multiply 4 by to get 100. I then multiplied the numerator by the same amount.

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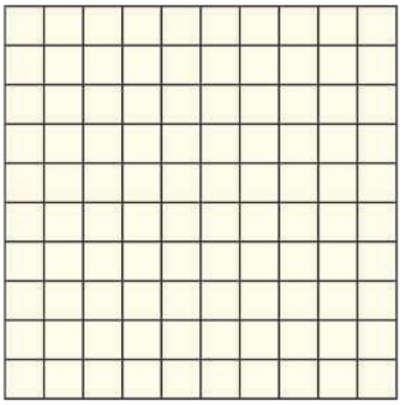
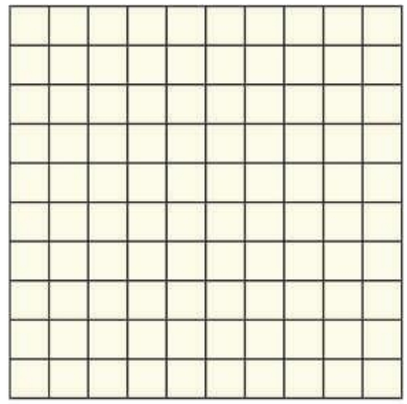
Practice Exercise 2

1. Use Alice's method of using a 100 grid to convert each fraction to an equivalent fraction with a denominator of 100.

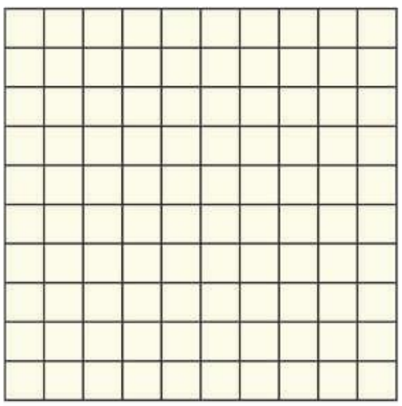
a) $\frac{1}{2} = \frac{}{100}$



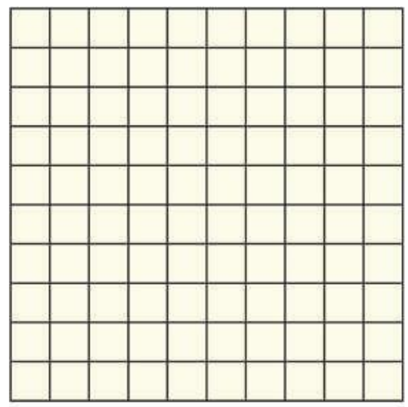
c) $\frac{1}{20} = \frac{}{100}$



b) $\frac{1}{5} = \frac{}{100}$



d) $\frac{1}{10} = \frac{}{100}$



2. Use Jenna's method of using knowledge of equivalence to convert each fraction to an equivalent fraction with a denominator of 100.

a) $\frac{3}{4} \quad = \quad \frac{}{100}$

c $\frac{6}{20} \quad = \quad \frac{}{100}$

b) $\frac{5}{10} \quad = \quad \frac{}{100}$

d) $\frac{4}{25} \quad = \quad \frac{}{100}$

3. Convert these fractions to fractions with a denominator of 100 and then write each as a percentage.

a) $\frac{1}{2} \quad = \quad \frac{}{100} \quad = \quad \%$

d) $\frac{8}{20} \quad = \quad \frac{}{100} \quad = \quad \%$

b) $\frac{2}{5} \quad = \quad \frac{}{100} \quad = \quad \%$

e) $\frac{10}{25} \quad = \quad \frac{}{100} \quad = \quad \%$

c) $\frac{3}{10} \quad = \quad \frac{}{100} \quad = \quad \%$

f) $\frac{3}{25} \quad = \quad \frac{}{100} \quad = \quad \%$

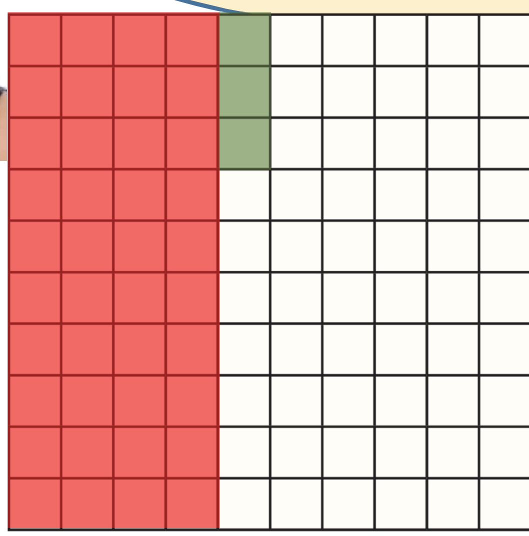
Whole Class Activity 4

Think: How are decimals and percentages linked?

We use our knowledge of tenths and hundredths to make the link between decimals and percentages.

Alice visualises tenths and hundredths on a 100 grid. To work out what 0.43 is as a fraction and a percentage she visualises how many squares would be shaded.

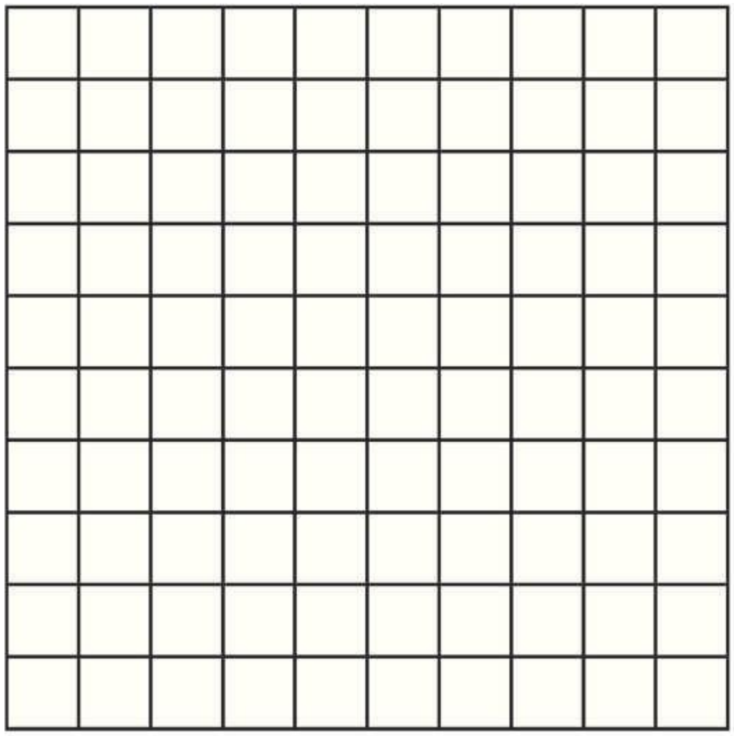
0.43 means 4 tenths and 3 hundredths.
If I write this as a fraction it is $\frac{43}{100}$.
This means I would shade 40 squares for the tenths and 3 squares for the hundredths.
$\frac{43}{100}$ is the same as 43%.



Alice can see that 0.43 = $\frac{43}{100}$ = 43%.

Write all the fraction, decimal and percentage equivalences for 0.57, 69% and $\frac{89}{100}$.

This one whole square has been partitioned into 100 parts.



Colour the square according to the following rules. Write each decimal as a fraction and a percentage.

0.15 red = $\frac{15}{100}$ = 15%

0.4 blue = =

0.33 green = =

0.04 black = =

What decimal amount of the whole square is shaded? What decimal amount of the whole square is unshaded?

What fraction of the whole square is shaded? What percentage of the whole square is unshaded?

Convert these decimals to a fraction with a denominator of 100, then write as a percentage.

0.4	0.95	0.07
0.23	0.1	0.09

Practice Exercise 3

1. Colour each grid below to show the decimal or percentage amounts. Write the equivalent decimal or percentage for each.

a) 0.3 = %	d) 0.06 = %	g) 55% =
b) 0.85 = %	e) 43% =	h) 9% =
c) 0.62 = %	f) 5% =	Create your own

2. Convert each decimal to a percentage.

a) 0.1 = %

b) 0.5 = %

c) 0.65 = %

d) 0.92 = %

e) 0.03 = %

f) 0.29 = %

g) 0.09 = %

h) 2.79 = %

3. Convert each percentage to a decimal.

a) 10%

b) 23%

c) 1%

d) 75%

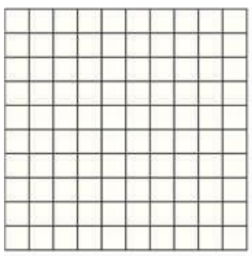
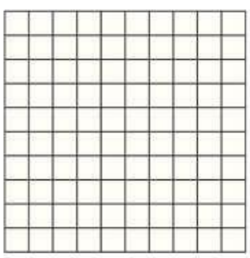
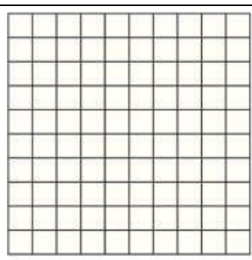
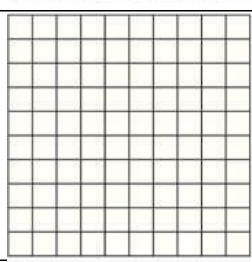
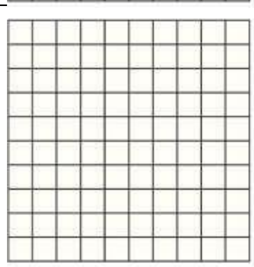
e) 50%

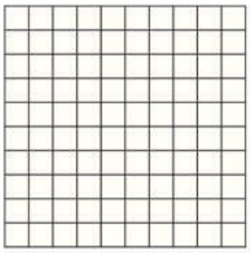
f) 25%

g) 82%

h) 123%

4. Complete the blank spaces on the table.

Grid	Fraction	Decimal	Percentage
a) 	$\frac{55}{100}$		
b) 			5%
c) 		0.13	
d) 	$\frac{4}{5}$		
e) 		0.6	

f) 			75%

Reflection and Discussion

Sometimes a fraction, decimal or percentage number might describe an amount that is more than one whole or greater than 100%.

Which numbers are describing an amount that is more than one whole?

99% 110% $\frac{150}{100}$ 0.33 2.5 $\frac{13}{100}$

How do you know they are greater than one whole?

In what situations is a fraction, decimal or percentage greater than one whole, used in everyday life?

Whole Class Activity 5

Think: Where do fractions, decimals and percentages go on a number line?

Hang a piece of string across the classroom and peg up two cards; the first labelled 0 and the other 1, at either end of the string.

Write 100%, $\frac{1}{100}$, 0.5, 50%, $\frac{1}{5}$, 25% and $\frac{20}{100}$ onto cards. Discuss where they belong on the line and peg them up. Equivalent numbers can be pegged under each other.

Each pair of students selects a number from the list below, writes it onto a piece of card and decides where on the string it should go and the reason for its position.

0.4	0.87	0.06	72%	5%
11%	$\frac{2}{100}$	$\frac{25}{100}$	$\frac{3}{4}$	$\frac{80}{100}$

Where does your number belong on the number line? Justify.

Write an equivalent percentage, decimal or fraction for the number you have chosen.

What strategies were your classmates using to decide where the numbers belong?

Which numbers were the easiest to visualise where they belong on the string? Why?

Which numbers were the most difficult to visualise where they belong in the string? Why?

Practice Exercise 4

1. Electronic devices display the amount of power left in the battery using a battery icon. On each battery icon colour the amount shown by the percentage. Write an equivalent decimal or fraction. The last two examples require you to examine the power displays in some devices.

Shade the battery	Percentage	Equivalent fraction and decimal
a)	10%	
b)	100%	
c)	50%	
d)	35%	
e)	The percentage your device is on now. %	
f)	The percentage your friend's device is on now. %	

g) Why doesn't the percentage ever go over 100%?

2. Place each set of numbers on the number line.

a) 0.09, 90%, $\frac{9}{100}$, 19%

b) $\frac{1}{4}$, 30%, 0.4, 45%

c) 0.88, $\frac{8}{100}$, 8%, 38%

d) 1%, 10%, $\frac{5}{100}$, 0.5

e) 32%, 0.3, $\frac{23}{100}$, $\frac{1}{5}$

f) 0.42, $\frac{4}{100}$, 44%, $\frac{14}{100}$,

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3. ***Fraction, Decimal, Percentage Go Fish***

Number of Players: 2 - 4

Aim: Players have to find all three equivalent numbers to make a set of equivalent decimal, percentage and fraction cards. The player with the most sets wins.

Equipment: Make a set of playing cards with equivalent fractions, decimals and percentages.

Rules of the Game:

1. Each player is dealt 5 cards. The remaining cards are placed in the centre.

2. Players take turns to ask for a card they need to complete their set of 3 fraction, decimal and percentage equivalences

3. If the person being asked does not have the card asked for, then the player asking has to pick a card from the centre pile.

4. Play continues until a player runs out of cards in their hand.

0.5	50%	$\frac{1}{2}$	0.25	25%	$\frac{1}{4}$
0.1	10%	$\frac{10}{100}$	0.01	1%	$\frac{1}{100}$
0.75	75%	$\frac{75}{100}$	0.2	20%	$\frac{20}{100}$
0.01	1%	$\frac{1}{100}$	0.05	5%	$\frac{5}{100}$
0.15	15%	$\frac{15}{100}$	0.3	30%	$\frac{30}{100}$
0.62	62%	$\frac{62}{100}$	0.88	88%	$\frac{88}{100}$
0.56	56%	$\frac{56}{100}$	0.65	65%	$\frac{65}{100}$
1	100%	$\frac{100}{100}$	0.02	2%	$\frac{2}{100}$
1.5	150%	$\frac{150}{100}$	0.98	98%	$\frac{98}{100}$
0.89	89%	$\frac{89}{100}$	0.33	33%	$\frac{33}{100}$

Reflection on Learning 1

Tarsia Puzzle.

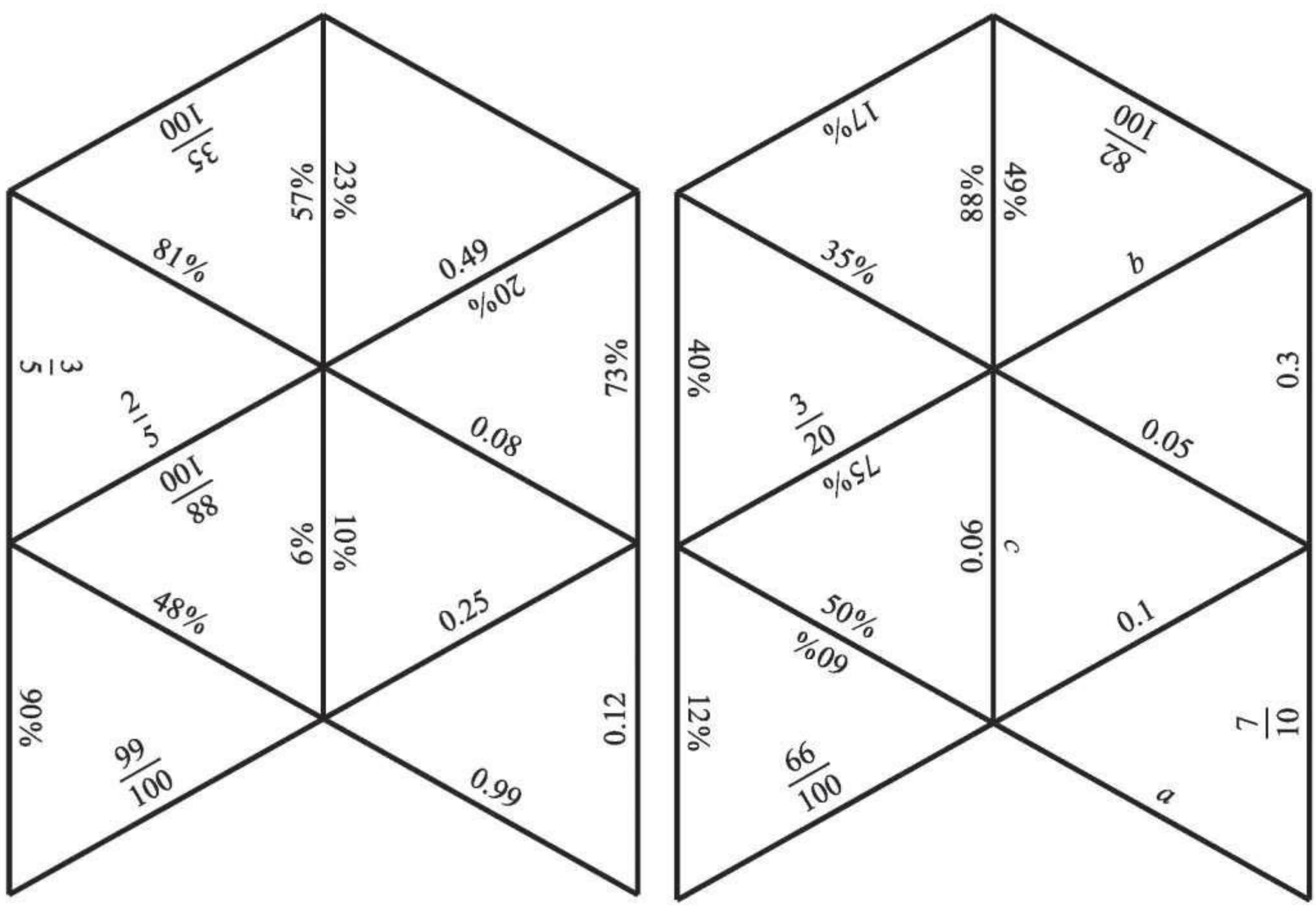
Copy the puzzle pieces below. Cut along the black lines to form 24 triangles.

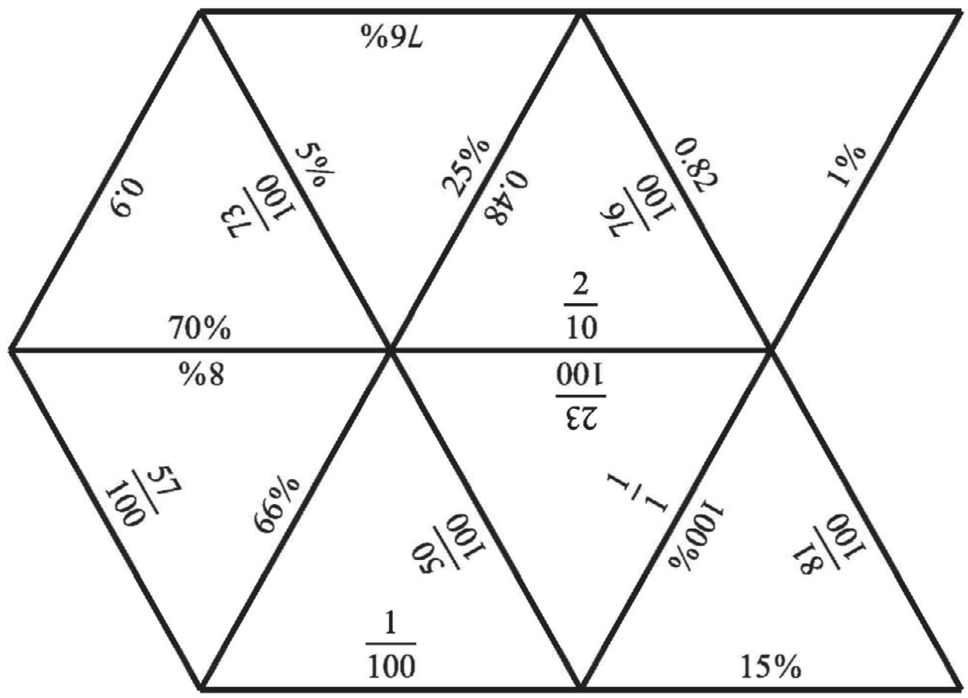
To complete the puzzle, you must match the equivalent fractions, decimals and percentages.

When you complete the puzzle, glue it onto a sheet of paper.

Three of the numbers are missing, they are labelled with the letters a, b and c. Work these out and record below.

a) b) c)





Reflection on Learning 2

Complete the table showing fractions, decimals and percentage equivalents.

	Fraction	Decimal	Percentage
a)	$\frac{1}{2}$		
b)	$\frac{1}{4}$		
c)	$\frac{2}{4}$		
d)	$\frac{3}{4}$		
e)	$\frac{1}{5}$		
f)	$\frac{2}{5}$		
g)	$\frac{3}{5}$		
h)	$\frac{4}{5}$		
i)	$\frac{1}{10}$		
j)	$\frac{1}{100}$		

Reflection on Learning 3

Refer back to your collection of percentage examples from Whole Class Activity 1. Choose 5 percentage numbers and write an equivalent fraction and decimal for each.

Percentage	Fraction	Decimal

OLNA Practice Questions

1. Which glass is 25% filled?

A B C D

2. Select the fraction that is equivalent to 7%

A. $\frac{70}{100}$ B. $\frac{1}{7}$ C. $\frac{7}{10}$ D. $\frac{7}{100}$

3. Which set is equivalent to 0.15?

A. $\frac{15}{100}$ and 15% B. 15% and $\frac{5}{20}$ C. 150% and $\frac{1}{5}$ D. 1.5% and $\frac{15}{100}$

Topic 2

Calculating Percentages Mentally

Mathematics Discussion

To calculate a percentage problem mentally, we can use one of two ways:

1. Change the percentage to its equivalent fraction. For example,
    - to work out a 25% discount on a $80 jacket we can think of 25% as its common equivalent fraction of $\frac{1}{4}$. We can then find $\frac{1}{4}$ of $80, which is $20 discount.
    - sixteen out of 25 people agreed to volunteer for a beach clean-up. To calculate this as a percentage we use the equivalent fraction with a numerator of 100. 4 times 25 is 100, so therefore, $\frac{16}{25} = \frac{64}{100}$ or 64 % of the group volunteered.
2. Break up the percentage into parts, in the same way we do with whole numbers, and calculate the parts. For example,
    - to calculate 40% discount on a $300 chair we can break up 40% into 4 groups of 10%. 10% of $300 is $30, so 40% is $30 + $30 + $30+ $30 = $120 discount.
    - break up 3% into groups of 1% to calculate a 3% salary increase on a weekly wage of $550. 1% of $550 is $5.50 so 3% is $5.50 + $5.50 + $5.50 = $16.50 extra/week.

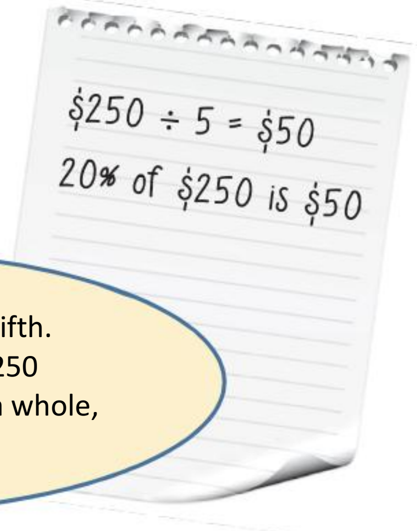
We use written jottings or diagrams to keep track of calculations that cannot be stored completely in our heads. For more difficult calculations we can use a calculator or a spreadsheet (see Topic Three).

Whole Class Activity 1

Think: How do you mentally calculate the percentage of an amount using common equivalent fractions?

Melva uses her knowledge of the relationship between common fractions and their percentage equivalents to work out the percentage of an amount.

Melva has just started work at a local art supplies shop. She wants to work out 20% of \$250 because this is how much she is hoping to save from each pay.



I know 20% is the same as one fifth. One fifth of 250 is the same as 250 divided by 5. So to find 20% of a whole, I divide it by 5.

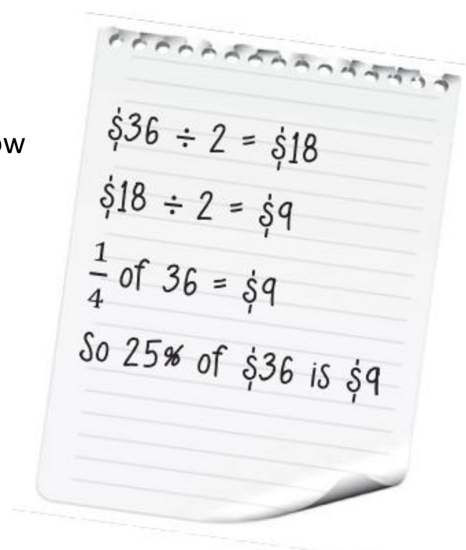
Use Melva's understanding of converting percentages to equivalent fractions to mentally calculate:

50% of \$1 426   25% of \$12.40   75% of 24 000 people   33.33% of 2 733 mm

Work with a partner to make a list of all percentages where it is helpful to know and use the equivalent fraction, in order to solve percentage problems.

Melva can now get a staff discount of 25% on her art supplies. She plans to buy a new canvas which costs \$36, and wants to know how much to take off the price and how much to pay.

To work out the amount of the discount, Melva does the following calculations:



I know 25% is the same as one quarter, so to divide by four, I halve the whole amount of $36, then halve again to work out what 25% of the whole is.

How will Melva calculate how much she will pay for the canvas? What is the new price of the canvas?

On her first day at work, Melva sells two sets of fluoro paint sets which are discounted by 33.33%. One set has an original price of $42 and the other $27.30. Calculate the new selling price each of the fluoro paint sets.

Why would Melva's shop be discounting the paint sets? List reasons why businesses discount their goods and services?

Practice Exercise 1

1. Use Melva's thinking to mentally solve the following problems.

a) 50% of 90

b) 25% of 120

c) 75% of 300

d) 20% of $150

e) 80% of 400 m

f) 33.33% of 330 km

2. Melva buys all her work clothing and equipment on sale. Using Melva's method, mentally calculate the discount she will get for each of her work expenses. Use jottings to help.

a) 50% off a pair of $72 work shoes

b) 25% off a pair of black pants $48

c) 33.33% off toiletries costing $63

d) 75% concession discount on $40 public transport costs

e) 20% discount on buying a $400 laptop

f) 40% off an art apron costing $35

3. Calculate the new selling price of each of the items in question 2

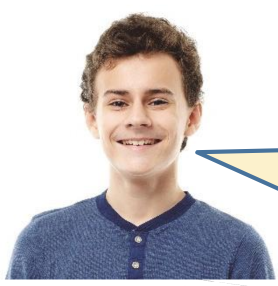
Whole Class Activity 2

Think: How do you mentally calculate a percentage of an amount by making a fraction with a denominator of 100?

Harry is reading the results of a survey taken at a newly opened local restaurant in the community newspaper.

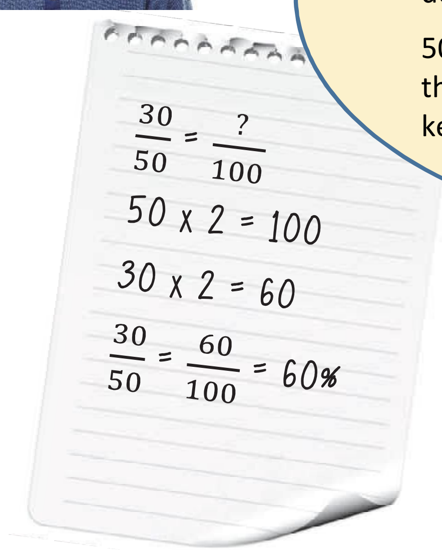
"Out of 50 people surveyed, 30 said they were satisfied with the service provided by the staff."

Harry wondered what percentage of people were satisfied with the service.



I use the survey information to make a fraction, $\frac{30}{50}$. Then I need to make an equivalent fraction that has 100 as the denominator.

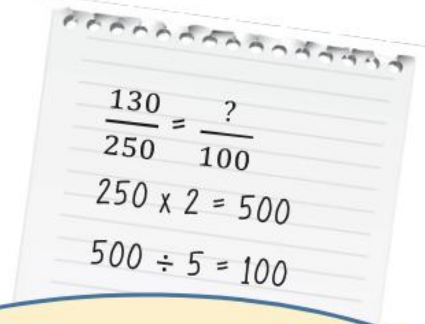
50 can be multiplied by 2 to make 100, and then I need to multiply the 30 by 2 also. This keeps the proportion the same.



16 out of 25 people surveyed at the new restaurant thought the food was "Excellent". What percentage is this? Use jottings to show how Harry would calculate the answer.

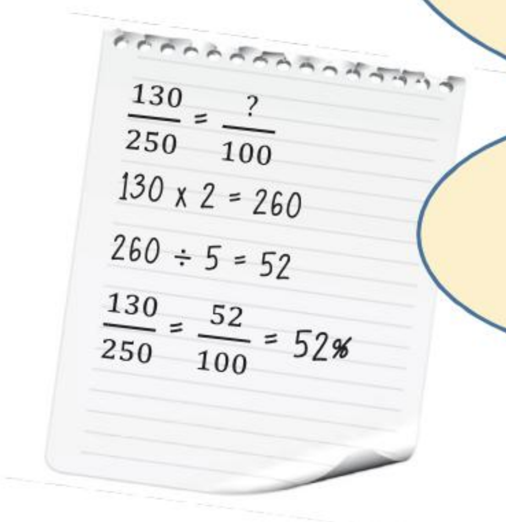
This method can also be used when the numbers involved are bigger than 100.

In another survey Harry read that of 250 people surveyed, 130 said they would like to change the school uniform at the town District High School. He wonders what percentage of people want the uniform changed.



I think about the survey numbers as a fraction, $\frac{130}{250}$. Then I make an equivalent fraction that has 100 as the denominator

250 can be multiplied by 2 to make 500, and then divided by 5 to make 100.



I then multiply and divide 130 in the same way.

65 out of 150 people surveyed thought the new school uniform should be blue. What percentage is this? Use jottings to show how Harry would calculate the answer.

30 out of 40 people thought the uniform should incorporate a tie. What percentage is this? Use jottings to show how Harry would calculate the answer?

Look at the survey question concerning the school tie. Can you mentally calculate the answer to this problem using a method other than Harry's. Explain your thinking.

Practice Exercise 2

1. Use Harry's thinking to mentally calculate each amount as a percentage. You may wish to use jottings as well.

a) $\frac{17}{50} = \frac{\quad}{100} =$ %

b) $\frac{120}{250} = \frac{\quad}{100} =$ %

c) $\frac{250}{500} = \frac{\quad}{100} =$ %

d) $\frac{33}{150} = \frac{\quad}{100} =$ %

e) $\frac{70}{200} = \frac{\quad}{100} =$ %

f) $\frac{210}{350} = \frac{\quad}{100} =$ %

2. Use Harry's method to work out the following percentage situations. Show your thinking.

a) The year eleven students surveyed 200 students about whether they ate lunch each day and 54 responded with the answer yes. What percentage of students eat lunch every day?

b) A local phone poll revealed that 320 people out of 500 said they would like a different prime minister. What percentage of people would like a new prime minister?

c) Of the 450 people that attended the function, 225 ordered chicken. What percentage of people ordered chicken?

d) There are 150 students in year 11 and 12 at Ocean Rise High School. 90 of the students are girls. What percentage of the students are boys?

e) Terri scored 90 out of 125 on her English test. What percentage did she score?

f) Out of the 250 students who attend Rawlinson High School, 75 can speak a second language. What percentage of the students can speak another language?

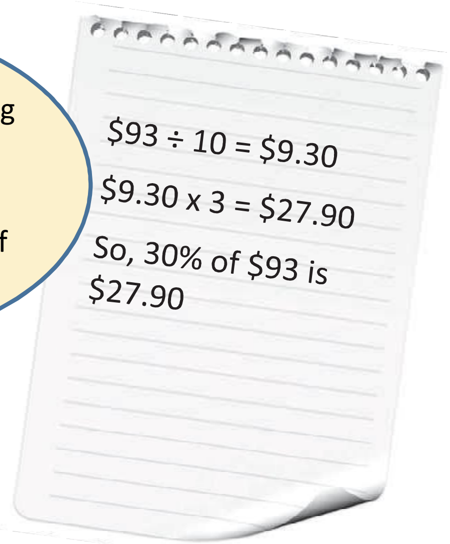
Whole Class Activity 3

Think: How do you work out the percentage of an amount by first finding the value of 10%?

Nancy knows that in some percentage problems, she can work out the percentage of a total amount by first finding the value of 10% of the total. Breaking percentage amounts into groups of 10% can be very useful.

Nancy makes 30% profit on all items she sells in her party plan business. She wants to know her earnings on a $93 sale.

I find 10% first, by dividing the $93 by ten because 10% is the same as $\frac{1}{10}$. I then multiply the value of 10% by 3 to find 30%.



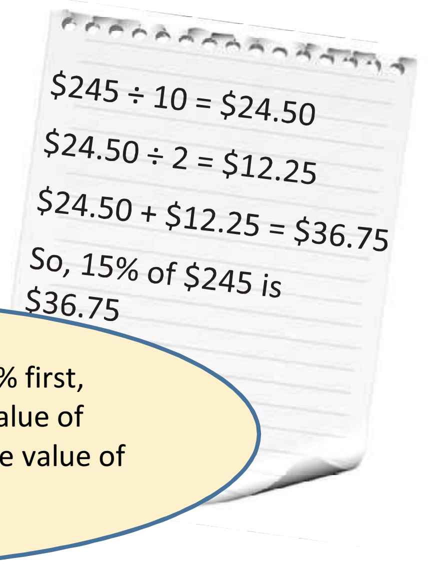
Use Nancy's method to find:

20% of 410 mm   60% of $32   40% of $1.50

How could Nancy use her understanding of finding 10% of an amount to find 90% of an amount? Record two different methods for calculating 90% of 50 products that Nancy sells in her business.

How could you use Nancy's method to calculate 110% of $900. Explain your thinking.

Nancy only makes 15% profit on the items she is offering for a discount. What profit will Nancy make if she sells $245 worth of discounted stock?



To work out 15% of $245, I find 10% first, which is $24.50. Then I halve the value of 10% to find the 5%. Finally I add the value of 10% and 5% together.

Use Nancy's method to find:

15% of 600 products | 35% of 5 000 milk cartons | 55% of 76 hours

Explain how you could use Nancy's method to mentally, or with jottings, find the new selling price of a $45 shirt that is to be discounted by 35%

Practice Exercise 3

1. Use Nancy's thinking to mentally calculate these amounts.

a) 5% of $840

b) 20% of 120 people

c) 15% of $80

d) 30% of $90

e) 35% of 80 sales

f) 110% of 300 people

2. Use Nancy's method to work out the following percentage problems. Show your thinking.

a) Nancy aims to increase her party bookings by 15% each year. If she had 40 bookings last year, how many more will she need this year?

b) Jarred has a $2 500 loan and needs to budget for the 5% interest charge. How much does he need to put aside?

c) Lucas made $12 000 profit in a year. With help, he believes he can increase that amount by 35%. How much total profit will that be?

d) Olivia is eligible for a 15% discount on her booklist this year. The booklist cost $230. How much will Olivia pay for her booklist?

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e) Kate paid $230 for her last water bill. A pipe sprung a leak causing the next bill to be 60% higher. How much will Kate be paying on the next water bill?

f) Finn had a wheat yield of 2 400 tonnes last year. This year he had a 20% decrease in yield. How many tonnes of wheat did Finn harvest this year?

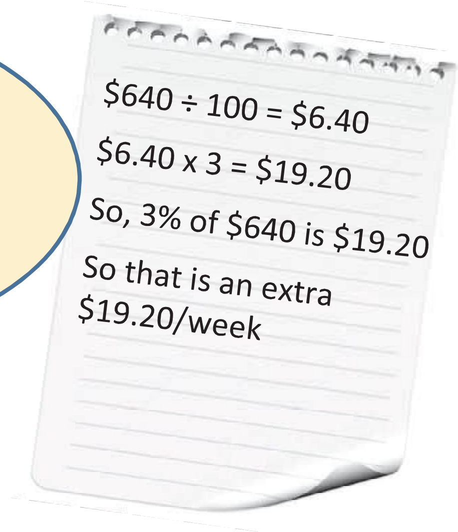
Whole Class Activity 4

Think: How do you work out the percentage of an amount by first finding the value of 1%?

Paddo knows that in some percentage problems, he can work out the percentage of a total amount by first finding the value of 1% of the total. Breaking percentage amounts into groups of 1% can be very useful, especially for working out percentages less than 10% and percentages close to 100%.

Paddo read that the Australian minimum wage of $640 per week was increasing by 3%. He wondered how much more money you would get each week with the new increase in the minimum wage.

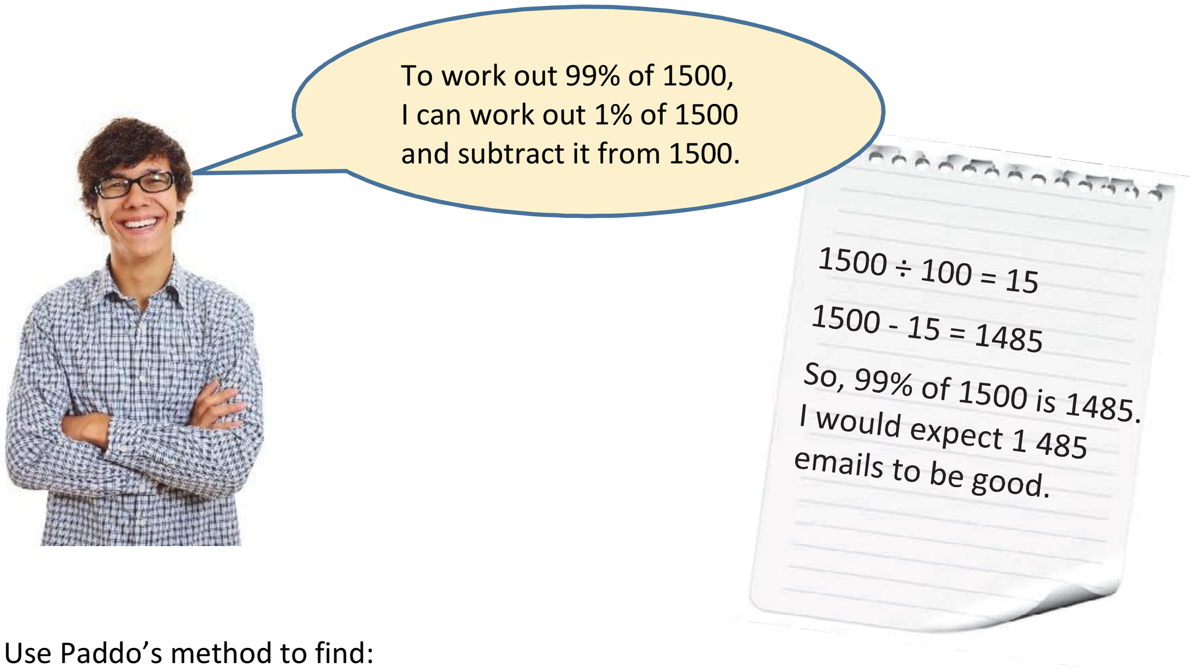
To work out 1%, I divide the $640 by 100 as 1% is $\frac{1}{100}$ and I get $6.40.
I then multiply the value of 1% by 3 to find the value of 3%.



Use Paddo's method to find:

2% of $200 | 4% of 340 days | 7% of 6 200 books

Paddo read that 99% of all emails are good and 1% of emails contain a virus. If Paddo receives 1 500 emails in a month, how many would you expect to be good?



Use Paddo's method to find:

99% of $12 000   98% of 420 years   97% of 600 DVD's

How could you use Paddo's method to work out 101% of $75? Explain your thinking.

Practice Exercise 4

1. Use Paddo's thinking to mentally solve the following problems. Use jottings to keep track.

a) 2% of $400

b) 8% of $15 000

c) 3% of $120

d) 99% of $1 600

e) 98% of 380 minutes

f) 101% of 800 km

2. Use Paddo's thinking to solve the percentage problems below. Show your thinking.

a) A $320 mobile phone is discounted by 2%. How much is the discount?

b) Johnathon earns $425 per week. If he gets a 4% raise, how much will he now earn?

c) Jenny sold $4 100 worth of products last month. This month her sales have increased by 3%. How much did she sell this month?

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d) The news said there had been a 7% increase in the amount of burglaries and that last year there had been 3 000 burglaries. How many burglaries has there been this year?

e) Saverio has a small catering company. Each month, Saverio estimates that 99% of all food purchased is used and the rest wasted. If he purchases $7 500 worth of food, how much is used?

f) The number of tourists that visited Northam during summer was 2 350. Out of that number, 98% of these tourists were from Perth. How many tourists were from Perth?

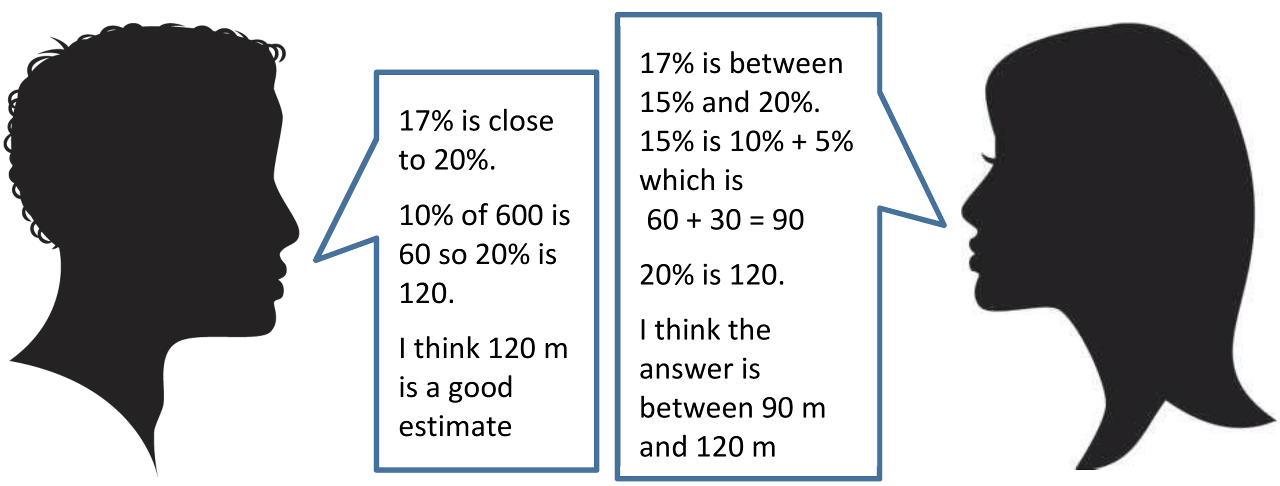
Whole Class Activity 5

Think: What estimation strategies can I use to calculate approximate answers to percentage problems? How can I use these strategies to check if an answer is reasonable?

When mentally calculating difficult percentage amounts, it is often useful to use rounding. When a percentage is near a tens number we can round up or down to the nearest 10% to estimate a solution. We can also round the amount that we are finding the percentage of, to estimate a solution.

In some situations we might choose to round up to a convenient percentage such as to the nearest 10% and think of that as our *upper limit*. We might also round down to a percentage that is easy to calculate and think of that as our *lower limit*. We can then use the *upper limit* and the *lower limit* percentages to estimate a solution.

Max and Tess were calculating 17% of 600 metres.



Who has the best estimate? Justify your answer.

Use a calculator to find the exact answer to 17% of 600 (check with your teacher or classmates about calculating percentages on a calculator, if you are unsure). How did the estimations compare to the exact answer?

Use Tess's strategy of rounding, and upper and lower limits, to estimate:

23% of $1 200 | 88% of 700 kg

Max wondered about estimating an answer to a problem like 22% of $68.80.Tess reminded him that this is actually a multiplication problem and that when estimating a multiplication problem, the most accurate estimation is found by rounding one number up and the other down. Use Tess's idea to calculate 22% of $68.80. Check your answer with a calculator. How close were you to the actual answer?

Describe two situations where using estimation strategies to solve percentage problems is helpful.

Max and Tess were calculating 38% of 800 mm. Max said the answer was 304 mm. Tess said the answer was 30.4 mm.

Whose response is reasonable? Justify your answer.

Practice Exercise 5

1. Use rounding to estimate the solutions to:

a) 21% of $40

b) 34% of 600 kg

c) 39% of 8 800 m

d) 72% of 197 cm

e) 87% of 1 287 flowers

f) 14% of 62 apples

2. Use upper and lower limits to estimate an answer to:

a) 16% of 40 mL

b) 74% of 24 minutes

c) 84% of $49.99

d) 32% of 19 netball players

e) 63% of $199.95

f) 42% of 2 480 hours

3. Read each student's estimate. Decide if their estimate is reasonable or unreasonable. Justify your choice. If the estimate is unreasonable, provide a reasonable estimate.

a) Tara estimates 4% of $250 is $10.

This estimate is reasonable unreasonable.

Justify:

What would be a more reasonable estimate?

b) Sann estimates 15% of 1500 is 200.

This estimate is reasonable unreasonable.

Justify:

What would be a more reasonable estimate?

c) Tristan estimates 63% of 500 people is 260 people.

This estimate is reasonable unreasonable.

Justify:

What would be a more reasonable estimate?

d) Tegan estimates 23% of 700 metres is 175 metres.

This estimate is reasonable unreasonable.

Justify:

What would be a more reasonable estimate?

Reflection on Learning 1

For each problem:

Circle the mental strategy you would use to find the answer. Solve and use jottings to show your thinking.

a) Out of 560 students at Sunmore Cummunity College, have been to Bali in the past year. How many students is this? COMMON FRACTIONS DENOMINATOR OF 100 FIND 10% FIND 1%
b) Henry scored 54 out of 150 on his Maths exam. What percentage did he score? COMMON FRACTIONS DENOMINATOR OF 100 FIND 10% FIND 1%
c) Jemima wants to buy a new camera that costs $540. The shop has a 30% off sale. What is the new cost of the camera? COMMON FRACTIONS DENOMINATOR OF 100 FIND 10% FIND 1%
d) Out of 20 people in the class, 25% passed the test. How many passed? COMMON FRACTIONS DENOMINATOR OF 100 FIND 10% FIND 1%
e) Last month the clothing store made a profit of $600. This month they experienced a 20% decrease in profits. How much profit did they make? COMMON FRACTIONS DENOMINATOR OF 100 FIND 10% FIND 1%

f) Out of all the people passing through customs at Perth airport, 99% had nothing to declare. If 4 000 people passed through customs, how many had nothing to declare?

COMMON FRACTIONS DENOMINATOR OF 100 FIND 10% FIND 1%

Reflection on Learning 2

a) Complete the following online activities.

http://www.scootle.edu.au/ec/viewing/L125/index.html

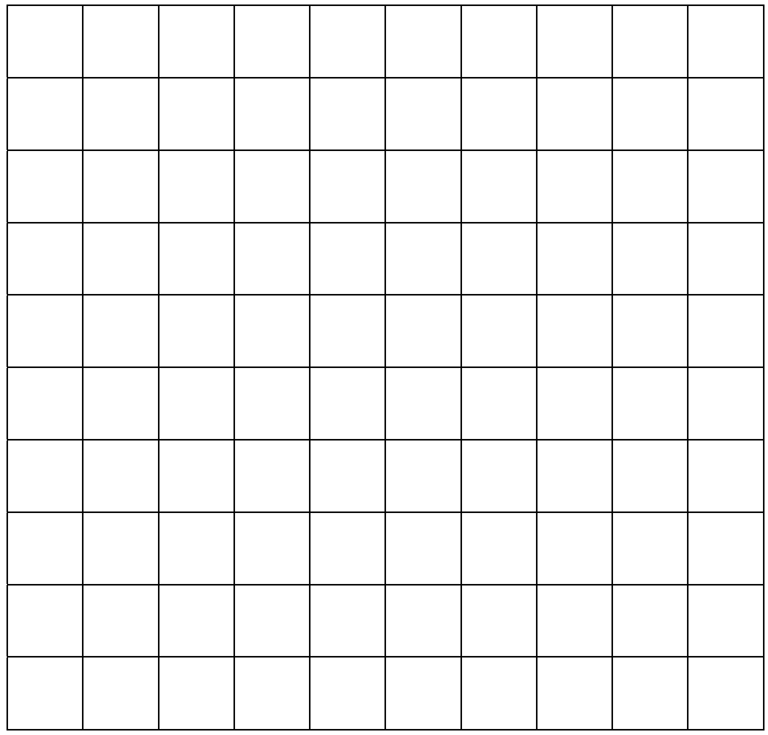
http://www.scootle.edu.au/ec/viewing/L9928/index.html

http://www.scootle.edu.au/ec/viewing/L9929/index.html

http://www.scootle.edu.au/ec/viewing/L9930/index.html

b) Use the grid below to plan a garden. Decide the percentage of each garden feature and plot on the grid. You may include any combination of paving, pool, grass, garden, pond, trees, sandpit and play area. Complete the table below showing each feature, its percentage amount and the number of squares needed to be coloured.

Colour	Feature	%	squares

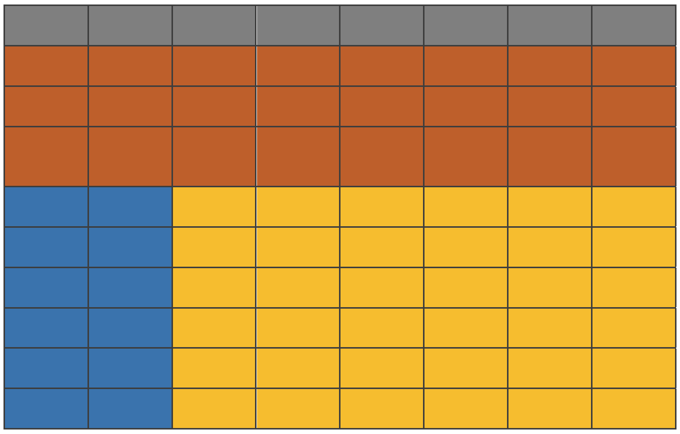


OLNA Practice Questions

1. What is the best estimate for the discount off the chair?

A. $90 B. $80 C. $100 D. $60

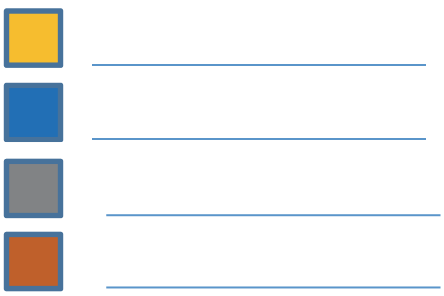
2. Gerry drew this plan of his back yard.



10% paving 15% vegetable patch

45% patio 30% grass

Label the key to Gerry's plan.



Topic 3

Calculating Percentages Using a Calculator or Spreadsheet

Mathematics Discussion

When solving everyday percentage problems, we need to decide to use a mental strategy with jottings, or use a digital resource such as a calculator, phone or spreadsheet. We then need to think of the problem as a number sentence in order to calculate the solution.

We tend to use a mental strategy to solve percentage problems when we can use a common fractional equivalent, can change our problem to having a denominator out of 100 or by being able to find 10% or 1% of the amount. These types of problems were discussed in the previous topic and include number sentences such as 20% x $600.

We tend to use a calculator or the calculator on our phone, when solving problems with 'difficult' numbers like 18% of $80.23. When we represent a percentage problem as a number sentence, we can choose between equivalent forms of numbers. As we learnt in Topic One, we can think of a percentage such as 18% as a fraction $\frac{18}{100}$ or as the decimal 0.18. To find 18% of $80.23, we can represent the problem in a way that makes calculating easier for us. For example, we might choose a number sentence such as 18 ÷ 100 x 80.23 or 0.18 x 80.23.

Sometimes problems involve a percentage increase of an amount. For example, you receive a 19% increase on a wage of $1 350. To find your new wage you could use your calculator to find 19% and add that amount to $1 350. However, you could use one operation and work out your new wage by calculating 119% of $1 350 or by multiplying $1 350 by 1.19.

Sometimes problems involve a percentage decrease, for example with discount sales. If there is a 12% discount on a $65 pair of shoes, you can use your calculator to find 12% and subtract that from $65 to work out the amount you will pay. Alternatively, you could find 88% of $65 or multiply $65 by 0.88 to find the price you will pay.

For problems involving a sequence of percentage calculations or a situation where we need to alter the numbers in the problem, we tend to use a spreadsheet. When we input a percentage into a spreadsheet formula, we can choose to use either the percentage symbol (e.g. =18%*80.23) or its decimal equivalent (e.g.=0.18*80.23).

In this topic, we will be focussing on choosing and using calculator or spreadsheet strategies, and deciding what to put into the calculator or spreadsheets in order to solve percentage problems.

Whole Class Activity 1

Think: How do I use a calculator to convert a fraction to a percentage?

These are the scores Lauren achieved on her maths assessments so far this semester.

$\frac{10}{17}$ $\quad\quad$ $\frac{33}{36}$ $\quad\quad$ $\frac{3}{4}$ $\quad\quad$ $\frac{15}{24}$

Lauren wants to know what each score is as a percentage, so she uses her calculator like this;

To convert a fraction like $\frac{10}{17}$ to a percentage I need to think:

What is $\frac{10}{17}$ *of 100?*

I can use my calculator and enter;

PART ÷ WHOLE x 100 =

So I enter;

10 ÷ 17 x 100 =

Use this method to convert each of Lauren's test scores to a percentage.

What is the part and what is the whole amount in each of the test scores above?

Why do we divide the part by the whole?

Why do we multiply by 100?

Which of the above examples is best converted to a percentage mentally? Explain how to convert this fraction to a percentage.

Some common fractions are difficult to mentally convert to a percentage. Use a calculator to convert each of the fractions below to a percentage.

Fraction	Calculator buttons pushed	Percentage
$\frac{1}{3}$		
$\frac{5}{6}$		
$1\frac{1}{6}$		
$2\frac{5}{8}$		

Why are these fractions difficult to convert mentally?

Practice Exercise 1

1. Convert each of these fractions to a percentage using a calculator. Record the buttons you pushed in the boxes below.

a) $\frac{3}{8}$ = %

b) $\frac{2}{3}$ = %

c) $\frac{17}{25}$ = %

d) $\frac{65}{98}$ = %

e) $1\frac{3}{7}$ = %

f) $\frac{211}{90}$ = %

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2. Convert each of these fractions to a percentage using mental or calculator strategies. Circle the strategy you used. Record any jottings you needed or keys typed into the calculator.

a) MENTAL or CALCULATOR $\frac{15}{50}$ = %	d) MENTAL or CALCULATOR $\frac{50}{95}$ = %
b) MENTAL or CALCULATOR $\frac{10}{20}$ = %	e) MENTAL or CALCULATOR $\frac{150}{200}$ = %
c) MENTAL or CALCULATOR $\frac{72}{43}$ = %	f) MENTAL or CALCULATOR $2\frac{4}{5}$ = %

3. Solve each of these problems using the most efficient strategy.

a) This year at the Geroford driver testing centre, 357 learners drivers have completed the test. Out of those, 284 of the learner drivers passed. What is the pass rate as a percentage?

b) Amy scored 148 points out of a possible 200 points on her cookery exam. What is her score as a percentage?

c) The school has 321 boys and 289 girls. What percentage of the student population is male?

d) Lauren plays basketball and so far this season has made 134 attempts from the free throw line. Out of those attempts 91 were successful. What is Lauren's free throw percentage?

e) Last year Henry earned $35 350 and spent $15 600 on rent. What percentage of Henry's income is spent on rent?

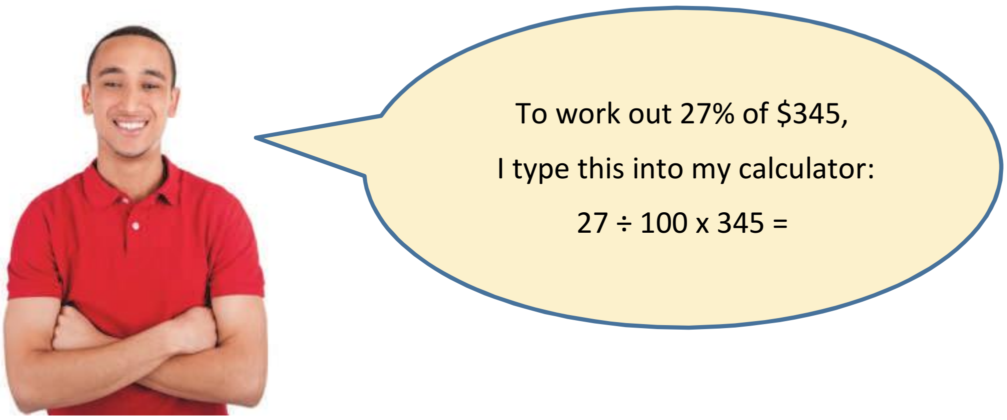
f) The football club quiz night was attended by 125 people. Out of those people, 27 won a prize. What percentage of people were prize winners?

Whole Class Activity 2

Think: How do we work out the percentage of an amount using a calculator?

PART A

Casey knows a few methods for working out percentage amounts on a calculator.

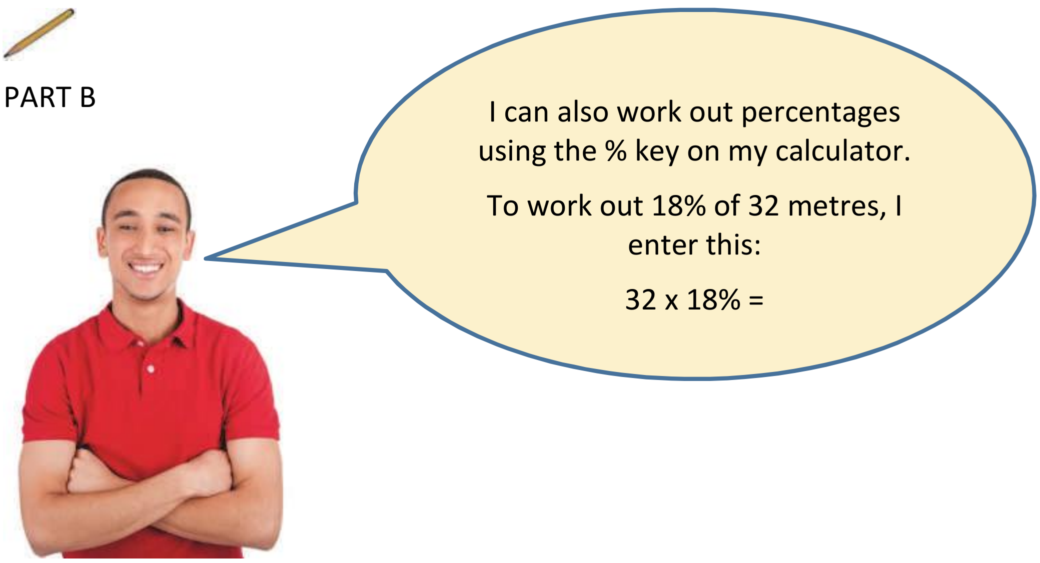


Why did he do 27 ÷ 100 first? Where does the 100 come from?

Why did he *multiply* by 345?

What is 27% of $345?

PART B



Why does he multiply the whole by the percentage amount?

What is 18% of $32?

Does your phone have a % button? Investigate how to calculate 18% of $32 using your phone. List the steps, in dot point form, of how to calculate 18% of $32 using this digital resource.

Practice Exercise 2

1. Use one of Casey's methods to work out each of these percentage amounts. Write the calculator or phone keys you typed in the boxes.

a) 3% of $940

b) 19% of 1 005

c) 38% of 392 kilometres

d) 61% of 120 litres

e) 84% of 700

f) 127% of 24 kilograms

2. Work out each of these percentage amounts using mental or calculator strategies.

Circle the strategy you used.

a) MENTAL or CALCULATOR 15% of $90	d) MENTAL or CALCULATOR 25% of $4 800

b) MENTAL or CALCULATOR 83% of $145. 50	e) MENTAL or CALCULATOR 6.2% of 8 200
c) MENTAL or CALCULATOR 20% of $215	f) MENTAL or CALCULATOR 118% of $12.40

3. Choose the most efficient strategy to solve the following problems.

a) Josh Kennedy, a West Coast footballer, scores goals from the 50 m arc at a conversion rate of 73%. If he had 116 shots from the 50 m arc, how many goals would you expect him to score?

b) Verity weighs 70 kg. She is hoping to lose 5% of her weight. How many kilograms is this?

c) About 31% of people have the A+ blood type. If there were 8 million people, how many of these would be expected to have A+ blood type?

d) The cash price for a zone 3 bus ticket is $4.95. A smart rider ticket gets a 15% discount. How much is the discount?

e) An audit has shown that 3% of all stockings produced at a factory have holes in them. If 27 500 000 pairs of stockings are produced by the factory in a given year, how many would you expect to have holes?

f) The government taxes you at a rate of 19% for every dollar over $18 200 that you earn in a job. How much tax would you pay if you earn:

(i) $21 000 (ii) $25 754

Whole Class Activity 3

Think: How can we use a calculator to work out a percentage decrease or increase of an amount?

Percentage Decrease

Form a trio, and assign a letter to each person.

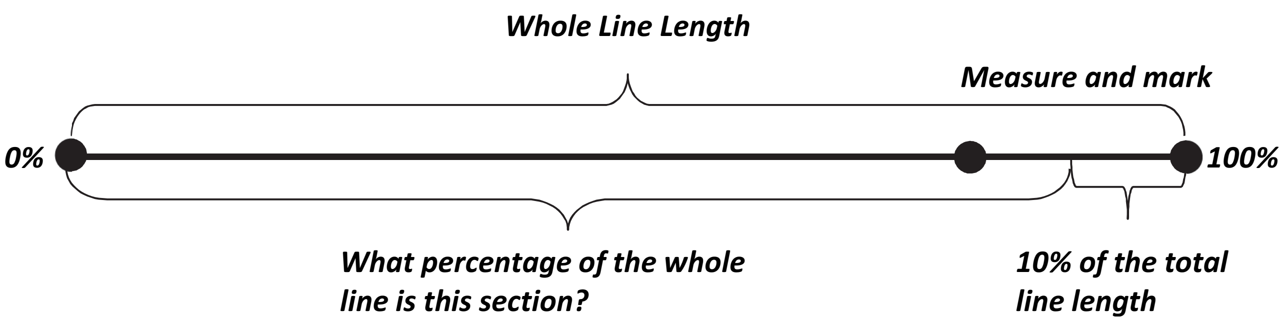
On a piece of paper, draw a line with the length that matches the letter you are assigned.

A: 150mm B: 210mm C: 90mm

Label the end of the line with 100%.

Mentally work out 10% of the whole line length.

Go to the 100% mark and, using your ruler, measure and mark where 10% of the total line length is from the end.



Measure from 0% to the mark you made. How long is this?

With your calculator type in ‘0.9 x original length = ‘.

What did you find out?

Why did multiplying the length of the whole line by 0.9 give you the length of the part between 0% and 90%?

If you are asked to reduce an amount by 10% what two methods could you use on your calculator to solve the problem? Share this with the other members of your trio. Write notes about the other team members findings.

Percentage Increase

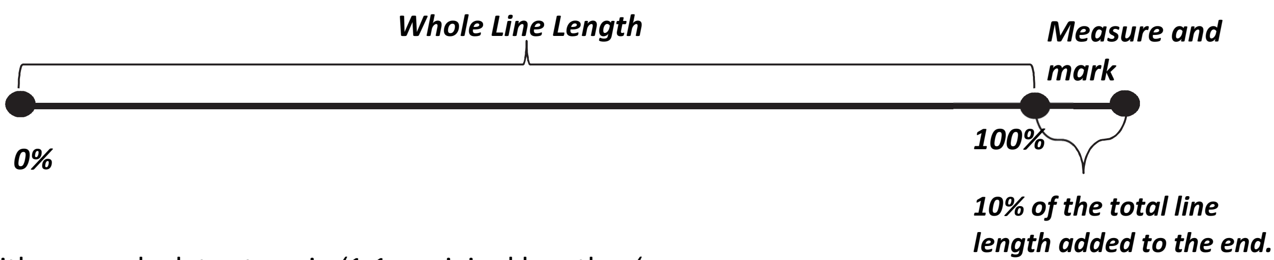
Draw another line the same length you used in the previous activity and mark 100%.

Work out 10% of the whole line length.

Add that amount to the end of the line where you marked the 100%.

What percentage of the whole line length is this?

Measure the new total length.



With your calculator type in ‘1.1 x original length = ‘.

What did you find out?

Why did multiplying the whole by 1.1 give you the length of the new line?

If you are asked to increase an amount by 10%, what two methods could you use on your calculator to solve the problem?

Share this with the other members of your trio. Write notes about the other team member’s findings.

Whole Class Activity 4

How do I solve everyday percentage decrease and increase problems?

PART A

There are a number of strategies, including those you learnt about in the previous Whole Class Activity, that you can use to solve percentage decrease problems. These strategies can be used to solve percentage decrease problems like working out discounts on sale items.

Lauren, Kayden and Casey were buying items in a sale where everything was reduced by a percentage. They wanted to work out what they would actually be paying for the items.

First, I work out the percentage discount and then subtract that amount from the original price. For a jumper priced $79 with a discount of 33%, I work out 33% of 79 and subtract that from the original price.

U se Lauren’s method to calculate how much you would pay on these sale price items:

25% off a $78.50 backpack

33% off a pair of $249 hiking boots

45% off a $329 waterproof jacket

When I work out a percentage discount with my calculator, I think about the percentage amount I **<u>will</u>** be paying. In a 33% off sale, I just multiply the price by 67%. That is the amount I will pay after the discount.

Use Kayden’s method to calculate how much you would pay on these sale price items:

25% off a $78.50 backpack

33 % off a pair of $249 hiking boots

45% off a $329 waterproof jacket

When I work out a percentage discount with my calculator, I think about the percentage amount I **<u>will</u>** be paying, as a decimal.
I just multiply the price by 0.67. That is the amount I will pay after the discount.

Why does multiplying the price by 0.67 give Casey the amount he pays?

Use Casey’s method to calculate how much you would pay on these sale price items:

25% off a $78.50 backpack

33 % off a pair of $249 hiking boots

45% off a $329 waterproof jacket

Which of the three methods do you think is the most efficient? Justify your answer.

PART B

There are a number of strategies, including those you learnt about in the previous Whole Class Activity, that you can use to solve percentage increase problems. These strategies can be used to work out increases in hourly work rates and the cost of paying additional taxes on advertised items on the internet.

For example, Lauren, Kayden and Casey were buying camping gear from a website that did not add 12% Goods and Services Tax (GST) to the displayed prices. They wanted to work out what they would actually be paying for each camping item.

To work out the total price of a camping torch priced at $24 with GST of 12%, I work out 12% of 24 and add it to $24.

Use Lauren's method to calculate how much you would pay on these items if 12% GST was added:

$345 tent

$19.95 water bottle

$54.50 camper chair

To work out a percentage increase, I think about the percentage amount I **<u>will</u>** be paying. I just multiply the price by 112%.

I would multiply a $24 torch by 112 % to get the price I will pay.

Use Kayden's method to calculate how much you would pay on these items if 12% GST was added:

$345 tent

$19.95 water bottle

$54.50 camper chair

When I work out a percentage increase I think about the percentage amount I **<u>will</u>** be paying. I just multiply the price by 1.12. I would multiply a $24 torch by 1.12 to get the price I will pay.

Use Casey's method to calculate how you would pay on these items if 12% GST was added:

$345 tent

$19.95 water bottle

$54.50 camper chair

Which of the three methods do you think is the most efficient? Justify your answer.

Practice Exercise 3

1. Match what you would enter into a calculator to the percentage you need to work out.

Add on 10%	multiply the whole by 0.09
Take off 25%	multiply the whole by 1.17
Find 36%	multiply the whole by 0.45
Add on 17%	multiply the whole by 0.75
Take off 55%	multiply the whole by 0.36
Find 9%	multiply the whole by 1.1

2. For each problem below:

- Say whether it is a percentage increase or decrease situation.
- Write what you would multiply the whole by to get the answer.
- Record the solution to the problem.

Problem	% decrease or increase	Multiply the whole by?	Solution
a) A \$300 television is on sale for 25% off. What is the sale price of the television?			
b) The profit of the burger van was \$1 200 at the end of March. The profit grew by 17% over the next three months. How much profit was made by the end of June?			
c) The 56 cm wheat plant grew 22% over the following week. How tall was it at the end of the week?			
d) On Wednesday 120 people visited the shop. There was a 14% drop in visitors on Thursday. How many people visited on Thursday?			
e) Ginny pays \$300 rent each week. This went up by 15%. How much is the new weekly rental amount?			
f) Minetown had a population of 12 000 people. The mine closed and the population number dropped by 65%. What is the new population of Minetown?			

3. Write the number sentence you would enter into a calculator to solve each problem. Calculate the answer.

a) My football club had 2 500 members last year. There was a 6.5% increase in membership this year. How many members are there now?

b) The tree was 2.88 metres tall when I planted it and then it grew in height by 75%. How tall is the tree now?

c) At the start of the school year Valley High had 560 students enrolled. During the year the number of students decreased by 13%. How many students were still enrolled at the end of the year?

d) The business made a profit of \$45 000 last year. This year the profit was down by 22%. How much profit was made this year?

e) The lake is 459 m^2 during summer and increases in area by 60% in winter. How big does the lake get?

f) The puppy was 3.45 kg when he came home. By the end of the year he had increased in size by 250%. How much did the puppy weigh at the end of the year?

Whole Class Activity 5

Think: When and how do I use a spreadsheet to work out percentage problems?

Melva wants to buy a scooter and needs to borrow some money from the bank. She has decided to borrow $3 000 and make repayments of $200 each month. Interest is calculated at 1% of the remaining loan amount (principal) each month.

USING A CALCULATOR

Melva sets up a table to work out her repayment schedule so she can see how much will still be owing after 12 months.

Melva knows each month the bank will calculate:

AMOUNT + INTEREST – REPAYMENT to calculate the amount she still owes at the end of the month. Melva wants to know how much she will owe at the end of 12 months.

Use a calculator to complete the table.

MELVA'S BANK LOAN

Month	Amount owing at start of month	Interest	Repayment	Amount owing at end of month
1	$3 000	$30	$200	$2830
2	$2830			

How much does Melva still owe after 12 months?

Is using a calculator the most efficient digital technology to use in solving this problem? Justify and explain your answer.

USING A SPREADSHEET

The scooter Melva was planning to buy sold, and she decided she could afford to spend a bit more.

Melva now wants to borrow $4 500 from a different bank with a slightly higher interest rate of 1.14% per month. Melva also decides to make a larger monthly repayment of $250.

Melva decides to calculate the new costs and balances of the loan using a spreadsheet instead of a calculator.

Open a new spreadsheet and enter the following title, headings and numbers for 12 months.

	A	B	C	D	E
1			MELVA'S BANK LOAN		
2	Month	Amount	Interest	Repayment	Amount owing at end of month
3	1				
4	2				

CARRY OUT THE FOLLOWING STEPS TO CREATE A SPREADSHEET:

a) Click in cell B3. Enter the amount Melva borrows.

b) Use a calculator to work out 1.14% of the amount in B3. Enter this number in cell C3.

c) Click in cell D3. Enter Melva's repayment. Highlight D3. Click on the black cross in the bottom right hand corner of cell D3 and scroll down until you reach cell D14. The column should be filled with 250 in each cell.

d) Circle the formula below, that you would enter in cell E3, to calculate how much Melva owes after one month?

A. B3+C3-250 B. =B3+C3+250 C. =B3+C3-250 D. =B3*C3/250

Type the formula you have chosen for E3 and press enter.

You should now see how much Melva owes after one month.

e) What formula would you enter in cell B4 so that the opening balance of the second month is the same as the closing balance of the first? Discuss with your classmates.

Type this formula in cell B4 and press enter

f) Circle the formula you would enter in cell C4 to calculate the interest for the second month.

A. =B4/1.14% B. B4*0.0114 C. =A4*0.0114 D. =B4*0.0114

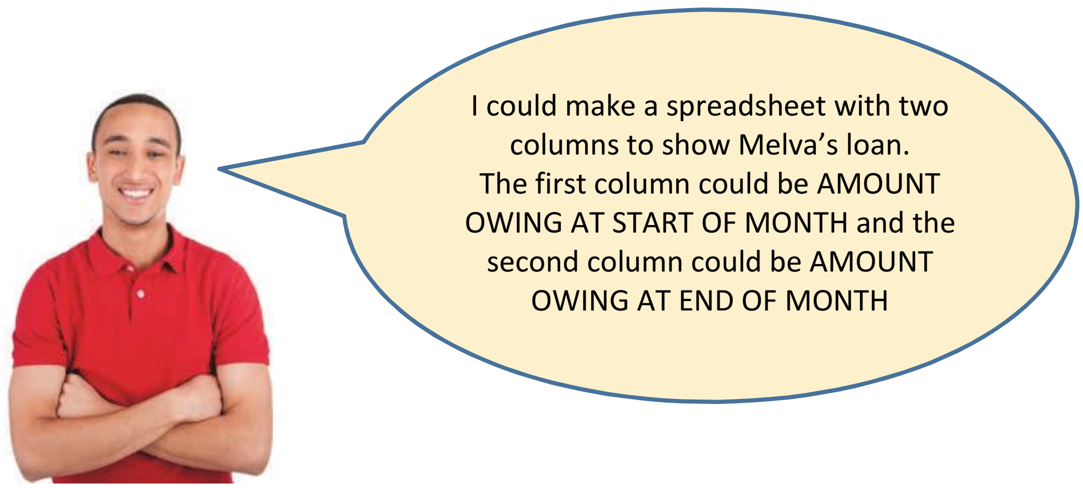
g) Type the formula you have chosen for C4 and press enter

h) What formula do you need to enter in cell E4 to calculate how much Melva owes after the second month. Type the formula you have chosen for E4 and press enter.

i) Highlight the row from cell B4 to cell E4. Click and scroll down from the black marker on the corner of E4 down the spreadsheet.

j) Save your worksheet giving it the name 'Melva's Scooter Loan', by selecting *Save As* from the *File* menu and entering the file name. Print and staple the spreadsheet to the side of this page.

Melva's friend Casey was sure there was a quicker way to complete this spreadsheet.



Is Casey right? What formula would Casey enter in the second column to set up this spreadsheet? Discuss with your classmates and record the formula below.

Set up a new spreadsheet workbook titled 'Casey's Scooter Loan Calculation'. Save, print and staple the spreadsheet to the side of this page.

How much did Melva owe after one year? Did you get the same result on both the original and Casey's spreadsheets?

How much interest has she paid in one year? What are her total repayments in one year? Which spreadsheet provides the most amount of information? Which spreadsheet is the best to use in this case? Discuss with your classmates.

Circle the most efficient way of solving Melva's scooter purchasing problems:

CALCULATOR SPREADSHEET

Justify and explain your answer.

Practice Exercise 4

1. Place the following questions in the correct place on the table below. Justify your choice.

a) Checking if the amount of tax taken out of your pay is correct.

b) Working out the total amount of interest your term deposit earns over the time you decide to invest for.

c) The percentage of questions answered correctly on a maths assessment.

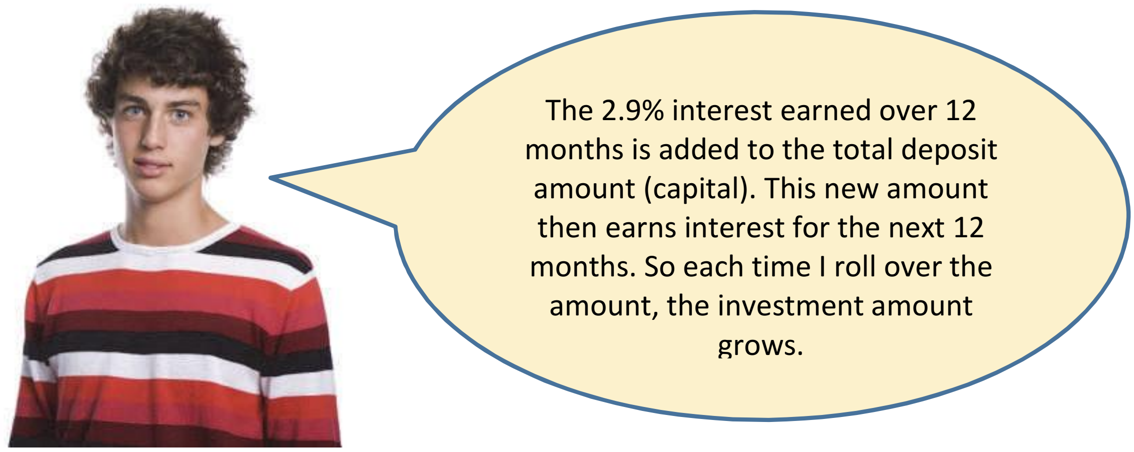
d) Working out a repayment schedule for repaying a credit card debt, where the interest is calculated at an annual rate and compounded monthly.

e) Keeping a record of the percentage rate of commission you earn over a year of selling goods in an online store.

f) Calculating the percentage of people who chose Toyota as their favourite car brand on a survey.

Problems best solved by calculator	Problems best solved by spreadsheet
Justify your answer	Justify your answer

2. Kayden inherited \$1 500 from his grandfather. Kayden decides he wants to put it into a term deposit account so it can earn interest. The best term deposit rate he can find is 2.9% pa for 12 months. Kayden plans to keep rolling over the investment each time it matures.



a) Open a new spreadsheet. Work with a partner and follow the steps in Whole Class Activity 5 to design a spreadsheet that calculates the interest Kayden will earn if he invests the $1 500 for 5 years.

Consider the following points.

- Spreadsheet title
- The layout of the spreadsheet
- The headings on the columns and rows
- Efficiently entering the data and formula

Complete the spreadsheet, showing the growth of Kayden's investment over the next 5 years. Save, print and staple this spreadsheet to the side of this page.

b) How much interest would Kayden earn on his investment altogether over the 5 years?

c) Was it helpful to create and use a spreadsheet to calculate the interest earnings on Kayden's term deposit? Explain.

d) Kayden found a better interest rate at another bank after 2 years, so he moved his money to them. The new interest rate is 3.6% for 12 months. Kayden invested his money with the new bank for 3 years. Create a spreadsheet for the new interest rate and years of investment. Save, print and staple this spreadsheet to the side of this page.

e) How much will the investment be worth in total after 5 years?

f) How much could the $1500 be worth if it was invested for 3 years at 2.8%, 3.3% and 4%?

3. Felicity works at a restaurant as an apprentice cook.
http://awardviewer.fwo.gov.au/award/show/MA000119#P652_57141

She is a 4th year apprentice and her base pay rate is $19.12 per hour.

Her normal roster is 30 hours during Monday to Friday, with an 8 hour shift on Saturday.

PENALTY RATES
Sat 125%
Sun 150%
Public Holiday 250%
10pm to midnight extra 10%
Midnight to 7am extra 15%

Felicity has asked for some extra shifts because she is saving for a holiday. Over the next fortnight Felicity is working these extra shifts as well as her normal roster.

- On both Saturdays an extra 3 hours
- One Monday night working an extra 3 hours, with 2 hours being from 10pm to midnight
- 5 hours on one Sunday
- 4 hours on Labour Day public holiday

Select a digital resource to answer the following questions:

a) If using a spreadsheet, circle the formula used to calculate Felicity's pay rate for working on a Saturday.

= base rate * 125	= base rate * 1.25
= base rate * 0.25	= base rate * 0.75

b) How much did Felicity earn in this fortnight?

c) Felicity can use the fortnightly tax table from the Australian Tax Office to work out the tax that should be deducted from her gross income.

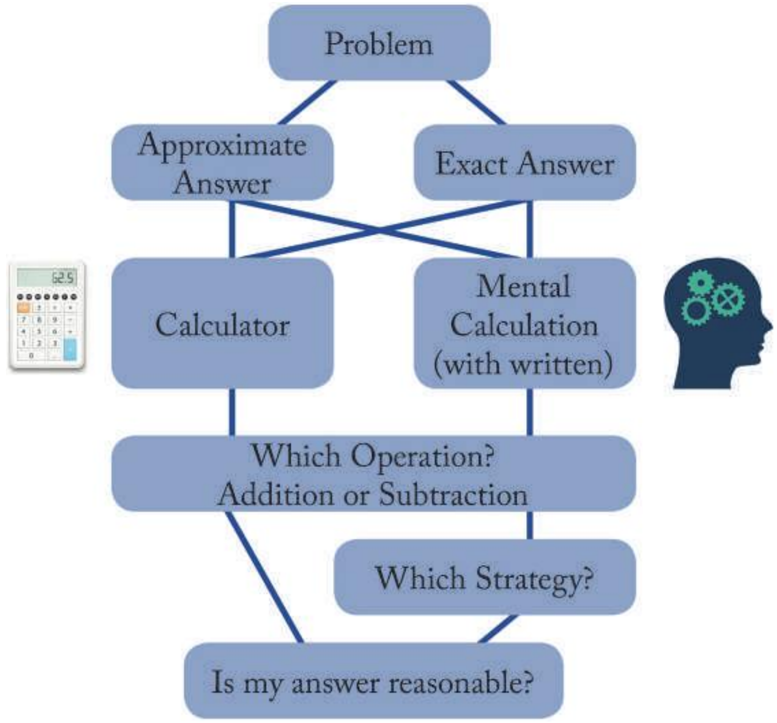
https://www.ato.gov.au/uploadedFiles/Content/MEI/downloads/Fortnightly-tax-table-2015-16.pdf

How much tax will be deducted from Felicity's pay this fortnight?

d) If used, save, print and staple your spreadsheet to the side of this page

Reflection on Learning

Work as a class to discuss each step of the decision making process as you solve the following problems. Record any jottings, diagrams or spreadsheets in the working space below.



1. Jeremy is an apprentice electrician and earned $26 000 last year. View the tax rate table https://www.ato.gov.au/rates/individual-income-tax-rates/ How much tax does he need to pay?

2. Henry scored $\frac{15}{25}$ on his test. What percentage is this?

3. Joe buys some shares for $3 750. They grow at a rate of 6.2% each year for 8 years. How much are the shares worth at the end of 8 years?

4. Last year the rainfall for winter was 350 mm, the news said there was an increase of 7% this year. How much rain fell this winter?

5. There is a '35% off' sale at the electronics store. Shafiq wants to know the discounted price of a $789 television.

WORKING SPACE:

OLNA Practice Questions

1. Addie has to save 13% of the money she earns from her stall at the local market, so she can pay her tax each month. She earned $623 last month.

Which equation below could Addie type into her calculator to work out how much money she needs to save?

A. 632 x 1.3 =   B. 13 x 632 %   C. 632 x 0.87 =   D. 623 x 13 %

2. Monty has a lawn mowing business. This spreadsheet shows his income over the past 4 quarters. Monty pays a tax instalment each quarter, which is 11% of his income.

	A	B	C
1	SEASON	INCOME	TAX INSTALMENT
2	Summer	$2390	
3	Autumn	$3900	
4	Winter	$2050	
5	Spring	$4575	

What spreadsheet formula should Monty use to calculate the tax instalment in cell C2?

A. =B2*11   B. B2*1.1   C. =B2x110%   D. =B2*0.11

Section 4

Location, Time and Temperature

Content Focus

Mathematics Foundation

Location
3.4.1 Locate and describe the purpose of maps and plans in everyday contexts
3.4.2 Read and interpret everyday maps and plans, (both printed and web-based) referring to labels, symbols, keys, distance, direction, coordinates and whole number scales
3.4.3 Place key features of known locations on maps and plans, attending to relative position and proximity
3.4.4 Locate north, east, south and west on simple maps and within their environment
3.4.5 Use simple maps to locate themselves and other items within an environment
3.4.6 Use a simple map to work out distances, practical routes and directions from one location to another
3.4.7 Communicate information (oral and written) about location using language and symbols consistent with the context

Time
3.4.8 Identify and understand the importance of naming and recording a time, and working out how much time has elapsed within work and community life
3.4.9 Read and use digital and analogue watches, clocks (including 24 hour time), and stopwatches
3.4.10 Convert between digital and analogue time
3.4.11 Read and use various forms of more complex calendars and timetables with both12- and 24- hour time
3.4.12 Use various written forms of time to record events; for example, timesheets
3.4.13 Compare and order time events
3.4.14 Use the relationship between time units to convert one unit to another; for example, $1\frac{1}{2}$minutes = 90 seconds, $2\frac{1}{4}$hours = 135 minutes
3.4.15 Solve simple problems involving elapsed time in situations involving combinations of time units
3.4.16 Communicate information (oral and written) about time using language and symbols consistent with the context

Temperature
3.4.17 Identify and describe the tools and units commonly used to measure temperature
3.4.18 Develop a sense of how hot/cold, as compared to the Celsius unit; e.g., today is hot, it must be more than 35°
3.4.19 Use a thermometer or digital readout; to measure and compare temperatures to the nearest degree Celsius
3.4.20 Read, write and interpret temperatures to the nearest degree Celsius, using the symbol for degrees (°)
3.4.21 Calculate changes in temperature, including difference between maximum and minimum temperatures
3.4.22 Communicate information (oral and written) about temperature using language and symbols consistent with the context

Australian Curriculum Link

ACMMG044 Interpret simple maps of familiar locations and identify the relative positions of key features

ACMMG065 Create and interpret simple grid maps to show position and pathways

ACMMG090 Use simple scales, legends and directions to interpret information contained in basic maps

ACMMG113 Use a grid reference system to describe locations. Describe routes using landmarks and directional language.

ACMMG143 Introduce the Cartesian coordinate system using all four quadrants.

ACMMG085 Convert between units of time

ACMMG086 Use ‘am’ and ‘pm’ notation and solve simple time problems

ACMMG110 Compare 12- and 24-hour time systems and convert between them

ACMMG139 Interpret and use timetables

ACMMG199 Solve problems involving duration, including using 12- and 24-hour time within a single time zone

ACMMG084 Use scaled instruments to measure and compare lengths, masses, capacities and temperatures.

ACMMG124 Investigate everyday situations that use integers. Locate and represent these numbers on a number line

Topic 1

Location

Mathematics Discussion

When we give directions and follow directions, for moving around and locating things in our environment, we usually need to refer to order, direction and distance. Order means how places or things are positioned in relation to other places or things. Distance refers to how near or far one object or place is from another. When describing direction, using compass bearings is far more accurate and less error prone than using words like left, right, forwards and backwards. For example, we might say, the oval is about 100 metres east of the shopping centre and is on the left just before you get to the Karel Avenue intersection.

Maps are two dimensional representations of locations. They have a range of features which may include keys, compass roses, grid references, coordinates and scale. Most maps show the order of things in relation to each other. Some maps do not show direction and some may not be useful to work out distances. Different kinds of maps help us to accurately locate ourselves and things, find our way around, describe routes and work out distances between places and objects.

This topic is concerned with reading and interpreting maps. Plans will be covered in the Section 5, Topic 3 of this book.

Whole Class Activity 1

Think: How do we use order, distance and direction to locate things and places?

PART A

Casey and Sarah had arranged to meet at the university carpark. Casey provided the following written instructions for Sarah.

To get to the carpark head south from the South street exit of the freeway, go over Murdoch drive, take the second road on the left, turn left at the roundabout and first right. Go past the gym on your left and keep going for about 40 metres. The carpark is between South Street and the large education building.

When we give directions or describe the location of a place we use words to describe *order*, *distance* and *direction*.

The table below provides an outline of the meaning of the words *order, distance* and *direction*. It also gives an example of each from Casey's directions.

Order How things are positioned in relation to other things?	Distance How near or far things are from each other?	Direction Which way do I go?
the second driveway on the left.	*keep going for about 40 metres.*	*turn left at the roundabout and first right.*

Describe your location in the classroom and the direction you are facing right now?

How do you get from this location to the school entrance?

How do you get from the school entrance to the local shop?

Read through your descriptions to the three situations above. Use one colour to highlight examples of words and phrases that describe order. Use a different colour for distance and direction. Add to the table above using examples of your words and phrases.

From your directions above:

Which words were the most effective at communicating the **order** (position in relation to other things) of landmarks?

Which words were the most effective at communicating the **distance** between landmarks?

Which words were the most effective at communicating the **direction** being travelled?

PART B

From your current position, how do you work out where north, south, east and west are?

Use a compass or a compass application on a mobile phone or tablet to work out where north, south, east and west are in relation to you right now. With you at the centre, label where north, south, east and west are on the diagram below.

What are the limitations of using words like; turn left, turn right, go forward, go back and go sideways? Why are compass points useful when describing location?

Go back to your description of how to get from school to the local shop.

Rewrite the description replacing the words like turn left, turn right, go forwards or backwards with compass direction words.

Compare your direction words with another student. Refine your directions if they are not completely accurate.

Practice Exercise 1

1. List four objects in the classroom and four objects or places outside of the classroom. Say where you are in relation to those objects.

In the Classroom		Outside the Classroom	
Object or Place	Direction	Object or Place	Direction

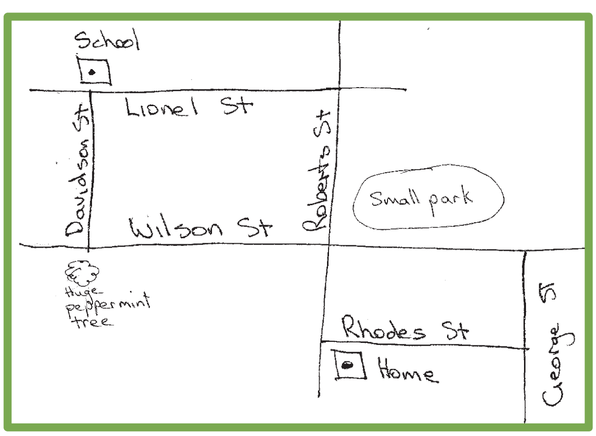
2. Use a hand held or mobile phone compass to work out the direction each wall of the classroom is facing. Write a description explaining how the classroom is oriented to the points of the compass.

Whole Class Activity 2

Think: How do I use and create a mud map?

Look at the map on the following page. What is this a map of?

What is the purpose of the map?



A mud-map is a roughly drawn map that shows a journey to a particular place. A mud-map is usually drawn quickly to show someone where something is. It often has verbal instructions to go with it. A mud-map shows only the features that are important to the journey and may include obvious natural landmarks such as the ocean, lakes and parks that will help orient the reader. Distance is often not accurately shown.

Draw a mud-map to show how to get from school to the local shop

Write some instructions to accompany the mud-map. How are these instructions different to what you wrote above, without the mud map?

Swap and compare mud-maps and directions with another student. What was similar/different?

Add and delete details to your mud map to make it more effective

Staple your directions to the side of this page.

How did your map show:

The **order** of landmarks?

The **direction** of the location?

On a mud map, **distance** is often not drawn accurately. Why?

What information could you include to assist the reader have a sense of distance between places?

Add a compass rose to your mud-map, making sure you check the position of the directions with a compass.

Go back to the directions you wrote to go with the mud-map.

Improve the directions by adding some compass directions.

Practice Exercise 2

1. "When I was a kid, I thought north was always in front of me."

a) Why is this thinking wrong?

b) Why might I have developed this idea?

2. On a sheet of paper, sketch a top view of your house and show how it is oriented to the points of the compass. Draw top views of a few houses and streets around you so that you get a sense of buildings or roads to the north, south, east and west of your house. Staple your drawing to the side of this page.

3. Create a mud map to show how to get from one location to another in your local community. Create a simple set of instructions to go with the map. Show compass directions in your map and use compass point directions in your description. Share your work with another student to see if they can follow your map and instructions. Refine if necessary. Staple your mud-map and directions to the side of this page.

4. Imagine you are travelling to Broome for a holiday, staying at Cable Beach Backpackers on Sanctuary Road.

a) Use Google maps to look up how to get from the airport to Cable Beach Backpackers by car. Draw a mud-map showing how to get from the airport to the accommodation.

b) Add a compass rose to your mud map.

c) Write a set of basic instructions to go with the map. Use compass directions in your instructions.

d) Explore the features of Google Maps to find out the distance between the airport and the backpackers. Go back to your mud map and include some distance information.

5. Search 'mud maps' in Google images. Select a mud map that interests you and print it.

Answer the following questions.

a) What is the mud map showing?

b) What level of detail has been included in the map?

c) Do you think the mud map would be easy or difficult to use? Justify.

Whole Class Activity 3

Think: What features do maps have?

Maps of locations and spaces are drawn as if looking down from above. They show the correct **order** and **direction** of the places and objects. The **distances** between places and objects are usually drawn to scale. They often have a scale that enables you to work out the real distances between locations and objects.

Look at the map below. What is this a map of? What is the purpose of the map?

You and your friend have gone to the Good Life music festival, http://goodlifefest.com.au/

You become separated so you ring her on her phone. You tell her you are standing next to the toilets closest to the Live Stage tent. She says she is at the Meet and Greet stage.

Write the directions you would give your friend so she could find you at the Live Stage tent.

Can you tell how far it is between the Live Stage Tent and the Meet and Greet Tent? Why/Why not?

Look at the map for the Goodlife Music Festival. Which of these features can you find on the map? Label them on the map.

a) Labels b) Symbols c) Key d) Distance e) Compass Rose f) Scale g) Coordinates

Which features are not present on the map?

This map is provided by the festival organisers to show people how to get to the venue.

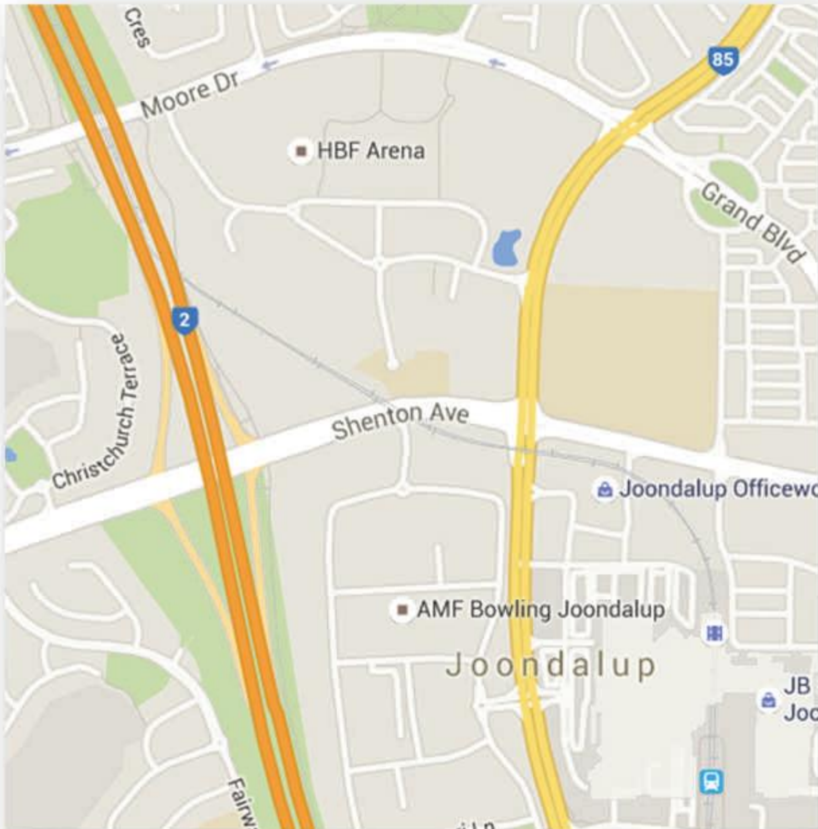
Label the features from the list above on this map?

Why are many of the features listed above missing from this map?

What does this map have that is similar/different to a mud-map?

The following map is from Google Maps and shows the same location as the previous map.

Compare this map to the previous two maps.



What is similar about the maps?

What is different about the maps?

Label the features from the list above on this map?

Why are many of the features listed in the table on the list above missing from this map?

What does this map have that is similar/different to a mud map?

Practice Exercise 3

1a) Add a compass rose to the Goodlife Music Festival map. Using compass points, write a set of directions explaining how to walk from the carnival rides to the shaded lounges.

b) Find the location of the festival (HBF Arena Joondalup) on Google Maps. Provide instructions for your parents or the person picking you up to find the Parent Pick Up Car Park as they come from their home. Use compass directions as part of your description.

2. Download the *Rottnest Settlement and Street Map* and *Rottnest Island Marine Reserve Map* from the following link http://www.rottnestisland.com/accommodation/accommodation-maps

Answer the following questions using compass directions where possible:

a) How do you get to the camping ground from the main jetty?

b) If you are staying in a cabin on Vlamingh Way, describe how to get to the Dome Café.

c) If you are at the Dome café, in which direction is Thompson Bay located?

d) If you were riding your bike past Garden Lake, in which direction would you need to travel to reach Geordie Bay?

e) In which direction do you walk to get from the visitor centre to the main bus stop?

f) List three locations that are situated north-west of the restaurant Aristos Waterfront Rottnest.

3. The paragraph below explains the layout of Fiona Stanley hospital so patients and visitors can orient themselves before they get there and make sense of it once they are on the grounds.

a) Read it and highlight the words and phrases that indicate order, distance or direction.

The main entrance to our hospital is on Robin Warren Drive, which is accessible from Murdoch Drive. Please visit an information desk for directions on how to locate specific areas. The desks are found at entrances and key locations throughout the hospital. You can identify them by the green strip and the information icon.

The main hospital concourse runs through the building from west to east. Most public services and facilities you will need to access are available off this concourse (For example: café, outpatient clinics, pharmacy, ATMs).You can access the wards via two sets of lifts found off the concourse. The lifts are coloured blue (for the western or ocean side) and orange (for the eastern or desert side). The wards and floors use a number and letter sequence.

The number indicates the level and the letter is uniform for levels 3 to 7. For example ward 4A would be found on level 4, northeast tower. Bed numbers are clockwise from the ward entry and the first number of the bed indicates the level number.

Interactive kiosks that provide public access to an electronic map system can be found near entrances and friendly volunteers will be available to help you find your way.

Source: http://www.fsh.health.wa.gov.au/For-patients-and-visitors/Finding-your-way

Download the map of Fiona Stanley hospital. Use the map and the description above to complete the following questions and activities.

http://www.fsh.health.wa.gov.au/For-patients-and-visitors/Hospital-Map#prettyPhoto

b) Circle the Main Entrance.

c) Label the main hospital concourse.

d) To which level do renal dialysis patients go for treatment?

e) Which coloured lift should you catch to get to Ward 4B?

f) On which side of the hospital is Ward 2C?

g) Label where bed number 568 would be?

4. Search for a map of your local community or for a place you would like to go. Print it and use it to answer the following questions.

a) What is the map showing?

b) Describe the level of detail that has been included in the map?

c) Label the features the map displays.

d) Staple your map to the side of this page.

Whole Class Activity 4

Think: How do we use grid references and grid coordinates on maps?

Look at the map on the following page. What is this a map of?

What is the purpose of the map?

Find examples of these features and label them on the map.

a) Labels b) Symbols c) Key d) Distance e) Compass Rose f) Scale g) Coordinates

Can you tell how far it is to walk from the Sheep Shearing and Wool Pavilion to the Main Arena? Why/Why not?

The numbers and letters on the outside of the map form a grid over the map. This creates a coordinate system which can be used to pinpoint places on the map.

Draw in the gridlines.

Each square formed by the gridlines has a reference which is made using a combination of the letter and number labels.


ROYAL AGRICULTURAL SOCIETY OF WA
PERTH ROYAL SHOW
26 SEPTEMBER TO 3 OCTOBER
MAIN ARENA
FREE IINET WIFI AVAILABLE THROUGHOUT THE SHOWGROUND
SIDESHOW ALLEY
SHOPPING & LIFESTYLE PAVILION
FYBR STOPS
FYBR SALES STOPS

Find grid reference D1 by going across to the letter reference and then up to the number reference.

What is located at this grid reference square?

1. Use the royal show map to answer the following questions.

a) What is the grid reference for the train station?

b) Provide the grid reference of one ATM.

c) Where are the Racing Diving Pigs located?

d) Provide grid references for two toilet locations.

e) List the grid references that Side Show Alley covers.

f) What direction is Fremantle from the showgrounds?

g) What is located at A5?

h) What is located at E4?

The previous map used grid references to help pinpoint locations. This is not a very precise way of describing a location on a map, as there may be many map features contained within one grid reference square.

Some maps use a grid coordinate system for locating positions on a map. This allows us to locate a particular point not a space. The numbering system for grid coordinates is like a set of number lines running over the map. There is a horizontal and a vertical number line. For example, to locate a point on the map below we provide a number by looking at the horizontal axis, followed by a vertical axis number. We write that location using numbers in brackets, for example, (3, 5).

2. Use the map on the next page to answer the following questions.

a) Whose yard is located at (4, 2)?

b) What is the grid coordinate for Jerry's house?

c) Which road is at coordinate (2, 3)?

d) What is the coordinate for Meg's house?

Because we are looking at number lines it means there are numbers between the whole numbers on the grid. The numbers between whole numbers can be decimals or fractions.

3. Use the map above to answer the following questions.

a) Whose house is located at (3.2, 3.5)?

b) What is located at (0.5, 4.7)?

c) Which road is located at (0.4, 0.2)?

d) What is the grid coordinate for the intersection of Abbott St and Gillard Blvd?

Practice Exercise 4

1. Use this map of Rottnest to answer the following questions.

http://www.arta.com.au/wamaps/rottnest_island.html

a) What is located at grid reference G, 14?

b) What is located at grid reference D, 10?

c) What is located at grid reference E, 16?

d) What is the grid reference for the ferry berth?

e) What is the grid reference for the Bathurst Lighthouse?

f) Where is Pink Lake?

2. Some scientists are taking a survey of where three different species are spotted around Bora Bora. This map shows where the animals were spotted in one day.

Answer the following questions by giving the grid coordinates of the locations. Use decimal numbers if needed.

a) Where were dolphins spotted?

b) Where were stingrays spotted on the Eastern side of the island?

c) Where were spotted fish seen?

d) Where was the most southern sighting of a shark?

e) What animal was seen at (02.5, 05.8)?

f) Where is the airport?

3. On the map below, draw and label your own grid coordinates.

Source: Lancelin Community Resource Centre

Create 6 questions using your coordinates for another class member to answer.

a)

b)

c)

d)

e)

f)

Reflection and Discussion

Grid references and grid coordinates are both useful for locating features within maps.

To what purposes do you think a grid reference system would be best suited?

To what purposes do you think a grid coordinate system would be best suited?

Whole Class Activity 5

Think: How do you use the scale on a map?

Most maps include a scale. The scale shows how much the real location has been reduced in size so it can be shown as a two dimensional image. The scale information enables the reader to work out how big something shown on the map is in reality.

Locate your school on Google Maps.

Find the scale information (it should be in the bottom right hand corner).

Find the zoom function.

Zoom

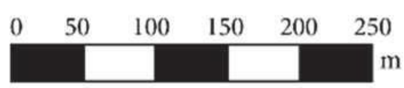
Scale

Use the zoom function to zoom in and out. When you zoom in and out, watch what happens to the scale and the map.

Describe what happens to the scale.

Describe what happens to the map.

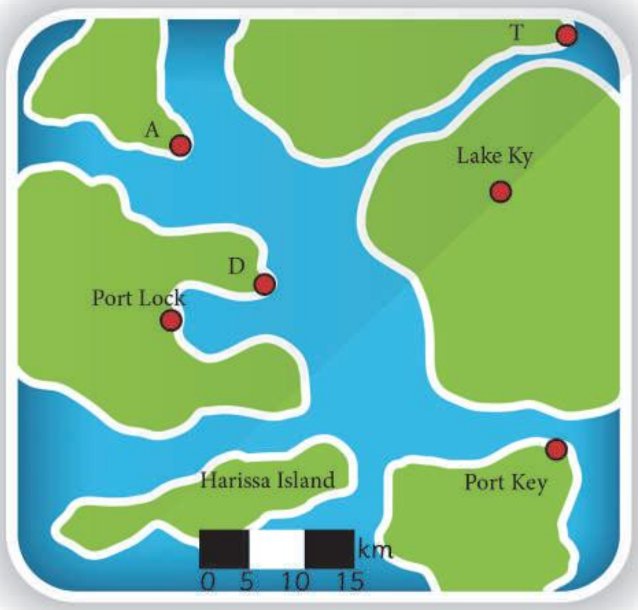
Scales can be represented on maps in three different ways.

Name of Scale	Example	How you use it
Explicit	1 cm = 5 km	Use a ruler or string to measure distances in centimetres then convert (by multiplying) to kilometres.
Graphic		The length of the scale shows what this is equal to on the map. Measure the distance on the map and compare it to the scale.
Ratio	1:25 000	This scale tells that every 1 unit on the map represents 25 000 of that unit in the real world. Choose the unit you want to use to measure distances on the map with, then multiply by 25 000.

Here are three maps of the same location. Each has a different scale. For each map identify the type of scale and answer the questions in the table below.

Map	Scale Type	Distance between
1		A and D =
2		C and F =
3		B and E =

Map 1

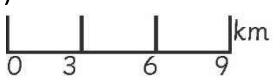
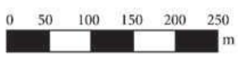


Map 2

Map 3

Practice Exercise 5

1. Explain in words what each of these scales is telling you, and use it to work out the given map distance.

Scale	What does it mean?	Conversion	
		Distance on map	Distance on the Earth
a) 1 cm = 500m		5 cm	
b) 1 cm = 10 km		11 cm	
c) 		7 cm	
d) 		2 cm	
e) 1:10 000		4 cm	
f) 1:250 000		8 cm	

2. Use the maps in Whole Class Activity 5 to answer the following questions.

Map	Question	Distance on the map	Working out	Distance on Earth
a) Explicit	How far is it from Port Key to Port Lock?			
b) Graphic	How far from Lake Ky and T?			
c) Ratio	What is the length of Harissa Island?			

3. Search for a map of a place that interests you and that includes a scale. Print it and use it to answer the following questions.

a) What is the map showing?

b) What type of scale is displayed?

c) Use the scale to work out the distance between 2 points on the map. Record the information on the table below.

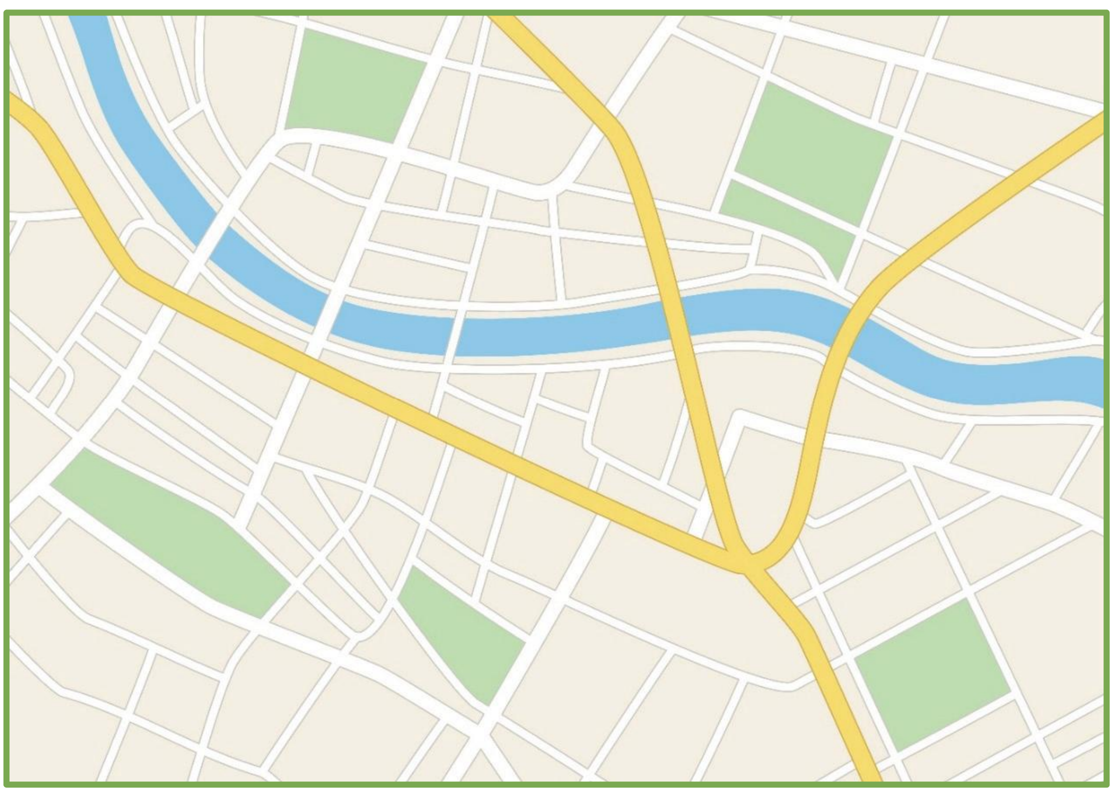
Scale from Map	Point 1	Point 2	Distance on the map	Working out	Distance in real life

Reflection on Learning

1. Use the map base below to create your own map.

Add these features;

Key, Labels, Symbols, Distance, Compass Rose, Scale and Coordinates.

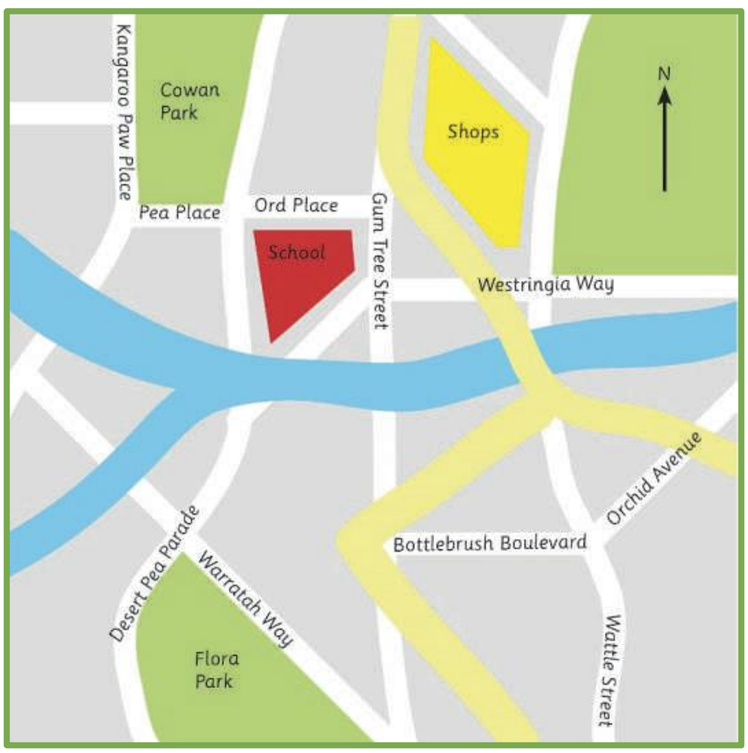


2. Select three different maps (physical or downloaded) to compare using the table below.

	Map 1	Map 2	Map 3
Location of map (eg Perth city centre)			
Purpose of map			
Features on map			

OLNA Practice Questions

1. Milly lives in a street that runs west to east. Her house is south of the shops and the river and north-east of a park.



What road does Milly live on?

A. Bottlebrush Boulevard
B. Westringia Way
C. Gum Tree Street
D. Pea Place

2. If a map has a scale of 1 cm = 200 m. How far would 6 cm on the map be in the real life?

A. 1 km B. 0.8 km C. 1.2 km D. 1 000 m

Topic 2

Time

Mathematics Discussion

Time is an important measurement in our everyday lives. We use time to order daily events from the past through to the present and into the future. For example, the times of swimmers in a 100 m butterfly final determines the order in which the swimmers finished the race. Similarly, an appointment at 2.25 pm determines the order in which we complete other activities in our lives as we plan for this future event.

We can calculate intervals between points in time. This is important when calculating hours worked in a job, planning when to take a cake out of the oven or working out when a game will finish based on the starting time and the duration of game.

Examples of tools used to measure time include a 12 hour analogue clock, a 12 hour digital clock, a 24 hour timetable, a stopwatch and a calendar. It is important to be able to use all these measures of time.

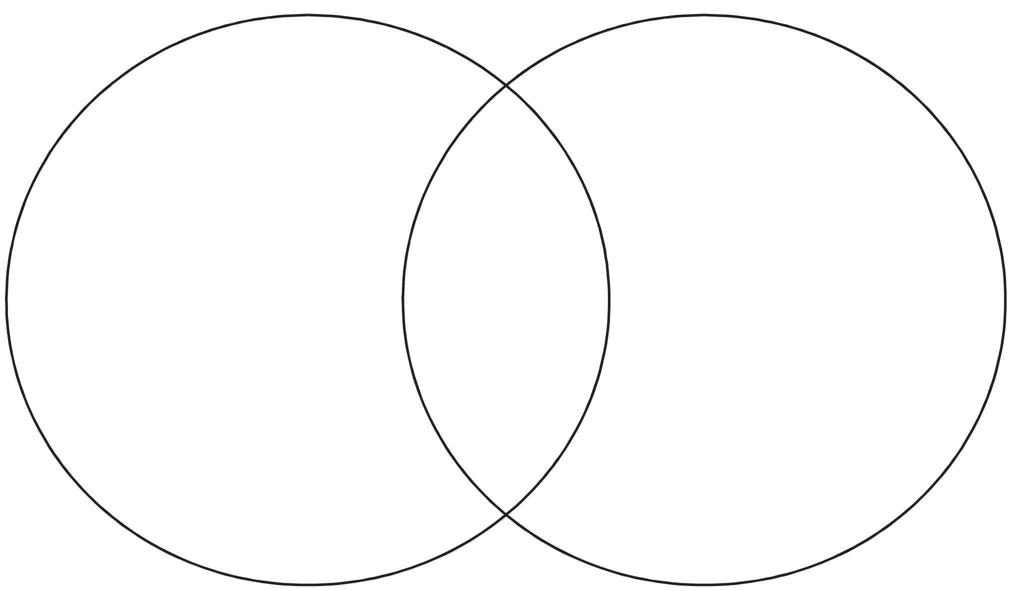
This topic explores this very important form of measurement. It involves reading time instruments, tables and calendars, calculating elapsed time and converting time between different time units.

Whole Class Activity 1

Think: How do you read 12 hour and 24 hour times?

Look at the clock below. Is it analogue or digital? 	Look at the clock below. Is it analogue or digital? 
What time is it showing? How do you say that in words?	What time is it showing? How do you say that in words?
What time is it showing? How do you write that in numbers?	What time is it showing? How do you write that in numbers?
What did you do to work this out?	What did you do to work this out?

List the differences and similarities between an analogue and digital clock in the Venn diagram below.



12 Hour Time

Analogue clocks display 12 hours. The hour hand rotates around the clock twice each day.

If you find reading a clock difficult, work through the YouTube clip

https://www.youtube.com/watch?v=pvmvA7a_C2o

List 5 points that will help you read a 12 hour clock

-
-
-
-
-

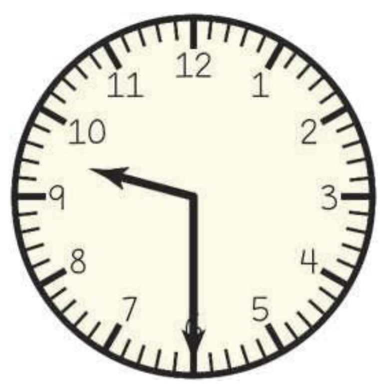
Look at each clock and write the time it is showing in numbers and words. Write one thing you might do at that time of the day.

Time:

Activity:

Time:

Activity:



Time:

Activity:

Share the activities you listed with another person. Are they similar or different? Explain.

How do you know if the time being shown is during the night, afternoon or morning?

We cannot tell by looking at an analogue clock whether the time is in the first 12 hours of the day or the second 12 hours of the day. This is the reason some times have ‘am’ or ‘pm’ written next to them.
‘am’ stands for “ante meridiem,” which means “before midday.”
‘pm’ stands for post meridiem, which means “after midday.”

Read each of the times in the table and write one activity you might do at that time.

Time	Activity
2:00 am	
9:30 am	
12:55 pm	
5:25 pm	
10:45 pm	

24 Hour Time

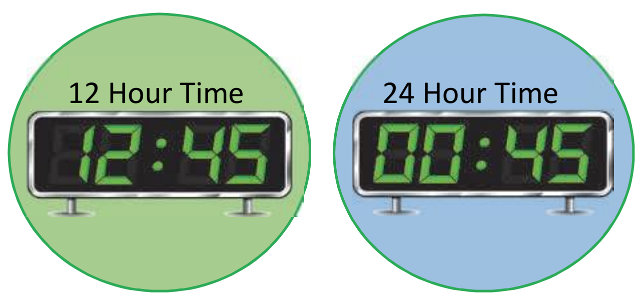
Digital clocks like the one shown here, show 24 hour time. The time tells how many hours have passed since midnight.

This diagram shows how the same time can be described in different ways.

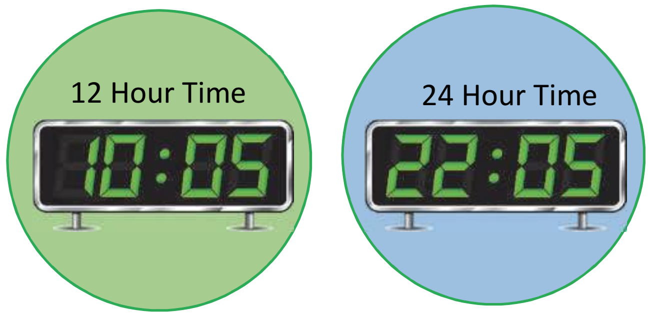
24 Hour Time																							
00 MIDNIGHT	01	02	03	04	05	06	07	08	09	10	11	12 MIDDAY	13	14	15	16	17	18	19	20	21	22	23
12 MIDNIGHT	1	2	3	4	5	6	7	8	9	10	11	12 MIDDAY	1	2	3	4	5	6	7	8	9	10	11
AM times												PM times											
12 Hour Time																							

To convert 12 hour time to 24 hour time.

- For the first hour of the day, (midnight to 12:59), subtract 12 hours,



- From 1:00 am to 12:59 pm, there is no change, except to put a zero in front on one digit hours (for example 08:39) and
- From 1:00 pm to 11:59 pm, add 12 hours.

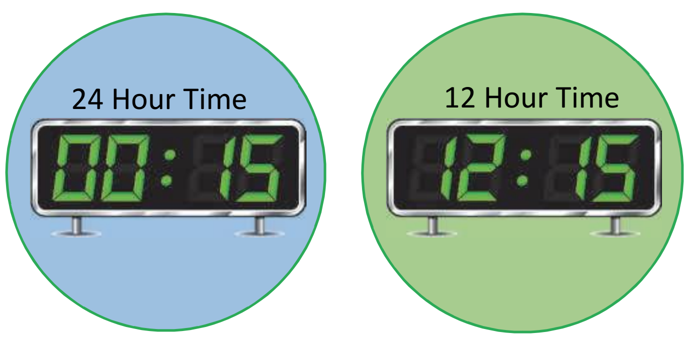


Read each time below and convert to 24 hour time. Write the reasoning you used to make the conversion.

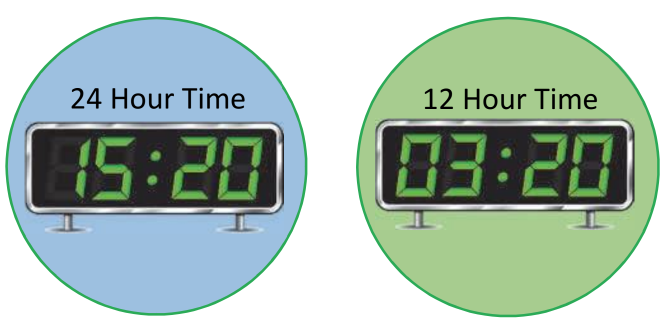
12 hour time	24 hour time	Reasoning used
a) 7:15 am		
b) 12:25 am		
c) 2:50 pm		
d) 9:30 pm		
e) 5:05 am		

To convert 24 hour time to 12 hour time.

- For the first hour of the day, (from 00:00 to 00:59), add 12 hours and label it 'am',



- For times from 01:00 to 11:59, just add the 'am' label,
- From 12:00 to 12:59, add the 'pm' label and
- For times from 13:00 to 23:59, subtract 12 hours and add the 'pm' label.

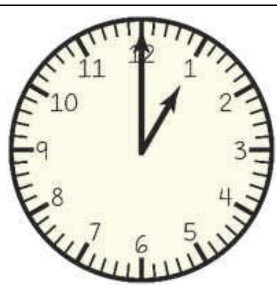
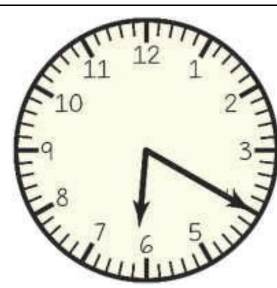
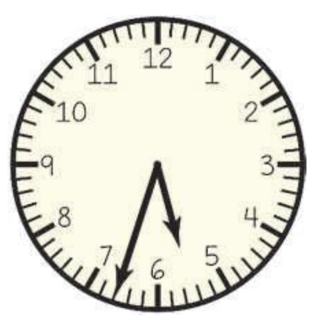


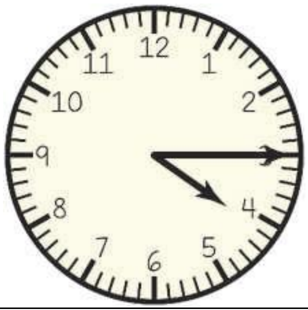
Read each time below and convert to 12 hour time. Write the reasoning you used to make the conversion.

24 hour time	12 hour time	Reasoning used
a) 03:45		
b) 13:05		
c) 10:30		
d) 20:15		
e) 23:55		

Practice Exercise 1

1. Look at each clock and write in words how to say the time displayed, as 12 hour time.

a) 	e) 
b) 	f) 
c) 	g) 

d) 	h) 

2. Convert the following 12 hour times to 24 hour time.

a) 7:20 am   e) 4:00 am

b) 9:05 pm   f) 12:50 am

c) 11:42 pm   g) 1:30 pm

d) 12: 07 am   h) 4:25 pm

3. Convert the following times to AM/PM time.

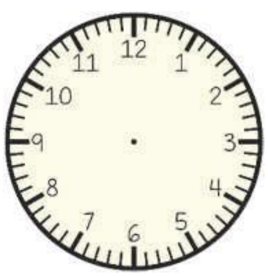
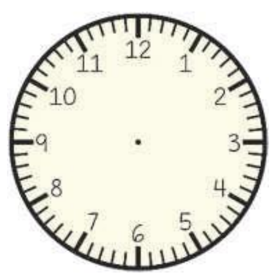
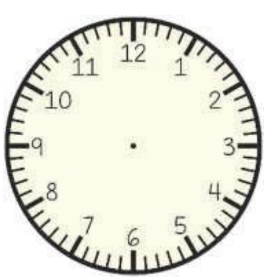
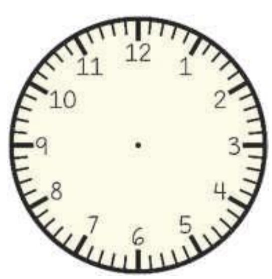
a) 06:40   e) 11:35

b) 00:10   f) 17:58

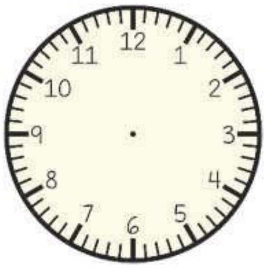
c) 14:05   g) 20:00

d) 05:23   h) 12:35

4. Read each scenario and circle if it is am or pm. Show the time on the clock and write it using 24 hour time.

a) Tia caught the bus for school at 7:55.  am or pm 24 hour time:	e) Cade walked home from school at 3:30.  am or pm 24 hour time:
b) Max stopped to eat lunch at 1:15.  am or pm 24 hour time:	f) Tom started cooking dinner at 6:15.  am or pm 24 hour time:

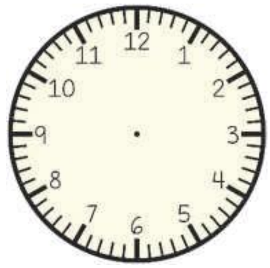
c) Sally finished her evening shift at 11:30.



am or pm

24 hour time:

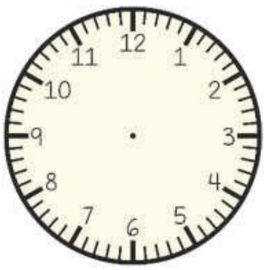
g) Tania went to bed at 10:25.



am or pm

24 hour time:

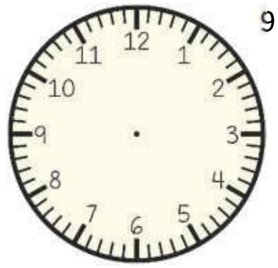
d) Wendy had Netball training at 6:00.



am or pm

24 hour time:

h) Monty met his brother for breakfast at 9:30.



am or pm

24 hour time:

5. These are the details printed on a plane ticket. Answer the questions that follow.

Your Itinerary

Date	Flight Number	Departing	Arriving	Status	Flight Information
16 Oct 15	QF568	Perth 2305, 11:05PM Terminal 4	Sydney 0605, 6:05AM 17 Oct 15 Terminal 3	Economy Confirmed	Est journey Time: 04:00 Non-Stop Aircraft Type: Airbus Industrie A330
18 Oct 15	QF583	Sydney 1940, 7:40PM Terminal 3	Perth 2150, 9:50PM 18 Oct 15 Terminal 4	Economy Confirmed	Est journey Time: 05:10 Non-Stop Aircraft Type: Airbus Industrie A330

a) What date does the plane leave Perth?

b) What time does the plane arrive in Sydney?

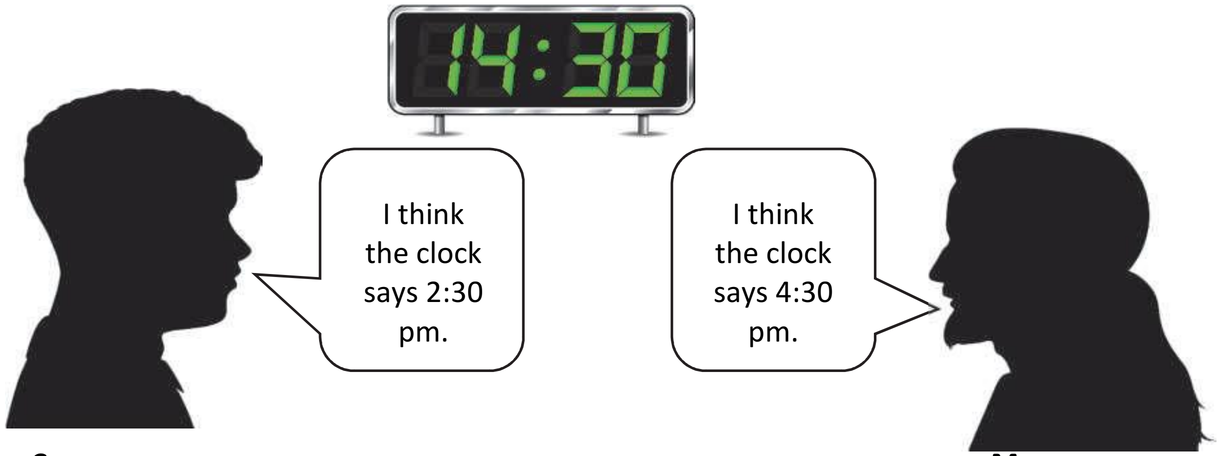
c) How many hours does it take to fly from Perth to Sydney?

d) What time does the plane leave Sydney?

e) How long is it estimated the plane will take to get to Perth?

f) If the plane lands in Perth 15 minutes late, what time will it be?

6.



Casey **Mason**

Who is wrong? Who is right?

What could you do to help the person who got it wrong understand how 24-hour time works?

Whole Class Activity 2

Think: How do you read and use a stopwatch?

Go to this site http://www.online-stopwatch.com/large-stopwatch/ and investigate how the stopwatch works.

Go to this site http://www.estopwatch.net/ and investigate how the stopwatch works.

What is different/similar about the 2 stopwatches?

Use the stopwatch from the first site listed above and observe the display until it reaches

How do you say the time displayed above?

Label the display above, showing which part of the stopwatch shows each unit.

- Seconds
- Minutes
- Hours
- Thousandths of a second (millisecond).

Describe how the numbers changed when you observed the stopwatch?

List three situations where a stopwatch might be used to measure time?

The following table shows some results for a kayaking race. These are the results for the first 5 competitors to finish the race.

Place	Competitor Number	Time	Difference
1	12	45:04.7	-
2	23	45:10.1	+ 0:05.4
3	7	46:25.5	+ 1:50.8
4	5	46:55.8	+ 1:51.1
5	32	47:09.3	+ 2:04.6

Read each of the times to another class member.

What does the difference column show?

What is the decimal point separating?

How much time separated competitor 5 and 7? How did you work this out?

Choose an activity from the list below for everyone in the class to complete.

- Run between two points
- Walk around a defined area
- Complete 20 star jumps
- Hold a forearm plank position
- Write the alphabet 3 times

Each student completes the chosen activity while another person times them with a stopwatch.

Record each person's time on a table.

Create a spreadsheet of the results (using the example below as a guide), showing the order of times from fastest to slowest.

	A	B	C
	Run 100m		
1	Name	Time	Difference
2	Sarah	02:21	-
3	Sam	02:24	+ 00:03

Hint: When entering time into spreadsheet cells, it is helpful to format the cell. To do this

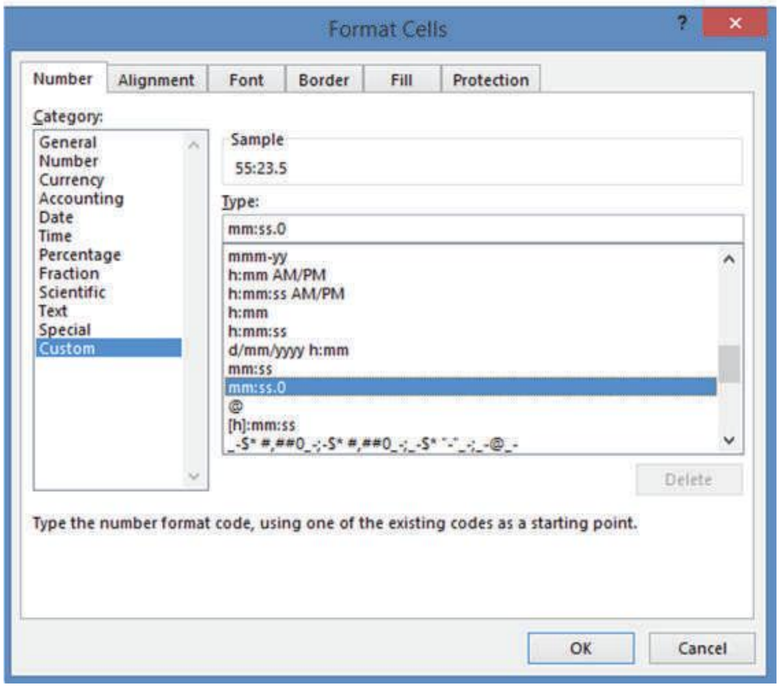
Select the cell you want to format.

Right click to bring up the menu and select 'Format Cells.'

In the Number Tab, click on the category 'Custom.'

In the Type box, find the format you want. For this activity you will need mm:ss or mm:ss.0

Click OK, and go back to the spreadsheet. Staple the completed spreadsheet to this page.



Practice Exercise 2

1. Use a stopwatch to record how long it takes you to do each of these things. Record each activity twice.

Activity	Time to Complete A	Time to Complete B
10 sit ups		
Write your whole name twice		
Walk from your class to the drink fountain		
Activity of your choice:		
Activity of your choice:		

a) Which activity did you complete the fastest?

b) Which activity took the longest to complete?

c) Which activity had the biggest difference between the times? What was it?

d) Which activity had the smallest difference between the times? What was it?

e) Which activity did you complete the fastest?

2. This spreadsheet shows some of the results for the 'Classic Paddle' event, where competitors race different paddle craft down the Swan River for 12km.

	A	B	C	D	E	F	G
1	Place	Bib	Name	Category	Gender	Time	Difference
2	1	27	Andrew Beaton/Bart Cunningham	Male Doubles	Male	55:55.1	-
3	2	3	Victor/Raymond/Hans	Triple Kayak	Male	55:56.2	+0:01.1
4	3	21	Trent Harlow	Single Surf Ski Male	Male	56:03.1	+0:08.0
5	4	15	Carmen/Brent/Jen	Triple Kayak	Female/Male	57:40.1	+1:45.0
6	5	215	Joe/John/Jay	Male Doubles	Male	58:24.6	+2:29.5
7	6	351	Ben/Alice	Female/Mixed Doubles	Female/Male	58:27.6	+2:32.5
8	7	2	Allan Crow	Single Surf Ski Male	Male	59:27.3	+3:32.2
9	8	64	Jebidiah Springfield	Single Surf Ski Vet 35+ M	Male	59:45.3	+3:50.2
10	9	40	Jazmin Jamison	Single Surf Ski Open F	Female	59:50.0	+3:54.9
11	10	33	Nick Nolte	Single Surf Ski U/23 M	Male	59:54.6	+3:59.5
12	11	25	Joseph Nazareth	Single Surf Ski U/23 M	Male	1:00:14.7	+4:19.6
13	12	63	Daniel Mann	Single Surf Ski U/23 M	Male	1:00:31.5	+4:36.4
14	13	55	Ricardo Mitcham	Single Surf Ski Male	Male	1:00:40.7	+4:45.6
15	14	76	Ken Dolly	Single Surf Ski Vet 55+ M	Male	1:01:16.6	+5:21.5
16	15	12	Nate Palmer	Outrigger 6	Male	1:01:18.1	+5:23.0

a) Write, in words, the time of the team that crossed the line first.

b) What was the time difference between 1^{st} and 3rd?

c) What time did the third Single Surf Ski cross the line?

d) What is the time difference between 7^{th} and 8^{th} place?

e) Which bib number got a time of one hour, fourteen seconds and 7 tenths of a second?

3. Put the following stopwatch times in order from fastest to slowest.

a) 1:02:40, 1:00:38, 55:25, 1:25:05, 56:25

b) 25:52, 52:25, 1:05:50, 1:50:05, 51:05

c) 3:30:30, 3:30:03, 30:30, 3:03:03, 3:33

d) 5:10:5, 55:45, 55:01, 5:04:50, 1:45:40

e) 10:01, 11:10, 1:01:10, 1:10:01, 10:11

f) 6:39, 9:03, 6:03:09, 3:39, 6:09

4. These are the competitor times for the heats in the under 13 girls 400m run event. The fastest 8 competitors get to race in the final.

Heat 1	
Competitor Number	Time
508	1:05.02
312	1:04.14
703	1:01.38
202	1:05.26
609	1:03.75
104	1:02.84
404	1:02.20

Heat 2	
Competitor Number	Time
308	1:03.39
610	1:00.38
109	1:04.12
250	1:03.84
711	1:01.72
405	1:02.80
207	1:05.22

a) Place the numbers and times of the fastest 8 competitors into the table below.

Competitor Number	Time

b) What is the time difference between the first and second fastest competitors?

c) What is the time difference between the 1st and 8th fastest times?

d) What is the time of the 4th fastest qualifier?

e) What was the difference between the 8th and 9th placed competitors?

Whole Class Activity 3

Think: How do you read and use calendars and timetables?

Calendars and timetables are used to show the timing of events over longer periods of time.

Jimmy lives in Karratha and is planning to visit his friend Taj who lives in Roebourne. They want to go fishing at Point Samson.

Jimmy needs to catch the bus from Karratha to Roebourne.

Jimmy's closest bus stop is Karratha Leisureplex.

What times does the bus leave on Saturday?

What time does the bus arrive in Roebourne?

What is the earliest time Jimmy and Taj could get to Point Samson?

Saturday and Sunday	1st run	2nd run
Dampier shops	11:00am	2:40pm
Lions Park Dampier	11:05am	2:45pm
Tambrey Oval	11:25am	3:05pm
Baynton West Park	11:30am	3:10pm
Pilbara Holiday Park	11:35am	3:15pm
Nickol Bay Hospital	11:40am	3:20pm
Karratha Leisureplex	11:45am	3:25pm
Karratha Centro	11:50am	3:30pm
Frank Butler Centre	11:55am	3:35pm
Roebourne-Padbury St / PCYC Hall	12:25pm	4:05pm
Wickham shops	12:40pm	4:25pm
Point Samson Community Hall	12:50pm	4:30pm

Source: Karratha.wa.gov.au

The timetable below shows sunrise and sunset times; and first and last light for Roebourne.

What is the earliest sunrise time shown? What day/s?

What is the latest sunset time shown? What day/s?

On Monday 9th November, how many minutes are between sunset and last light?

Roebourne Sunrise / Sunset Times

Australia / WA / Pilbara /

5-Day

	TODAY 7 Nov	SUN 8 Nov	MON 9 Nov	TUE 10 Nov	WED 11 Nov
First Light	5:02 am	5:02 am	5:01 am	5:01 am	5:00 am
Sunrise	5:25 am	5:25 am	5:24 am	5:24 am	5:24 am
Sunset	6:24 pm	6:24 pm	6:25 pm	6:26 pm	6:26 pm
Last Light	6:47 pm	6:48 pm	6:48 pm	6:49 pm	6:50 pm

Source: www.willyweather.com.au

What is the earliest sunrise time shown? What day/s?

What is the latest sunset time shown? What day/s?

On Monday 9th November, how many minutes are there between sunset and last light?

Why might a person want to look up the sunrise and sunset times for a place?

This timetable shows the tide times for Point Samson. The dark blue arrows indicate the incoming tide, the light blue arrows the tide going out.

Point Samson Tides

TODAY 7 Nov	SUN 8 Nov	MON 9 Nov	TUE 10 Nov	WED 11 Nov
2:26 am 2.64m	3:18 am 2.24m	3:54 am 1.85m	4:25 am 1.49m	4:53 am 1.19m
8:20 am 3.89m	9:16 am 4.22m	9:52 am 4.53m	10:23 am 4.79m	10:51 am 4.99m
2:38 pm 2.49m	3:26 pm 2.2m	4:01 pm 1.93m	4:32 pm 1.7m	5:01 pm 1.52m
8:49 pm 4.31m	9:25 pm 4.65m	9:54 pm 4.95m	10:22 pm 5.19m	10:48 pm 5.38m

Source: www.willyweather.com.au

What time does the tide go out on Wednesday morning?

What times does the tide come in on 7th November?

How much time is there between the tide going out and coming in on Monday evening?

Why might a person want to look up the tide times for a place?

Practice Exercise 3

1. Visit the timetable for the Dampier to Point Samson bus at http://goo.gl/xDrFQW

Answer the following questions.

a) On which days of the week does the service run?

b) At what time can you catch the bus from Karratha Centro to Dampier on Tuesday morning?

c) If you catch the bus at 2:40 pm on Thursday from Dampier Shops, what time will you arrive in Roebourne?

d) On Saturday, what are all the possible times you could catch the bus from the Wickham Shops, heading towards Dampier?

e) How long does it take to get from Point Samson Community Hall to Karratha Centro?

2. Linda is visiting her sister in Sydney. She needs to catch a few ferries to get to different places. http://www.transportnsw.info/sites/en/maps-and-timetables/ferry-timetables.page

a) Linda and her sister are planning travel from Circular Quay to Taronga Zoo on Saturday. If they want to arrive at the zoo before 11:00 am, which ferry should they catch?

b) Linda and her sister want to leave the zoo around 4:00 pm. What time should they catch the ferry from Taronga Zoo to Circular Quay?

c) On Monday, Linda and her sister are planning to visit another family member who lives near Manly. They want to be in Manly by lunchtime. At which two times could they could catch a ferry from Circular Quay.

d) On Tuesday Linda is going to see a play in Pyrmont, near Darling Harbour. She needs to be at the theatre by 2:00 pm. What time should Linda catch the ferry from Circular Quay?

3. Jackie and her best friend have decided to spend a year travelling around Australia, using fruit picking as their main source of income. Jackie wants to spend about two months in each location. Visit this site http://www.fruitpicking.org/fruit-picking-essentials/crops-calendar and use it to plan Jackie's trip in the table below.

Month	Place	Crop

Whole Class Activity 4

Think: How can the relationships between the units of time help us communicate times in different ways?

We can use the relationships between the units of time to convert between them, making them easier to calculate with, or communicate with others.

Write down as many time unit relationships you can think of in 1 minute (don't forget all the different units of time). For example, 1 minute = 60 seconds.

Work with a partner and use a calculator to convert each amount of time. Record the calculation you used to convert the time.

Time	Convert to	Calculation Used	Answer
90 minutes	hours		
135 minutes	hours		
$5\frac{1}{2}$ minutes	seconds		
10 minutes	seconds		
$3\frac{1}{4}$ hours	minutes		
14 hours	minutes		
36 hours	days		
126 hours	days		

Which operation (+, -, × or ÷) do you use when you are converting from a smaller time unit like seconds, to a larger unit like minutes?

Which operation (+, -, × or ÷) do you use when you are converting from a larger time unit like hours to a smaller unit like minutes?

How can this understanding of which operation to use when converting times help? Explain using 'convert 4 500 seconds to minutes'.

Practice Exercise 4

1. Convert these times.

a) 3 minutes = ________________________ seconds.

b) 6 hours = ________________________ minutes.

c) 25 hours = ____________ day ____________ hours.

d) 7 weeks = ________________________ days.

e) 72 minutes =____________ hour ____________ minutes.

f) 3 years = ________________________ months.

g) 66 minutes =________________________ seconds.

h) 210 minutes =____________ hour____________ minutes.

i) 20 weeks = ________________________ fortnights.

j) 300 seconds =________________________ minutes.

k) 90 seconds = __________ minutes __________ seconds

l) 2 weeks = ________________________ hours.

2. Solve these problems.

a) Allan completed the triathlon in 1 hour and 17 minutes. How many minutes is this?

b) Juliet worked out at the gym 3 times during the week. On Tuesday she exercised for 40 minutes, on Thursday for 1 hour and on Saturday for half an hour. What is the total number of minutes Juliet worked out for?

c) Lil has a part time job at Target. She worked 4 shifts last week; 3 hours, 5 and a half hours, 8 hours and 15 mins, 4 hours. What is the total amount of time Lil worked?

d) Manny volunteers at the local Food Bank. He worked 190 minutes on Saturday and 3 hours on Sunday. How much time did he volunteer over the weekend?

3. Put these times in order from shortest to longest. Use your calculator to convert them if necessary.

a) 2 hours and 5 minutes, 123 minutes, 1 day, 27 hours

b) 10 minutes and 45 seconds, 1 hour and 3 minutes, 61 minutes, a quarter of an hour

c) half an hour, 42 minutes, 240 seconds, 2 minutes

d) $1\frac{1}{4}$ minutes, 45 minutes, 80 seconds, 5 minutes

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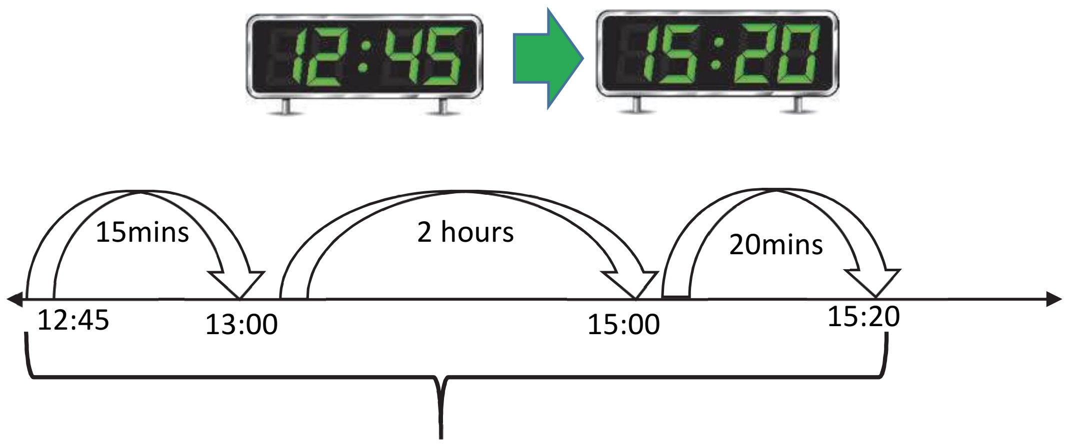
Whole Class Activity 5

Think: How do you calculate elapsed time?

Elapsed time is the amount of time that passes between one time and another. Visualising a number line is a useful strategy for working out elapsed time.

Melva used a number line to work out the amount of time between these 2 times.



Elapsed time is 2 hours 35 minutes

Use a numbers lines to work out the elapsed time problems below.

Marie left home at 16:20 to go to swimming training. She arrived back home at 19:45. How long was Marie gone?

Share how you solved it with anther person. Did you both do it the same or differently? Explain your thinking to your partner.

Sometimes we know the time something starts and how long it goes for. In this situation we have to work out the finish time. For example, Jackson's basketball game starts at 8:50 and goes for 55 minutes. What time will Jackson be finished at basketball?

Use the number line below to work out the finish time of Jackson's basketball game.

Sometimes we know how long an event took and what the finish time is. In this situation we have to work backwards to decide the start time. For example, Ryley looked at his phone and saw it was 13:10. He has been at work for three hours, what time did he start his shift?

Use the number line below to work out the start time of Ryley's work shift.

Practice Exercise 5

1. Brandan works for a construction company as a sub-contractor. He must account for at least 7.5 hours of work on his timesheet each day. Break time is not counted towards the 7.5 hours. He gets paid $22.30 per hour.

This is his timesheet for the week.

Date	In	Out	In	Out	Total Time	Gross Pay
23-Nov	7:30	12:15	1:00	3:30		
24-Nov	7:30	12:00	12:30	3:30		
25-Nov	8:00	11:45	12:15	3:00		
26-Nov	8:00	12:00	1:00	4:00		
27-Nov	7:00	12:00	12:45	2:15		
28-Nov	9:00	12:00	1:00	4:00		
				Weekly Total		

a) Work out his total time worked for each day.

b) Work out his gross pay for each day.

c) Work out the weekly total for time worked and gross pay.

d) On which day did he work the least hours?

e) On which day did he work the most hours?

f) Did he work at least 7.5 hours each day?

2. Complete the blank spaces on the table.

Start Time	Elapsed Time	Finish Time	Working Out
a) 13:10	4 hours 10 minutes		
b) 11:55		14:15	
c)	2 hours 7 minutes	00:23	
d) 08:39		12:50	
e)17:05	6 hours 25 minutes		
f)	4 hours 10 minutes	09: 13	

Reflection on Learning 1

Draw up and keep a time sheet of the school work you complete at school and home for three consecutive days. Record any activity you do that is considered work for school. Break times are not included.

Use this format.

Date	Activity	Time Started	Time Finished	Number of hours	Number of minutes	Running total

Present the data in a spreadsheet, print and staple to the side of this page.

Answer the following questions.

a) On which activity did you spend the most time?

b) On which activity did you spend the least time?

c) How many minutes of school work did you complete in the three days? How much time is this in hours and minutes?

OLNA Practice Questions

1. Archie needs to get to a job that starts at 5:00 am. It will take him at least 37 minutes to get there. At what time should Archie leave the house, so he gets there in time?

A. 5:37 am B. 4:23 pm C. 3:37 am D. 4:23 am

2. What time does the plane arrive in Melbourne?

Date	Service	Details		
Monday 09 Nov 15	**Flight**	**Airline:**	**QANTAS AIRWAYS**	**Flight** QF0476
		Departure Date:	**Mon 09 Nov 15 at 12:55**	PERTH, AUSTRALIA
		Arrival Date:	**Mon 09 Nov 15 at 19:30**	MELBOURNE, AUSTRALIA
		Aircraft:	Airbus A330-200	
		Class:	V - Economy Class - RED eDEAL	
		Stops:	Non-Stop	
		Airline Reference:	5E9F5M	
		Status:	Confirmed	
		Details:	PERTH, AUSTRALIA (TERMINAL - 4) MELBOURNE, AUSTRALIA (TERMINAL - 1), Dept Time 09-11-2015 12:55, Arrival Time 09-11-2015 19:30 - Travelling time: 3 hrs 35 mins - Meal Service: Lunch	

A. 9:30 am B. 7:30 pm C. 5:30 pm D. 9:30 pm

Topic 3

Temperature

Mathematics Discussion

Temperature is an attribute of measurement that describes how hot or cold something is. Just as we can ask measurement questions such as which object is longer, shorter or heavier, we can also ask which object is hotter or colder or which day was hotter or colder? When we want to describe how hot or cold something is we need to carry out a measurement. The unit of measurement for temperature is degrees Celsius (°C) and the measuring instrument is a thermometer.

There are many examples in our everyday life where our health and wellbeing is affected by temperature. We need to understand and predict temperatures, for example, to know not to leave the dog in the car even if it does not seem very hot. We need to consider the effect of temperature for food safety and other daily household practices. We need to be able to use a range of thermometers to accurately measure temperature for such things as cooking meat, checking the temperature of the fridge and taking body temperatures.

Whole Class Activity 1

Think: Why do we measure temperature and what tools are used to measure it?

What are we measuring when we measure the temperature of something?

Look up the definition of temperature. Write the definition using your own words.

A thermometer is one instrument used to measure temperature. There are different types of thermometers.

Different thermometers are used for different purposes.

Look at each thermometer below and think what it might be used for.

Write your thoughts next to each picture.

Write a list of situations where you might need to measure or find the temperature of something.

Read each scenario below and work out the reason the person is measuring temperature.

a) Shane works in the freezer department at the local supermarket and has to check the temperatures of the fridges and freezers at least once during his work shift.

Reason for measuring temperature:

b) Thuy works in a kitchen as a cook. Her boss has asked her to place the meat thermometer into the side of beef that is roasting in the oven.

Reason for measuring temperature:

c) Missy lives on a wheat farm and has a weather station in the paddock closest to the house. She records the temperature every day.

Reason for measuring temperature:

d) James went to the doctor because he was feeling unwell. The doctor put a thermometer in James' ear.

Reason for measuring temperature:

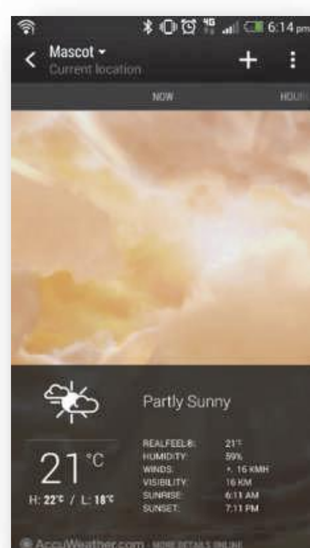
There are instruments other than thermometers that measure temperature. Use a search engine such as Google to list 4 other instruments.

Whole Class Activity 2

Think: What unit is used to measure temperature?

PART A

On the picture (right), circle where it shows the unit being used to measure the temperature.



°C is the symbol for the unit used to measure temperature. What does the ° mean?

What does the C mean?

Write the current temperature shown on the picture in words.

PART B

Some thermometers have an additional unit, called Fahrenheit, displayed.

Fahrenheit has not been used as the official unit for measuring temperature in Australia since 1970, but some countries still use it.

What is the symbol for Fahrenheit?

Investigate which countries still use Fahrenheit as the main unit for measuring temperature.

This is the method for converting Fahrenheit to Celsius.

“Subtract 32, then multiply by 5 and divide by 9.”

Convert the following Fahrenheit temperatures to Celsius using the method above.

96°F   100°F   300°F

What do you notice when you convert Fahrenheit to Celsius.

PART C

Thermometers can be analogue or digital.

Look at each thermometer and decide if it is analogue or digital. Write your decision next to each thermometer.

For the analogue thermometers, think how you would use the markings to read the temperature.

Which type of thermometer, analogue or digital, is easier to read? Justify your answer.

Which type of thermometer is more accurate? Justify your answer.

What do you do to interpret the markings on an analogue thermometer?

How do we describe the temperature when it goes below 0°C?

Practice Exercise 1

1. How would you say each of these temperatures? Write each one in words.

a) 23°C

b) 3°C

c) 103°C

d) 0.5°C

e) - 4°C

f) – 10.5°C

2. Draw a line to match the thermometer to the situation.

a) Checking if a baby has a fever.

b) Finding out what temperature it is outside.

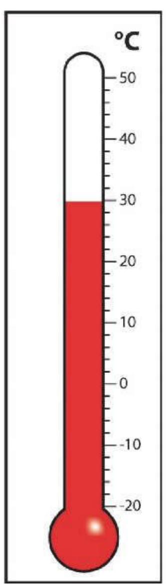
c) Seeing if the roast is cooked.

d) Measuring the temperature of the melted chocolate.

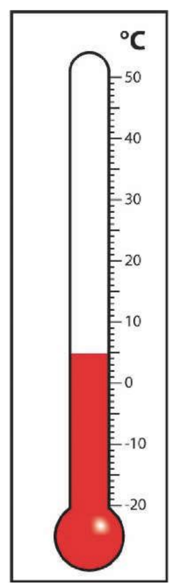
e) Observing if the freezer is working properly.

3. Write the temperature shown by each thermometer.

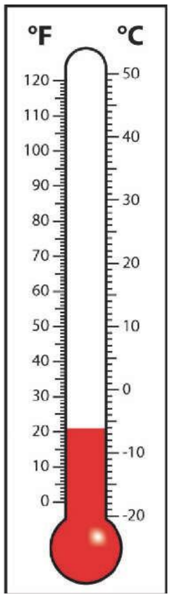
a)



d)



b)

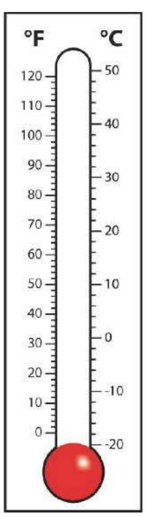


e)

c)

f)

4. Use the thermometer to help you decide if the temperature is being measured in degrees Fahrenheit or Celsius.



a) It is very hot outside and the thermometer tells me it is 95 degrees.

b) The car heater is set to a toasty 23 degrees.

c) I saw on the news the temperature in Geneva was 45 degrees on Christmas Day.

d) The fridge thermometer said it was 5 degrees inside the fridge.

e) It rained today and the news said the minimum was 10 degrees.

f) The recipe said the cake needed to be baked at 356 degrees.

5. Practice reading thermometers and other scales using this interactive resource.

TeacherLed.com Reading Scales

http://www.teacherled.com/2009/02/18/reading-scales-2/

Whole Class Activity 3

Think: How is temperature used to describe weather conditions?

One of the most common reasons for measuring temperature is to provide daily weather information. Recording and tracking temperature in the atmosphere is important to people for different reasons.

Why might each of these people find information about daily temperatures useful?

a) A wheat farmer.

b) A fire fighter.

c) A manager at a community pool.

d) You.

Here is an example of weather information found on Google.

Talk to another class member about the different information contained in the graphic above. Jot down the different information about temperature that is given.

Most weather reports will tell the public what the minimum and maximum temperatures for a day are.

What is meant by minimum and maximum temperature?

How do you work out the difference between two temperatures?

Practice Exercise 2

1a) Use a computer or mobile phone to find out what the temperature is right now in your location. Write down today's minimum and maximum temperature.

b) Find today's minimum and maximum temperature for 5 other places of your choice. At least one of them must be in another country. Represent the information in the table below.

Place					
Minimum temperature					
Maximum temperature					

2. Calculate the number of degrees difference between each of these minimum and maximum temperatures.

a) 14° and 23°

b) 21° and 40°

c) 8° and 15°

d) – 4° and 11°

e) – 12° and 5°

f) 5.8° and 15°

g) 15.5° and 28.2°

h) – 2.6° and 7.3°

3. Go to www.bom.gov.au and find the current temperatures for the capital cities of Australia.

Record the temperatures in the table below.

Sydney	Melbourne	Adelaide	Hobart	Darwin	Perth	Canberra	Brisbane

a) Which city has the highest temperature?

b) What is the difference, in degrees, between Brisbane and Hobart?

c) Which two cities have the coolest temperatures?

d) Write the cities in order from lowest to highest temperature.

e) Which two cities are the closest in temperature?

f) Which two cities have the biggest difference between them?

4. Imagine you are going on a holiday to Darwin next week. Find out what the forecast is.

a) Write down the minimum and maximum temperatures for the week.

b) Write a sentence to summarise what the temperatures will be like.

c) What decisions about the holiday could be affected by the forecast?

5 a) Put the following words and phrases, used to describe the temperature, in order from coldest to hottest.

cold, stinking hot, mild, hot, boiling hot, warm, cool, chilly, freezing

b) Next to each word, write what the temperature might be for you to describe it in that way.

c) List any other words you use to describe temperature.

Whole Class Activity 4

Think: How is temperature used in food preparation and storage situations?

Another reason why measuring and monitoring temperature is important is where food preparation and storage is involved.

PART A

Pair up with another student and have each partner visit one of the links below.

http://www.foodsafety.asn.au/wp-content/uploads/2012/02/NewcrookPoster_A2.pdf

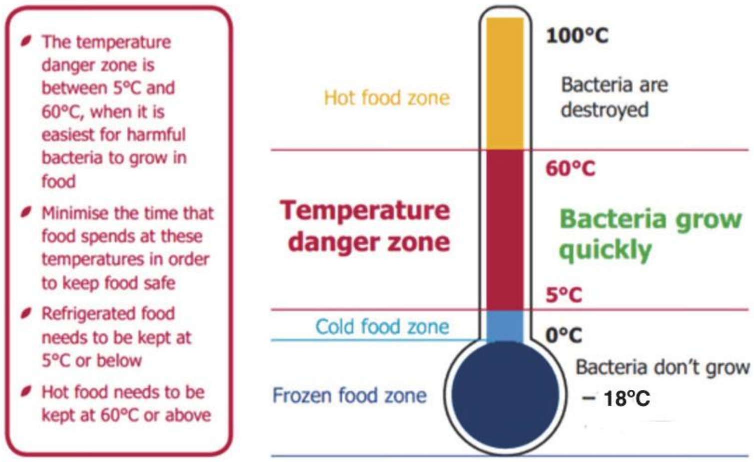
http://www.foodsafety.asn.au/resources/temperature-danger-zone-keep-hot-food-hot-and-cold-food-cold/

List 4 points the websites make about temperature and food safety

-
-
-
-

Read through the information in the diagram below.

Highlight and jot down the sentences that mention temperature.



Source: Food Safety Information Council

Explain in your own words what the diagram above is telling you about food safety.

PART B

All aspects of food preparation require an awareness and understanding of temperature.

List 4 examples from your own experience where you have had to use temperature during food preparation.

-
-
-
-

Read each scenario below and work out the reason the person needs to measure temperature. Circle the temperature needed for the situation.

a) The milk he frothed for a coffee needs to be approximately 75℃.

Reason for measuring temperature:

b) The steak needs to be at least 71℃ for medium rare.

Reason for measuring temperature:

c) The cake must be baked in a moderate oven for 1 hour.

Reason for measuring temperature:

d) The cheesecake must be refrigerated at a maximum temperature of 4.5℃ for 12 hours.

Reason for measuring temperature:

Practice Exercise 3

1. View the poster at this link:

http://www.foodauthority.nsw.gov.au/consumers/keeping-food-safe/cooking-correctly#.Vk7X9LcrLIU

a) Why is it useful to have a meat thermometer?

b) What temperature range should a fridge stay within?

c) What is the safe temperature for cooked chicken?

d) Why should frozen foods be defrosted in the fridge?

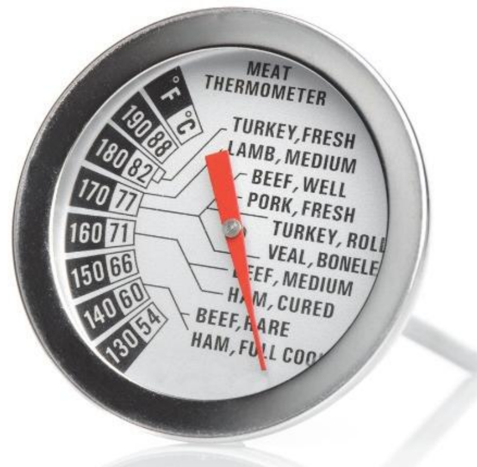
e) What is the 'food danger zone'?

2. This is a meat thermometer.

a) Investigate how to use a meat thermometer.

b) Describe how you would use this thermometer to test if a lamb roast was safe to eat.

c) What other types of thermometers are available for measuring meat temperatures?



3. This is a milk thermometer. It is used by a barista to check the temperature of the milk that will be added to coffee.

a) Investigate how milk thermometers are used.

b) Describe how you would use this thermometer to check the temperature of the milk.

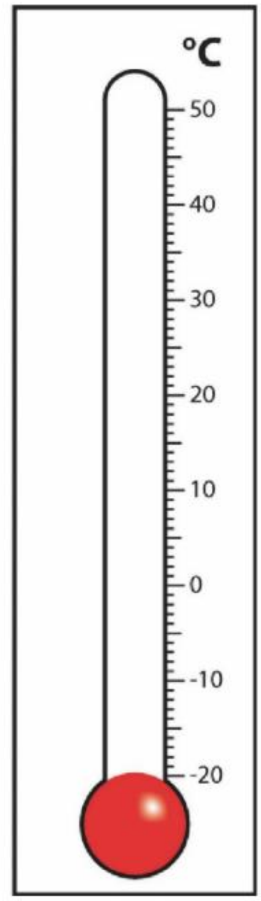
c) What is the temperature range for soy milk?

d) If a customer asked for the milk to be hot, what temperature would you make the milk?

Reflection on Learning

Rule a line from each object to the temperature on the thermometer you estimate it to be.

Write the reason you have chosen this temperature on the line that connects it to the thermometer.



Which situation would have the maximum temperature? Which situation would have the minimum temperature?

What do you estimate the difference in temperature of these two situations to be?

OLNA Practice Questions

1. The forecast for tomorrow is a high of 26 °C and a low of 17.3 °C. What is the difference between the temperatures?

A. 8.7 °F B. 9.3 °C C. 10.7 °C D. 8.7 °C

2. A temperature of 39°C is most likely to describe:

A. A can of soft drink in a fridge
B. A hot summer's day in Perth
C. A cup of freshly made coffee
D. A winter's day in Sydney

Section 5

Space and Design

Content Focus

Mathematics Foundation

3.5.1 Identify essential attributes of, and name, common two and three dimensional shapes found in everyday contexts.

3.5.2 Classify and describe familiar 2D and 3D shapes found in the environment, according to their properties and function.

3.5.3 Draw (by hand and with computer software) simple 2D plans to show placement of objects in relation to one another.

3.5.4 Draw by hand (or computer software) simple 3D objects using isometric, perspective, oblique and exploded drawings.

3.5.5 Match or construct simple 3D objects from various forms of drawings, including front, back and side views or 3D views.

3.5.6 Read and interpret plans, diagrams and simple scale drawings representing familiar real life shapes and objects.

3.5.7 Identify and estimate common angles; for example, a full turn = 360° and right angles = 90°

3.5.8 Communicate information (oral and written) about shape and design using language and symbols consistent with the context.

Australian Curriculum Link

ACMMG042 Describe and draw two-dimensional shapes, with and without digital technologies

ACMMG043 Describe the features of three-dimensional objects

ACMMG161 Draw different views of prisms and solids formed from combinations of prisms

ACMMG046 Identify and describe half and quarter turns

ACMMG064 Identify angles as measures of turn and compare angle sizes in everyday situations

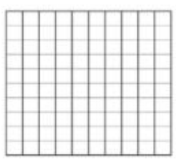
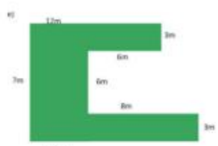
ACMMG221 Solve problems using ratio and scale factors in similar figures

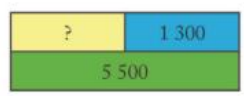
Topic 1

Two Dimensional Shapes and Three Dimensional Objects in our Environment

Mathematics Discussion

So far in our course we have come across and used many two dimensional shape drawings that help us to think about particular mathematics. Consider for example:

This topic however, aims to have us think and communicate about two dimensional shapes and three dimensional objects as they exist in our environment. Both living and nonliving things are made up of shapes and objects that have a particular function, form or aesthetic design.

Man-made objects and structures around us are made up of component parts which have particular functions that enable the whole structure to work as intended. Shapes and objects have properties or attributes that make them useful for particular functions. We classify two dimensional shapes and three dimensional objects according to those properties as a way of making sense of and describing the two and three dimensional world around us.

Whole Class Activity 1

In our workplaces, schools and surroundings, shapes are commonly used as easily recognised symbols and signs. Below are examples of signs seen on road sides.

What do they mean? How do you know?

Road Sign	Shapes used in the Road side signs	What do the signs mean? What is it about the shape that provides the clue?
		
		
		

Which logos have shapes that are more difficult to recognise and name? Why is that?

What other signs in your workplace and community, that are comprised of simple shapes, convey health, safety or other important information?

Sketch or take photos of those shape signs. Draw the figures or print and glue the photos in the space below.

Why do you think simple shapes are used in those signs?

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Whole Class Activity 2

Think: What do we need to know in order to be able to name, classify and talk about two dimensional shapes?

PART A.

Open a Word document on your computer. Locate and press the *Insert* tab and the *Shapes* button on the toolbar. Insert different shapes into your document. Experiment to:

- Enlarge and reduce shapes
- Distort shapes.
- Rotate and Reflect shapes. Locate and press the *Format* or *Drawing Tool* tab and the rotate and flip buttons. Alternatively, click on the object and use the rotation button at the top of the text box the object is in, to rotate the figure.
- Construct more complex shapes. Do this by connecting two or more simple shapes and deleting the outlines to produce one shape. Rotate and reflect shapes to position the component parts.

Save your page of shapes. Print and create a class poster of all student's design work.

What did you have to do to enlarge your shape? What stays the same and what changes when you enlarge or reduce a shape?

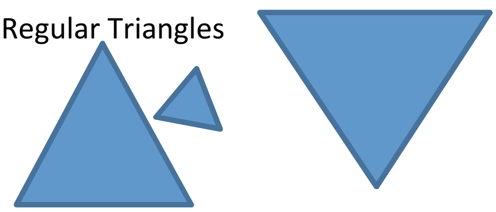
How did you distort a shape? What stays the same and what changes when you distort a shape?

Sketch one of the more complex shapes you drew. How did you use the drawing tools to make that shape?

PART B.

Work in pairs. Open a new Word document and reproduce the following table. Insert and manipulate shapes from the *Shapes* Tool on your computer to fit the criteria in each box. An example is provided in one of the boxes. Work though the table in the order shown by the letters. Insert at least three examples in each box. You might also construct shapes by inserting and placing lines together. You may need to carry out an online search to clarify the meaning of some of the terms.

Save your document. Print and staple it to the side of this page.

a) Not Polygon	b) Polygon
c) Irregular Polygon	d) Regular Polygon
e) Irregular Quadrilaterals	f) Regular Quadrilaterals
g) Parallelograms	h) Rectangles
i) Trapeziums	j) Kites
k) Rhombuses	l) Squares
m) Irregular Triangles	n) Regular Triangles 
o) Ovals	p) Circles

What is the same about each triangle in the Regular Triangle box?

A Foundations student described a square as a regular quadrilateral. Is this correct? Why?

How did you manipulate the shape to change a regular shape into an irregular shape?

What attributes do we look at when deciding if a shape is regular or irregular?

In pairs, look at each row and talk about what is the same and what is different about the two types of shapes.

Which shapes appeared in more than one box? Why?

Practice Exercise 1

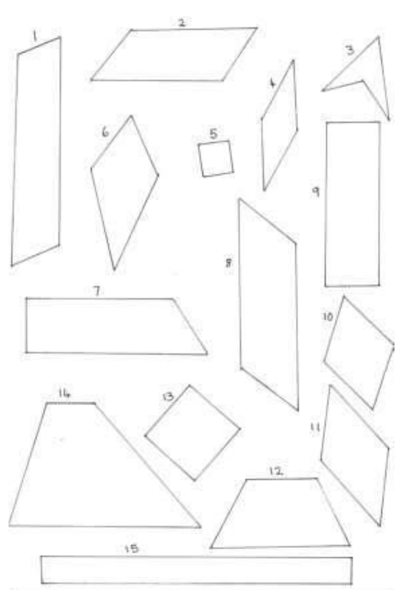
1. Match the descriptions below with the terms in the table. Write the correct description next to the term, in the table. Carry out an online search to clarify the meaning of terms if required.

Term	Description
Polygon	
Regular polygon	
Regular Triangle	
Quadrilateral	
Rectangle	
Parallelogram	
Trapezium	
Rhombus	

A quadrilateral with congruent sides and opposite sides parallel
A quadrilateral with one pair of parallel sides
A four sided polygon with opposite sides parallel
A polygon with four sides
All sides and angles are congruent
A polygon with three sides and three angles congruent
A closed figure with three or more straight sides
A quadrilateral with opposite sides congruent and all angles are right angles (90^0)

2. Look at the range of quadrilaterals below.

a) Place the number of the quadrilateral in the correct place in the table on the right.

<table>
<tr><td rowspan="6"></td><td>Parallelogram</td></tr>
<tr><td>Trapezium</td></tr>
<tr><td>Rhombus</td></tr>
<tr><td>Kite</td></tr>
<tr><td>Rectangle</td></tr>
<tr><td>Square</td></tr>
</table>

b) Using the terms below explain how you decided which shapes are:

parallel	opposite sides	congruent	quadrilateral	angle	right angle

Parallelograms

Rectangles

Squares

3. There are other polygons in the world around us.

a) Name and sketch shapes to complete the table below. You may need to use a search engine on your computer to help you name the shapes.

Number of sides	Name of shape	Regular shape	Irregular shapes
5			
6			
7			
8			

b) What is the same about the regular shapes? What is it that makes a shape irregular?

Whole Class Activity 3

Think: What do we need to know in order to be able to name, classify and talk about three dimensional objects?

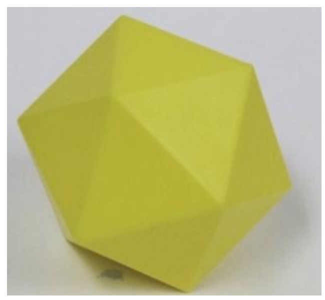
PART A

In describing objects it is helpful to use the terms faces, edges and vertices.

Draw a coloured line from the terms below to an example on each object. Use the colour indicated for each term.

Face (red) Edge (blue) Vertex (black)






What kinds of objects do not have vertices?

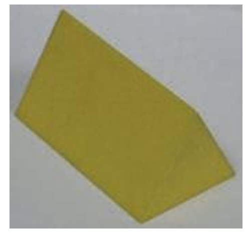
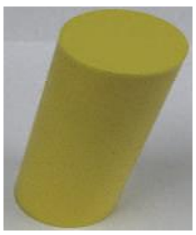
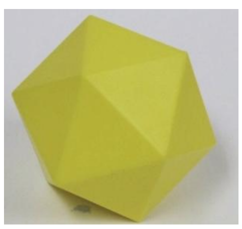
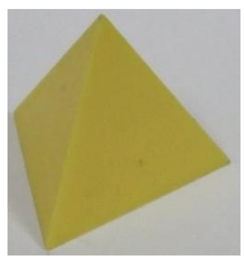
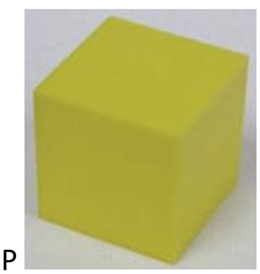
PART B

Search online for images of polyhedrons using search terms such as “Images of polyhedrons” or “Images for polyhedron table”. (The second site has real objects made from polyhedrons.)

Open a Word document and create a gallery of images that will help you to categorise and name polyhedra. Use a snipping tool or tool to take screen shots and paste images into your Word document. Save, print and staple your images to the side of this page.

What is the same about all those polyhedrons?

Examine the table of objects below:

A 	B 	C 	D 
E 	F 	G 	H 
I 	J 	K 	L 
M 	N 	O 	P 

Which ones are polyhedrons?

Which ones are not polyhedrons? Why can't we say they are polyhedrons?

PART C

Reproduce and enlarge the following table to fill an A4 sheet of paper.

a) Polyhedrons	b) Regular Polyhedrons
c) Prisms	d) Pyramids
e) Cylinders	f) Spheres

Search online, using websites such as http://www.mathsisfun.com/geometry/solid-geometry.html, to find the meaning of each of these terms. In your table, under the object name, list the attributes of the object. For example, what are the attributes of a pyramid?

Photocopy, cut out and paste the pictures of the objects on this page into the correct categories in your enlarged table. .

In pairs, look at each row and talk about what is the same and what is different about the two types of objects. Try to use words such as: *faces, edges, vertex, vertices, congruent and parallel.* Try to use phrases such as *polygon faces*, *opposite faces, parallel* and *rectangular faces.*

Which objects do not have a place in the table? Why not?

Which objects could appear in more than one box? Justify your answer.

Practice Exercise 2

1. Draw a line to connect the object categories to a suitable description.

Term
Polyhedron
Regular Polyhedron
Prisms
Pyramids
Cylinder
Sphere

Description
An object that has parallel congruent circles at opposite ends
A polyhedron with a polygon base and triangular faces that meet at a vertex
A polyhedron with end faces parallel and congruent and all other faces rectangular
A polyhedron with congruent faces made up of regular polygons. Also known as a platonic solid.
A three dimensional circle where the points on the surface are at the same distance from the centre
An object with flat faces

2. a) Refer to the object labels in the table in Whole Class Activity 3 to complete the table below. You may need to refer to sites such as http://www.mathsisfun.com/platonic_solids.html or other sources for the last four objects in the table.

Label	Object Name	Number of faces	Number of Edges	Number of Vertices	Have you seen this shape in real life? If so where?
C					
E					
F					
G					
H					
M					
N					
O					
P					

b) What is the convention for naming prisms?

c) What is the convention for naming pyramids?

Whole Class Activity 4

Think: Where are shapes around us and why are they that particular shape?

Structures around us are comprised of component parts for a reason. For example:

This roof structure has triangular supports. Triangles are used because they are rigid and will not flex.	
Window blinds are made up of a series of very thin rectangular prisms arranged parallel to each other. The shape and the way they are arranged and hinged together, means that they can be manipulated to be opened and closed, to prevent seeing in or out, or to adjust the amount of light being let into the room.	

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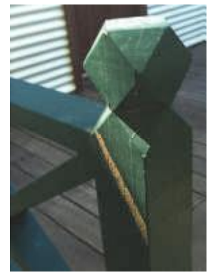
This polyhedron was placed on a top corner section of balustrading on the verandah of a building in Broome. It is purely decorative. The angles of the feature match the angular structure of the balustrading.	

Within your school or workplace, your local park and your closest city or town, think of, or search for, two interesting structures within each of those locations.

List, sketch or paste photos of these structures below. Name the component objects that make up the structures and say what the functions of those components are.

a) School or workplace

b) Local park

c) City or town

Practice Exercise 3

1. Jalen is making pizzas for his friends. He has everything he needs out on the bench.

a) Name some common geometric objects on the bench.

b) Sort the objects into categories (refer back to Practice Exercise 2, Question 1). Name the categories and list the products or objects within each category.

c) Select four products or objects and say why each one is the shape that it is. Take packaging requirements and function into consideration.

d) Three dimensional things or structures around us are not always comprised of just one object; they are mostly comprised of two or more objects called component parts. Name some items on Jalen’s bench that are comprised of component parts. For each of those items, list the component parts and say what the function is of each part.

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2. Complete the table below. Think about the structure of the object and how it has been put together and list the component parts of the object. State the function of the component parts. Look around your classroom and add some more objects to the list

Object or Structure	Component Parts	Function of the Parts
		
		
		
		

3. Consider how you might construct this birthday cake.

Source: http://www.cakecentral.com/gallery/i/2363713/jaws-birthday-cake

a) List the component parts of the cake.

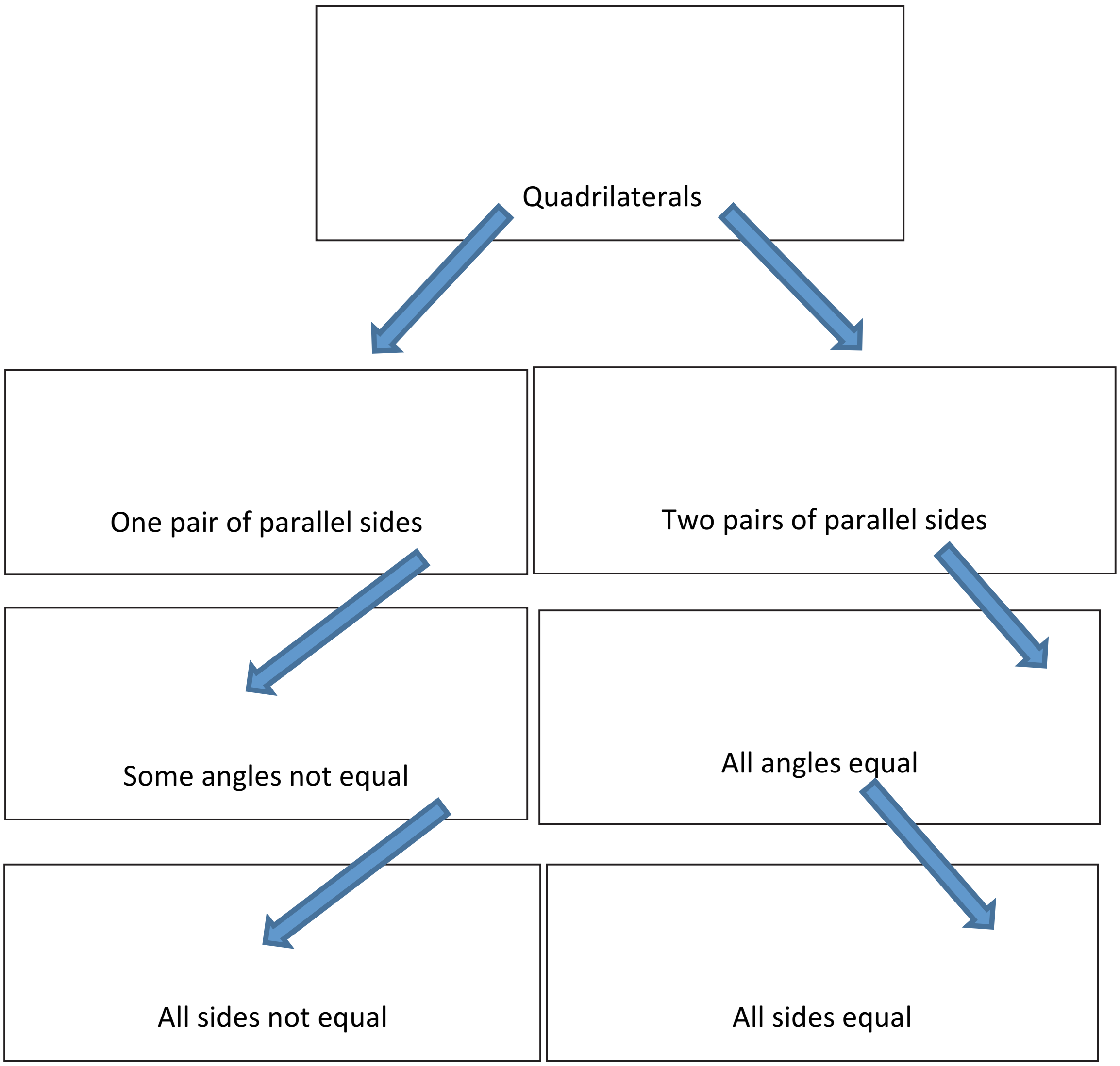
b) What kind of cake tins could you use to construct the cake? How would you construct each part and put it together?

c) Search recipes, magazines and online for children's birthday cake images. Seek out the more complex cakes that have component parts. Name the cake. List the component parts. Provide instructions or a diagram to show someone what they need to do to the component parts in order to construct the cake. Use the table below to show your thinking.

Cake	Component parts	Instructions for construction of the cake

Reflection on Learning

1. Consider this family tree of shapes. In each box sketch examples of the shape. The arrow indicates that the following shape must retain the properties of the previous shape. For example the shapes in the box labelled 'Not all angles equal' must also be a quadrilateral that has one pair of parallel sides.



a) In each box label the different shapes sketched.

b) Compare the shapes you sketched with a partner. Delete or add any shapes based on your discussion with your partner.

c) Write a definition for each shape below using the attributes above and the least amount of words you can.

(i) Quadrilateral: (ii) Parallelogram: (iii) Square:

2. In the table below sketch two different objects that fit each category. Tick the PROPERTIES that match the object category in the heading.

	Polyhedrons	Regular Polyhedrons	Prisms	Pyramids	Cylinders
SKETCHES					
PROPERTIES All faces are polygons					
All faces congruent					
End faces congruent and parallel					
Side faces rectangles					
Side faces triangles					

3. Consider the objects below. List the parts. What is the function of the component parts? The first one has been completed for you.

Object	Component Shapes	Why are they that Shape?
	Hexagons	Hexagons fit together. Large space for shelving items
		
		
		

OLNA Practice Questions

1. Sue bought the following outdoor table for her garden. The table consists of a rectangular prism resting on two:

A. Polygons B. Cubes. C. Spheres D. Cylinders

2. The following object has:

A. 8 Faces 6 Edges 8 Vertices
B. 6 Faces 6 Edges 12 Vertices
C. 8 Faces 8 Edges 6 Vertices
D. 6 Faces 12 Edges 8 Vertices

Topic 2

Drawing Three Dimensional Objects

Mathematics Discussion

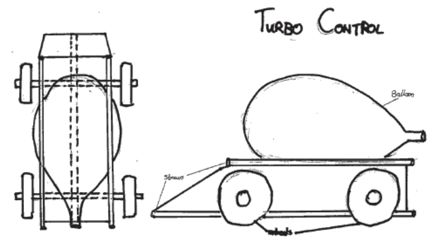
We need to be able to draw and interpret two dimensional representations of three dimensional objects. We can do this by orthographic, oblique, isometric or perspective drawings. Orthographic drawings are flat images of objects from different viewpoints. These kinds of views are also referred to as plans or elevations. Oblique, isometric and perspective diagrams help objects appear more real life or three dimensional. Choosing whether to draw an object from an orthographic, oblique, isometric or perspective view depends upon the purpose of the drawing.

Whole Class Activity 1

Think: How can we represent an object from different views?

PART A

Here are some real life examples of where front, side and/or top views have been drawn or filmed.

During a science project, James constructed a balloon powered car. He decided to sketch top and side views of the balloon powered car before he tested it out. Why do you think he might have done that?	
In the planning process of building a house, the architect started with drawing some floor plans. However, as these progressed, she also sketched some possible front and back views of the house. Why do you think she might have done those sketches? What can you see in these diagrams that you cannot see from a floor plan?	
This is an East facing elevation of a kitchen plan. Why do you think the draftsman might have made that drawing as part of the process of designing the kitchen space in a new house?	
Elizabeth Quay is a development on the banks of the Swan River in Perth. A drone is a device that films views of the earth. Use a search engine to find 'views of Elizabeth Quay from a drone'. How would the engineers and architects plans match this development on the Swan River foreshore? What view does the images from the drone show?	

These examples of *front, side or top views* of structures and objects are often called *plans and elevations.* A *plan* is a top view and *elevations* are views from the front, back and sides.

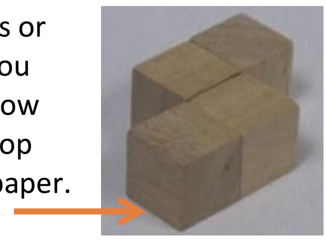
Watch the YouTube video https://www.youtube.com/watch?v=ekNqiLB8pL8 to deepen your understanding of plans and elevations.

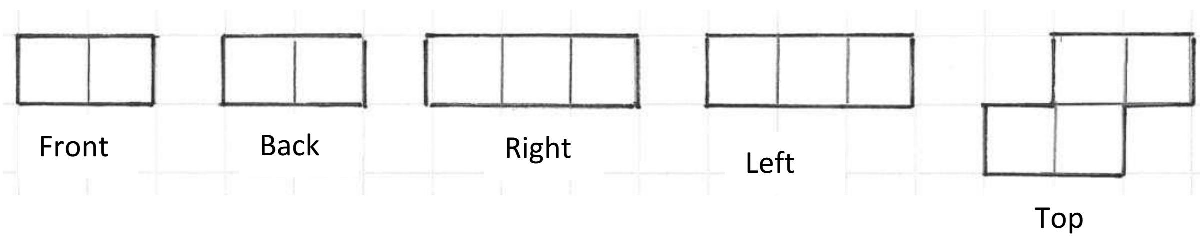
List 3 things you learnt from viewing this YouTube clip.

-
-
-

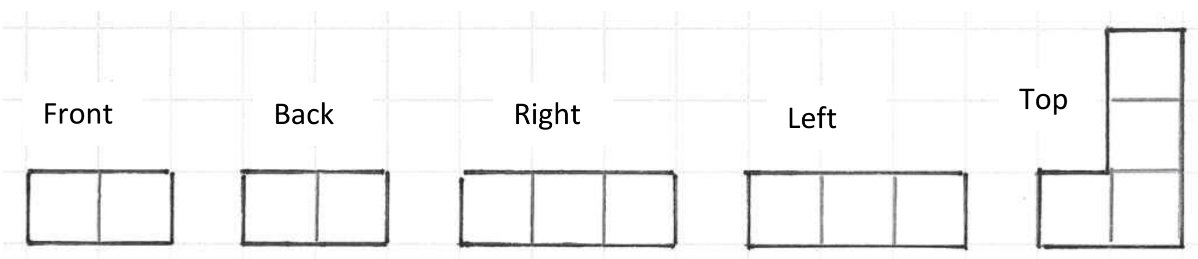
PART B

Here is an object made from four cubes. Notice there are no gaps or overlapping cubes. Edges are matched to other edges. Assume you are looking at the object front on, as indicated by the arrow. Below are orthographic drawings that show front, back, left, right and top views of this object. The drawings are made on centimetre grid paper.





Below is another set of orthographic drawings of a different object.



A

B

C

D

Which object has been drawn? How do you know?

What is an orthographic drawing? Share your definitions with a partner and class members.

Practice Exercise 1

1 a) Fold an A4 sheet of one centimetre grid paper into four. Label each of the quarters of the paper OBJECT 1, OBJECT 2, OBJECT 3 and OBJECT 4.

b) Use six cubes to construct a solid. Match the faces of adjacent cubes exactly, with no overlapping. Decide which view is going to be the front. Look at your object from the front. Draw the front view, the back view, the left hand side view, the right hand side view and the top, in the space under the label, OBJECT 1

c) Dismantle your object. Use your drawing as a guide to rebuild your object to check that your drawings accurately represent your object.

d) Build a different object using 6 cubes and draw the different views under the label OBJECT 2. Dismantle and rebuild your object using the views in your drawings.

e) Repeat for OBJECTS 3 and 4.

f) Swap your page with another student and use their drawing to recreate the objects. Check with your partner that the objects built are correct.

2. Use a search engine to find *Images for Orthographic Drawings* to see other objects represented this way. Create a table in a word document with two columns. Copy and paste some images that are of interest to you into the first column of the table. In the second column, write why an orthographic representation might have been used for that object.

3. Paddo wanted to purchase a set of bedside tables but could not afford any that he saw advertised. He saw a simple table that his friend has made out of spare pieces of wood. He thought he could use this design as a basis to make his bedside table.

a) What dimensions would make this structure suitable as a bedside table. How high, wide and deep should the table be in order to be useful?

b) Use centimetre square paper and sketch the front, side and top views of the structure incorporating the dimensions you have decided on. Consider that 10 centimetres on the real object can be represented by one centimetre on the grid paper.

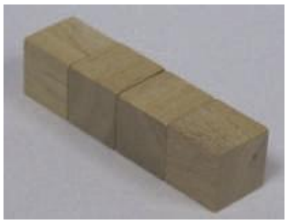
c) Share your diagrams with another student. Justify how you decided on the dimensions of your beside table and how you represented those measurements in each of your views.

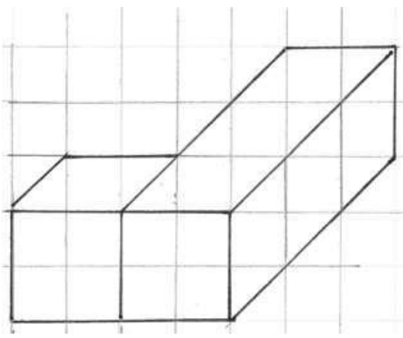
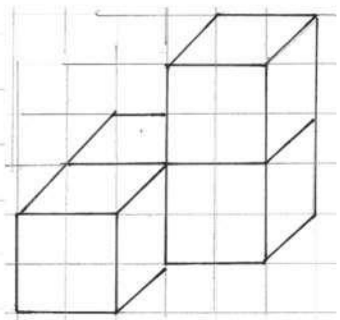
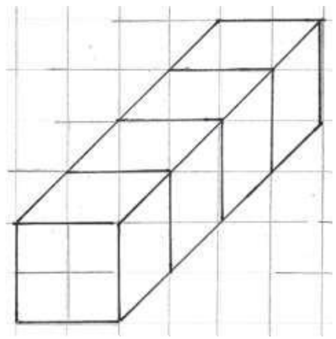
d) Consider putting in a horizontal beam under the table top to make some shelving space. What view would change? Draw diagrams showing the change in design. Staple your drawings to the side of this page.

Whole Class Activity 2

Think: How can we represent and interpret oblique drawings of simple objects?

Here are some simple objects made from four cubes. Examine the oblique drawings of those objects, made on centimetre squared paper. Draw a line between the object and an oblique drawing of the object.



Use cubes to build the objects in the drawings above. Orient your structure so that the front of your objects matches the front of the drawings.

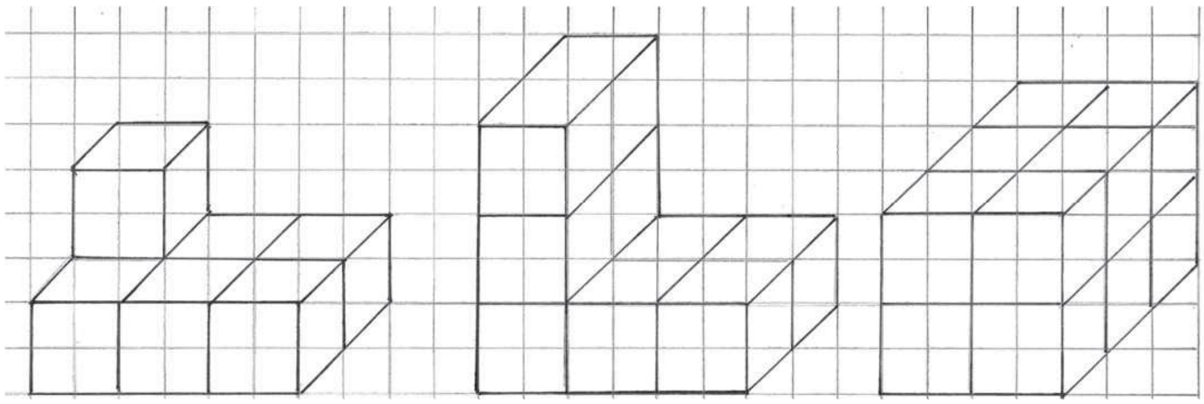
What do you notice about how many grid squares are used in the drawing to represent a front view of one square cube face on the real object?

What do you notice about how many diagonals on the grid represent the depth of one cube on the real object?

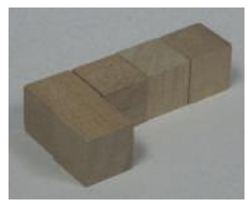
What is an oblique drawing? Share your definitions with a partner and class members.

On centimetre grid paper, draw one cube obliquely. Connect two cubes together and draw this object obliquely. Repeat by connecting three cubes and then four. Start by arranging the objects so that you can clearly see the front face and commence your drawing with the front face. Staple your drawings to the side of this page.

Using cubes, construct the structures represented by oblique drawings below.



Use squared grid paper and make oblique drawings of the structures below. Staple your drawings to the side of this page.

Practice Exercise 2

1 a) Fold an A4 sheet of one centimetre grid paper into four. Label each of the quarters of the paper OBJECT 1, OBJECT 2, OBJECT 3 and OBJECT 4.

b) Use six cubes to construct a solid, with the faces of adjacent cubes matching exactly and with no overlapping. Decide which view is going to be the front. Draw an oblique drawing of this object.

c) Dismantle your object. Use your drawing as a guide to rebuild your object to check that your drawings accurately represent your object.

d) Build a different object using 6 cubes and draw an oblique drawing of this object under the label OBJECT 2. Dismantle and rebuild your object using the views in your drawings.

e) Repeat for OBJECTS 3 and 4.

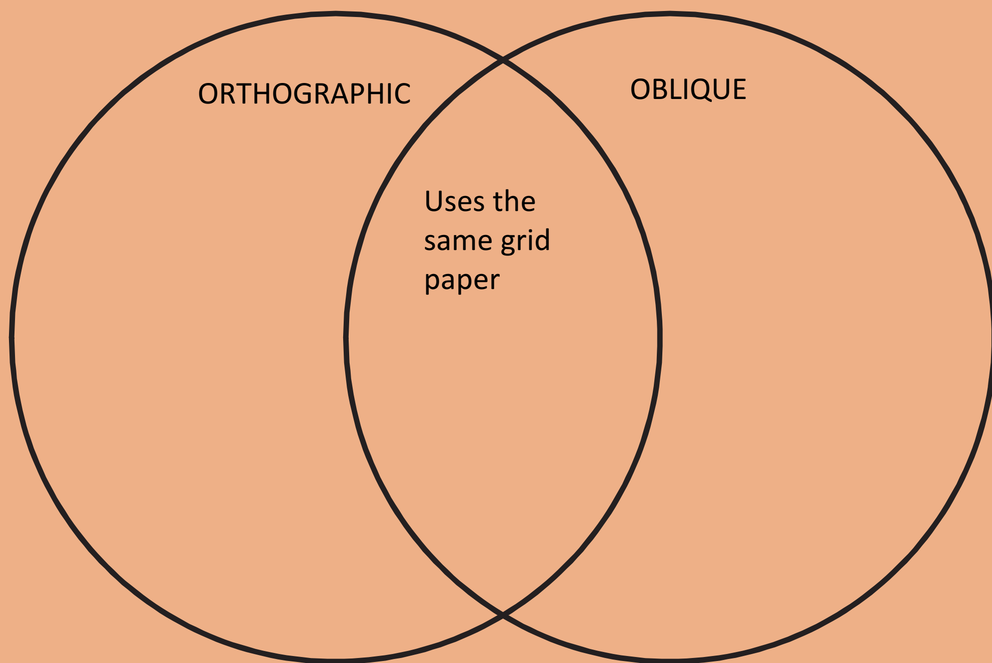
f) Swap your page with another student and use their drawing to recreate the objects. Check with your partner that the objects built are correct.

2. Use a search engine to find *Images for Oblique Drawings* to see other objects represented this way. Create a table in a word document with two columns. Copy and paste some images that are of interest to you into the first column of the table. In the second column, write why an oblique representation might have been used for that object.

3. Refer back to the diagrams you made of the bedside table in Practice Exercise 1. Using 5 mm square grid paper, make an oblique drawing of your proposed table. Consider that 10 cm of the real object can be represented by 5 mm on the grid paper.

Reflection and Discussion

We use square grid paper to make drawings of objects from orthographic (front, top and side) and oblique views. What else is the same and what is different about those two types of drawing? Show this in a Venn diagram.

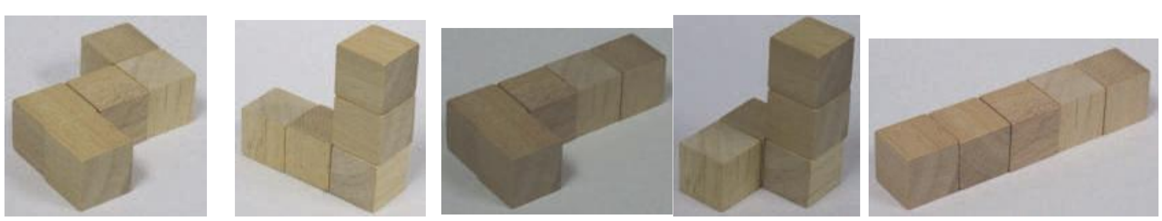


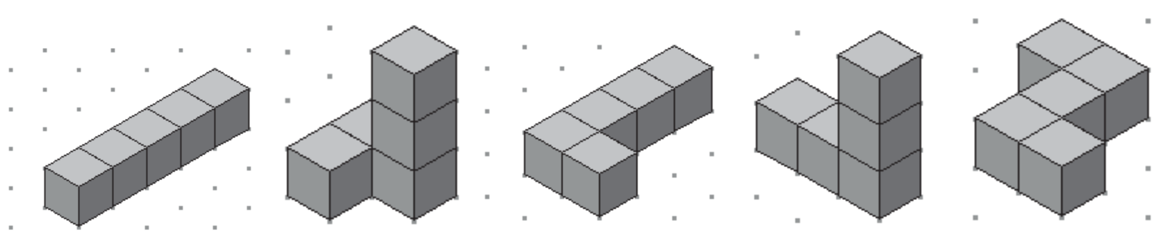
Whole Class Activity 3

Think: How can we represent and interpret isometric drawings of simple objects?

PART A

Here are some simple objects made from five cubes. Examine the isometric drawings of those objects. Draw a line between the object and the oblique drawing of the object.





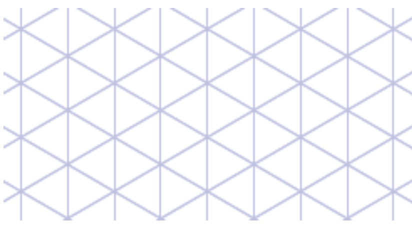
What do you notice about the type of grid paper used?

What do you notice about the way the front blocks are oriented in relation to the grid lines? How do you orient your structure to get started?

What is an isometric drawing? Share your definitions with a partner and class members.

When using A4 sheets of isometric grid or dot paper to draw 3D objects, the paper needs to be placed in a landscape orientation and not in portrait orientation.

CORRECT



INCORRECT

On isometric grid paper, draw one cube. Connect two cubes together and draw this combined object isometrically. Repeat by connecting three cubes and then four. Start by arranging the objects so that you can clearly see the 'Y' in the leading edge of the object. Commence your drawing by firstly drawing the 'Y'. Check your drawings with your partner. Staple your drawings to the side of this page.

Practice Exercise 3

1 a) Fold an A4 sheet of one centimetre grid paper into four. Label each of the quarters of the paper OBJECT 1, OBJECT 2, OBJECT 3 and OBJECT 4.

b) Use six cubes to construct a solid, with the faces of adjacent cubes matching exactly and with no overlapping. Slightly turn your structure so that a front vertical line on the object can be your starting point. Draw an isometric drawing of this object.

c) Dismantle your object. Use your drawing as a guide to rebuild your object to check that your drawings accurately represent your object.

d) Build a different object using 6 cubes and draw an isometric drawing of this object under the label OBJECT 2. Dismantle and rebuild your object using the views in your drawings.

e) Repeat for OBJECTS 3 and 4.

f) Swap your page with another student and use their drawing to recreate the objects. Check with your partner that the objects built are correct.

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2. Use a search engine to find *Images for isometric drawings* to see other objects and structures represented this way. Look for examples that are relevant and of interest to you. Create a table in a word document with two columns. Copy and paste some isometric images into the first column of the table. In the second column, write why an isometric representation might have been used for that object.

3. Make some different six cube structures. Use the Illuminations interactive *Isometric Drawing Tool* found at this site: https://illuminations.nctm.org/Activity.aspx?id=4182 to produce drawings of these cube structures. Print and staple some examples to this page.

4. Paddo visited Lauren and saw what she had made in Building and Construction class. She had made this box from old planks and scrap parts from her father's shed. Paddo thought an isometric drawing would help him to think about how he could make one for himself.

The planks in the box were about 10 cm wide. Four planks formed the lid. Three planks formed the sides. The box was about 70 cm wide

Make an isometric drawing of the box. Assume a scale of 10 cm from point to point on the grid paper as can be seen on the left. Staple your isometric drawing to the side of this page.

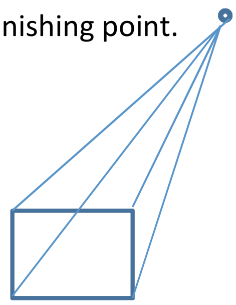
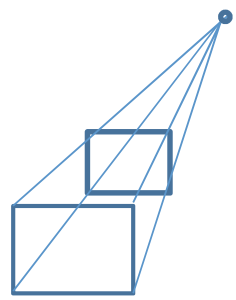
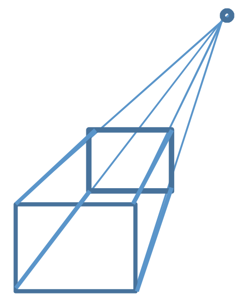
Reflection and Discussion

We use square grid paper to make drawings of objects from orthographic (front, top and side) and oblique views. What difference in the view you get when you use isometric grid paper?

Whole Class Activity 4

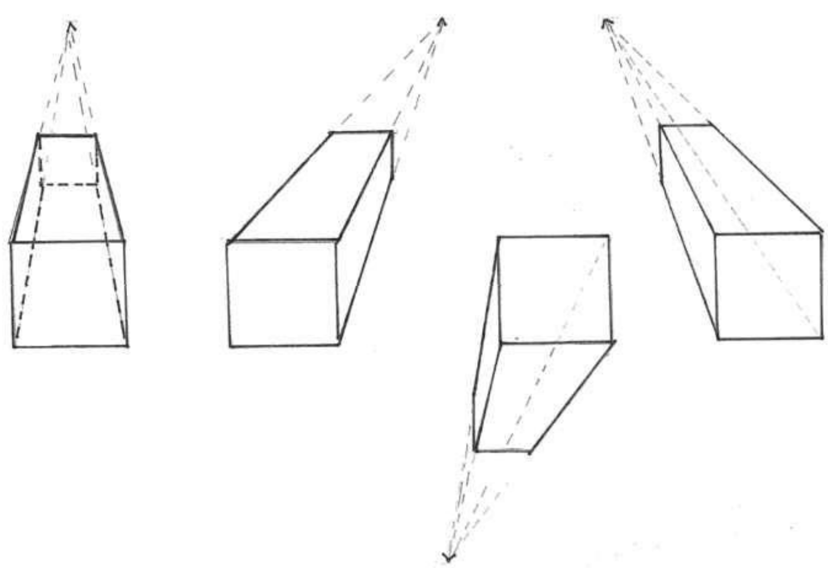
Think: How can we represent and interpret perspective drawings?

These steps show how to make a perspective drawing of a simple object. These drawings are made on a blank sheet of paper.

Step 1	Step 2	Step 3	Step 4
Draw the front face 	Place in a 'vanishing point'. Lightly draw a guideline from each corner to the vanishing point. 	Use the guidelines to size and place a smaller back face 	Mark in the edges to make your object stand out 

Perspective drawings make objects appear more true to life. We know that objects close to us appear larger than objects further away. You have probably noticed that parallel lines such as in roads and railway tracks appear to meet as we look towards the horizon. In perspective drawing parallel lines running away from the viewer come together at a point called a vanishing point.

Consider the following perspective sketches and write how the positioning of the vanishing point affects where the viewing point is. Use words such as above, below, left and right, to say where you are looking at the object from.



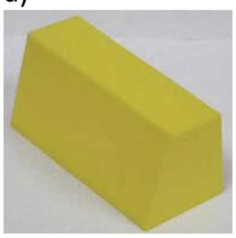
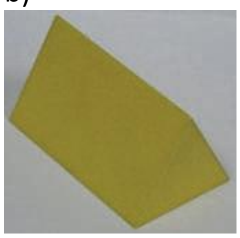
Access the following websites or carry out a search for sites that will help you learn more about perspective drawing.

1. http://www.bbc.co.uk/schools/gcsebitesize/design/graphics/drawingformalrev2.shtml

2. http://www.dummies.com/how-to/content/drawing-geometric-perspective.html

3.https://www.google.com.au/search?q=perspective+drawing+of+simple+objects&biw=1255&bih=747&tbm=isch&tbo=u&source=univ&sa=X&ved=0CBsQsARqFQoTCN7r7vf1gskCFQPHpgod3swKDw&dpr=1

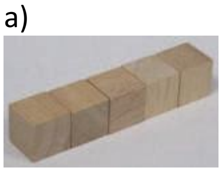
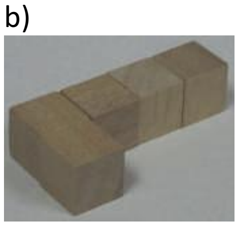
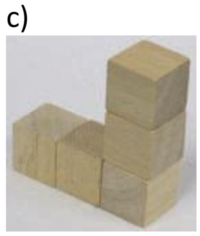
Draw each of these objects below using a perspective view on blank paper. To get started visualise the front face and draw that first.

a) 	b) 	 c)	 d)	e) Pentagonal Prism

Staple your drawings to the side of this page.

Practice Exercise 4

1. Use blocks to make each object below. Draw each using a perspective view. To get started, orient each structure so you get a front view of one face first. Select a 'vanishing point' to help complete the drawing. (You may need to work in pairs to draw d) and e).

a) 	b) 	c) 	 d)	e) 

2. Use a search engine to find *Images for perspective drawing of simple objects* to see other objects and structures represented this way. Look for examples that are relevant and of interest to you. Create a table in a word document with two columns. Copy and paste some perspective images into the first column of the table. In the second column, write why a perspective representation might have been used for that object.

3. Lauren visited Paddo and saw that he had made a shelf to fit this space in his Building and Construction class.

The shelf measured 70 cm wide, 65 cm high and 15 cm deep. Lauren thought a perspective drawing would help her to think about the structure and the dimensions so that she could make one for herself.

Use a blank sheet of paper or centimetre square grid paper and make a perspective sketch of this shelf. Insert the dimensions to make the drawing useful to plan from.

When you draw in the front face of the shelf consider using a simple scale of 10 cm to 1cm

Reflection on Learning

1. Consider using the three real life structures drawn in this topic.

For each of these scenarios, decide which kind of drawing you would find most useful in the following situations and explain why.

a) You are purchasing materials and need to think of the component parts of the bedside table.

b) You want the drawing of the box to look realistic as if you were taking a photo.

c) You want the drawing of the shelf to look three dimensional and scale matters.

d) You just need a quick sketch of the box, not to scale, so that you can label the dimensions.

e) You need to be able to see all of the faces of the shelf even those you cannot see from your view point.

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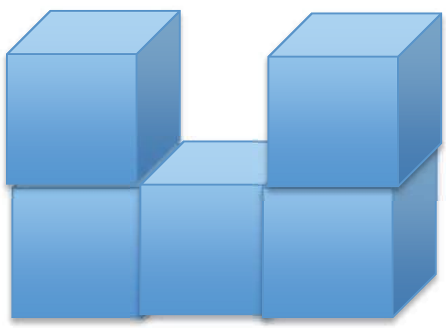
2. Examine your perspective drawings of the 6 block objects in Practice Exercise 4. Refer back to the isometric drawing of the 6 block objects in Practice Exercise 3. How are they the same and how are they different? Which drawing would you choose to use for those objects if you had a choice. Why?

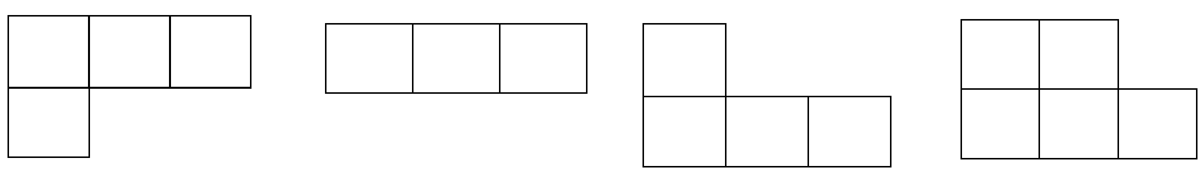
3. Select a simple object in your classroom to draw. You want the object to look three dimensional. Select a drawing technique and make a drawing of that object. Share and discuss your drawing and choice of technique with other students.

OLNA Practice Questions

1. John connects 5 blocks together as follows and then produces an orthographic representation of this object

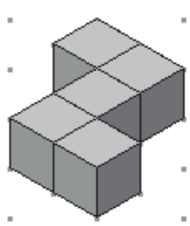


The top view would look like:



A B C D

2. The following diagram represents:



A. An isometric drawing B. A perspective drawing

C. An oblique drawing D. An orthographic drawing

Topic 3

Interpreting and Drawing Diagrams, Plans, Angles and Nets

Mathematics Discussion

Plans are diagrams used to show the organisation of objects in a confined space. Examples of plans include house plans, theatre plans and bus seating plans. The spaces between the objects and the objects themselves are drawn to the correct scale. When we interpret and create plans, we need a sense of size of the spaces and objects within the space, otherwise the plan is misleading. The features of plans are similar to that of maps. Plans often have titles, keys or legends, and a written scale.

There are also plans, diagrams and simple scale drawings that represent real life shapes and objects. Nets are the 2D representation of a 3D object. We will use what we have learnt about scale, to create nets that fold and form 3D objects and that can be used for packaging or containers.

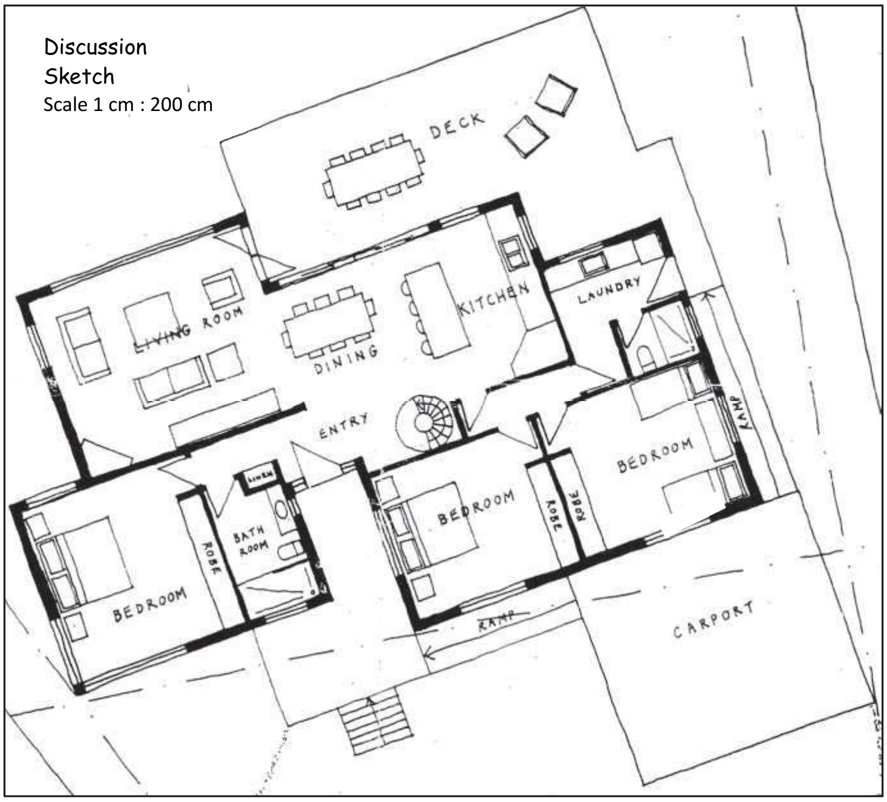
Angles measure the amount of turn. We use angle to describe movement, and to orient ourselves, and shapes and objects. The unit we use for measuring angle is a degree and the symbol is °. We can describe the amount of turn using degrees and direction. For example, creating a tessellation by turning a 2D shape 180° in a clockwise direction to fit next to another shape.

In this topic, we will be interpreting and drawing diagrams such as plans, angles, tessellations and nets.

Whole Class Activity 1

Think: How do we use and create plans of houses?

Here are two floor plans drawn during the planning phase of building a house. They are called Discussion Sketches.



What is the same and what is different between the plans?

Make a list below

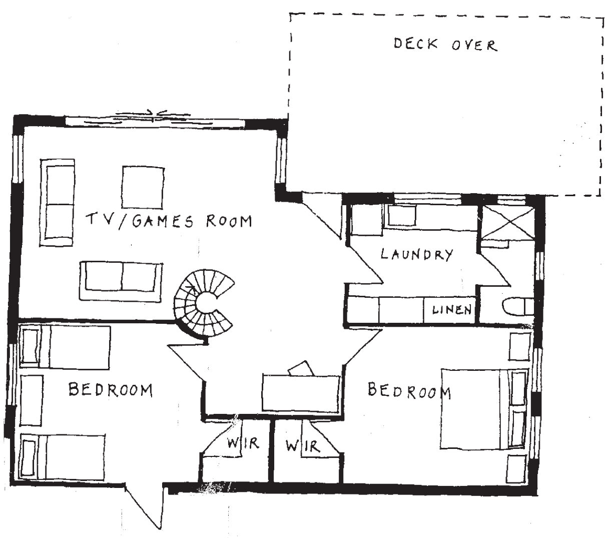
What do the different shapes and icons in the plans mean? Work with a partner, to label the shapes and icons on each of the plans.

Use the scale provided on the first plan. Calculate and label the dimensions of the following parts of the plan.

- The living room
- The carports
- The width of the stairs
- The width of the entry in the right hand plan

Why do you think it is important to know the dimensions of the rooms and the carport?

In thinking about fitting furniture into a plan, why do we only need two dimensions and not three dimensions?



This plan above does not give the dimensions of the rooms or have a scale legend.

A Queen sized bed has dimensions $1\frac{1}{2}$ m wide x 2 m long. How could you use the dimensions of a bed to estimate the dimensions of the bedrooms? How did you work that out?

A three seater lounge has dimensions 2 m wide by 1 m deep. A two seater lounge chair has dimensions $1\frac{1}{2}$ m wide x 1 m deep and a one seater lounge measures 1 m wide x 1 m deep.

How could you use the dimensions of the lounge chairs to estimate the dimensions of the TV/games room?

What could you measure in the laundry or the bathroom to help with estimating the dimensions of these rooms?

What are the dimensions of the laundry? What is the dimension of the bathroom? How did you work these dimensions out?

Practice Exercise 1

1. a) What is this a plan of?

b) What is the purpose of the plan?

c) Use the placement of furniture to estimate the dimensions of the rooms.

2. Use a Word document and collate a gallery of screen shots of two bedroom apartment floor plans. Use a search phrase such as *Apartments for sale in South Perth*. Use a snipping tool or a tool to take screen shots of each floor plan and paste into your word document.

a) Group plans together that show:

- The dimensions of the rooms
- A scale legend
- The area of the spaces but not the dimensions
- The furniture in the apartment to provide a sense of scale

b) Which of the ways listed above, that show size and space, were the most common out of the plans you found?

c) If you were purchasing an apartment, which plan would you prefer to have? Why?

3. Use an online interactive planning tool to design floor plans. Search for sites such as *Free Online Virtual Room Programs and Tools.* An example of one that you might use is Planner 5D found at https://planner5d.com/e/.

Access the program and press the *Create a Project* tab. You will start from *scratch*. See the toolbar functions on the right and a catalogue on the left. As a guide, match the floor plan dimensions to one of the plans in Whole Class Activity 1.

Create a lounge room (living room) plan by following these steps:
a) Drag and drop rulers from the tool bar along the length and width of your room. Use the ruler as a guide to set the dimensions of the room.

a) Place in windows

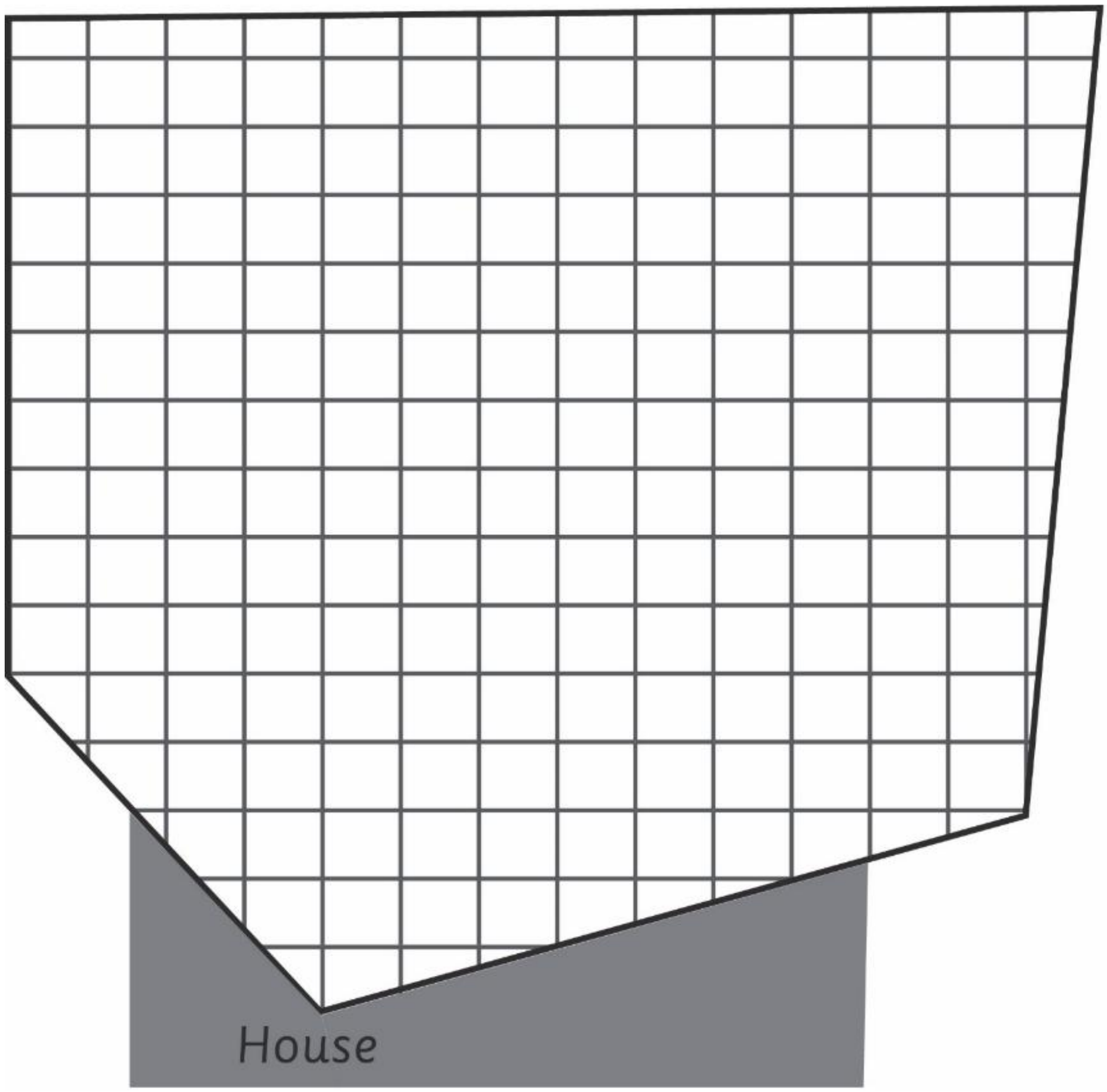
b) Click and drag in furniture. Access the items *without* a lock icon.

c) Rotate and slide furniture to orient it to the position you want.

d) Use the 3D icon to move to a three dimensional view of your plan.

Select another room from one of the plans in Whole Class Activity 1 and create your own arrangement of furniture. Print your plans and staple them to the side of this page.

4. You are working for a landscape designer. He has given you the job of planning an outdoor area for Mr and Mrs Thompson's backyard. Here is the outline of the garden area.



Mr and Mrs Thompson would like a spa, a barbecue area, lawn, patio area, garden beds and a storage shed in their backyard.

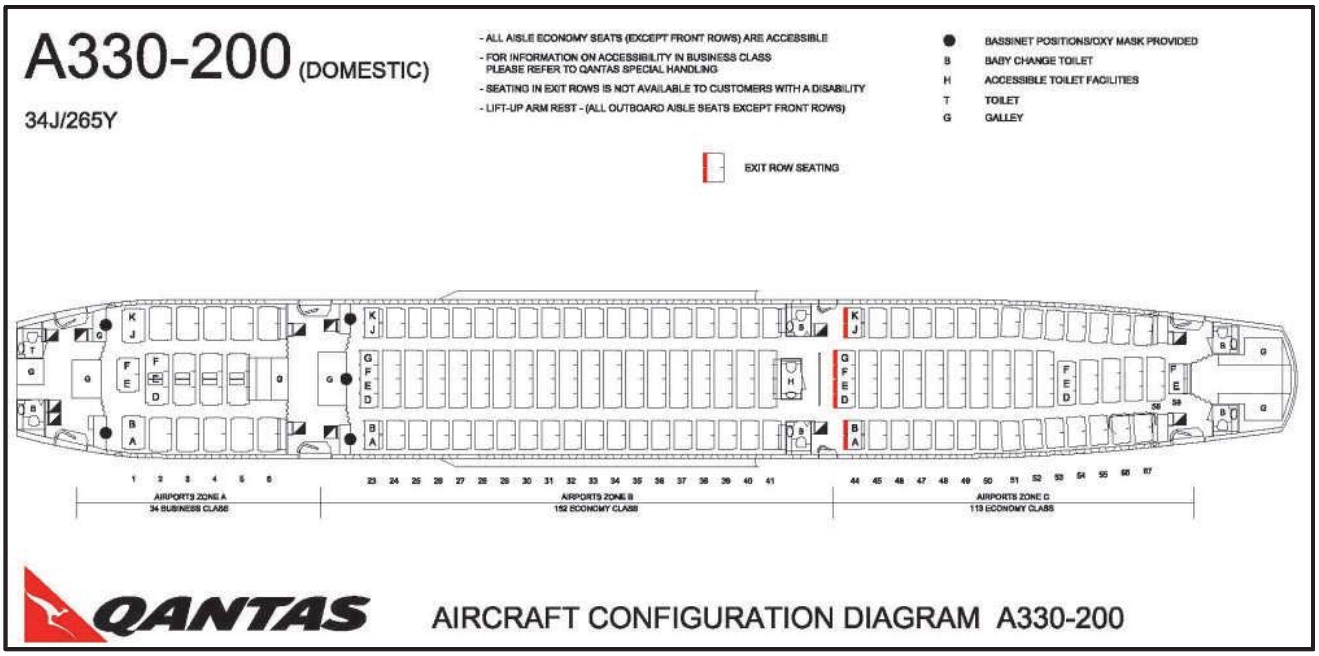
Create a plan of the garden to present to Mr and Mrs Thompson.

Whole Class Activity 2

Think: How do we use and create plans of other real life structures?

Plans are used to show the organisation of objects in a fairly confined space, such as those seen in Whole Class Activity 1. The position of the objects and the objects themselves are drawn to show the correct scale.

Here is an example of a plan that shows the organisation of objects in a confined space but this plan does not relate to houses.



What is this a plan of?

What is the purpose of the plan?

Use the plan to answer the following questions.

a) Put a cross on seat 32D.

b) Which row number is the exit row?

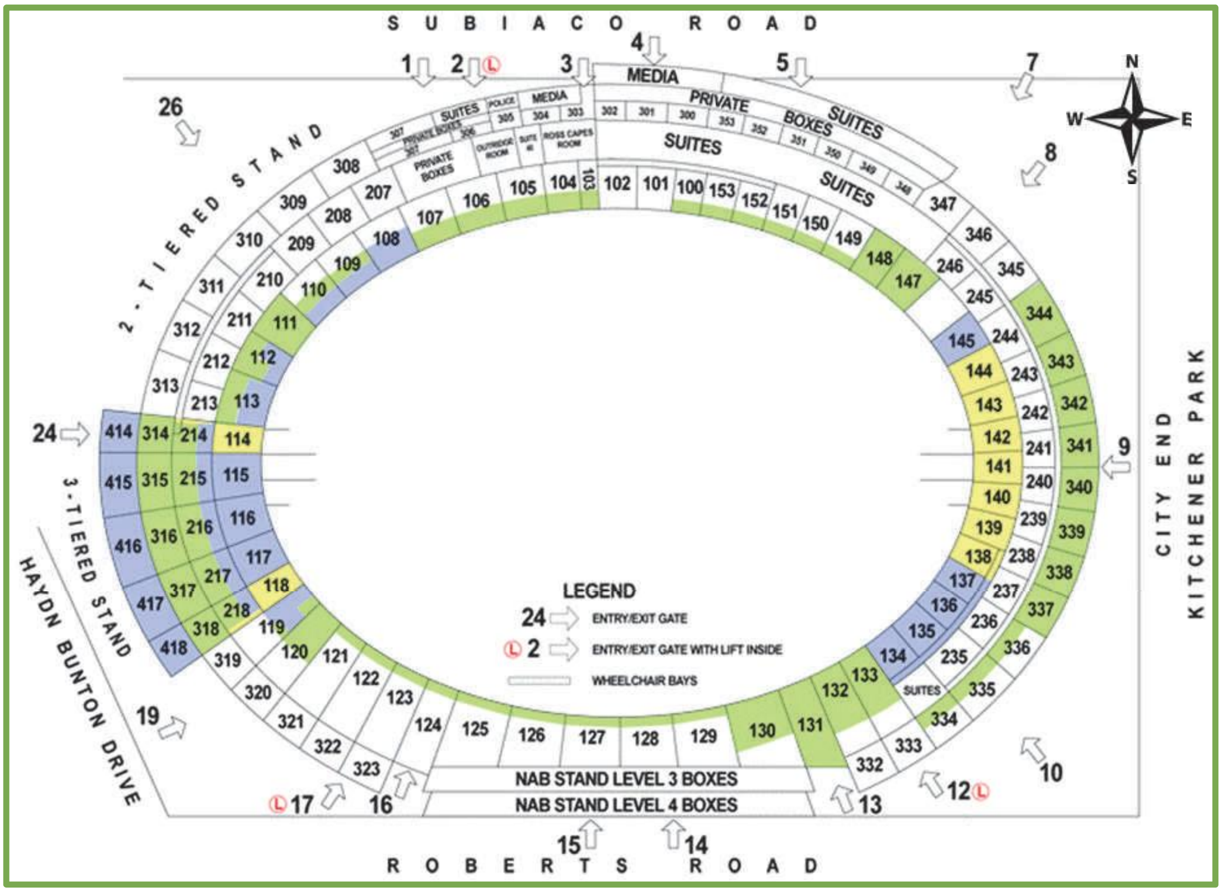
c) Circle the toilets.

d) Put a box around the business class section.

What is it in the plan that gives you a sense of order, direction and scale?

Practice Exercise 2

1. This is a plan of Domain Stadium. Use it to answer the following questions.



a) If you are sitting in section 141, which entrance is the closest?

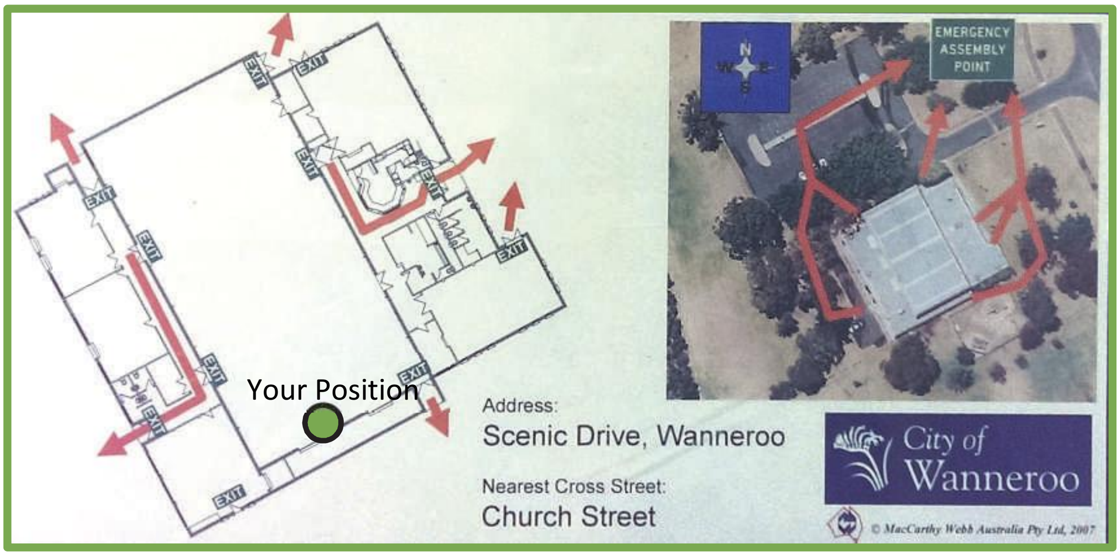
b) Which direction is the 3 Tiered Stand in?

c) On which side of the oval is the NAB stand?

d) Which road is on the Northern side of the oval?

e) Where are the goal posts?

2. Below is a plan of the Wanneroo Shire Offices. Describe, using key features in the plan such as exit points and windows, how to move from your position to the Emergency Assembly Point. Use compass directions in your exit description.



3 a) Measure the dimensions of the top view of your desk. Use 1 cm grid paper to create a scale drawing of this view. Write the scale you used next to the drawing.

b) On your desk, place a few objects (e.g. laptop, book, pen, scissors etc.). Draw these objects to scale on the grid paper plan of your desk.

Whole Class Activity 3

Think: How can we use what we have learnt about plans and scale to draw nets of simple objects?

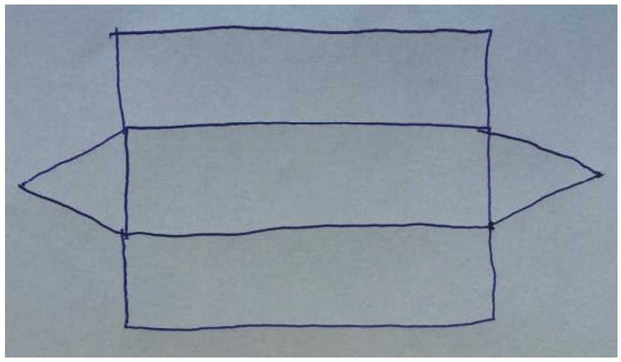
Riley was designing a package for a stationery business. The business wanted a package that would hold 10 coloured pencils. Riley thought that a triangular prism would make a good package.

Why would Riley think a triangular prism would be a good package?

How could the pencils be stacked within a triangular prism? Draw a sketch to show your thinking.

How could you use the dimensions of the pencils to determine the size of the package?

Riley drew a sketch diagram of the *net* of the triangular prism.



Using the measurements of the 10 pencils as a guideline, label Riley's sketch with the exact measurements needed to produce the final package.

Riley knows that the package will need to have small flaps so as to join the faces and edges of the prism. What is the minimum number of flaps needed to connect all faces? Draw these on the net above.

Consider how the package will be opened and how a customer would remove the pencils from the prism. Make any adjustments necessary to the sketch of the net above.

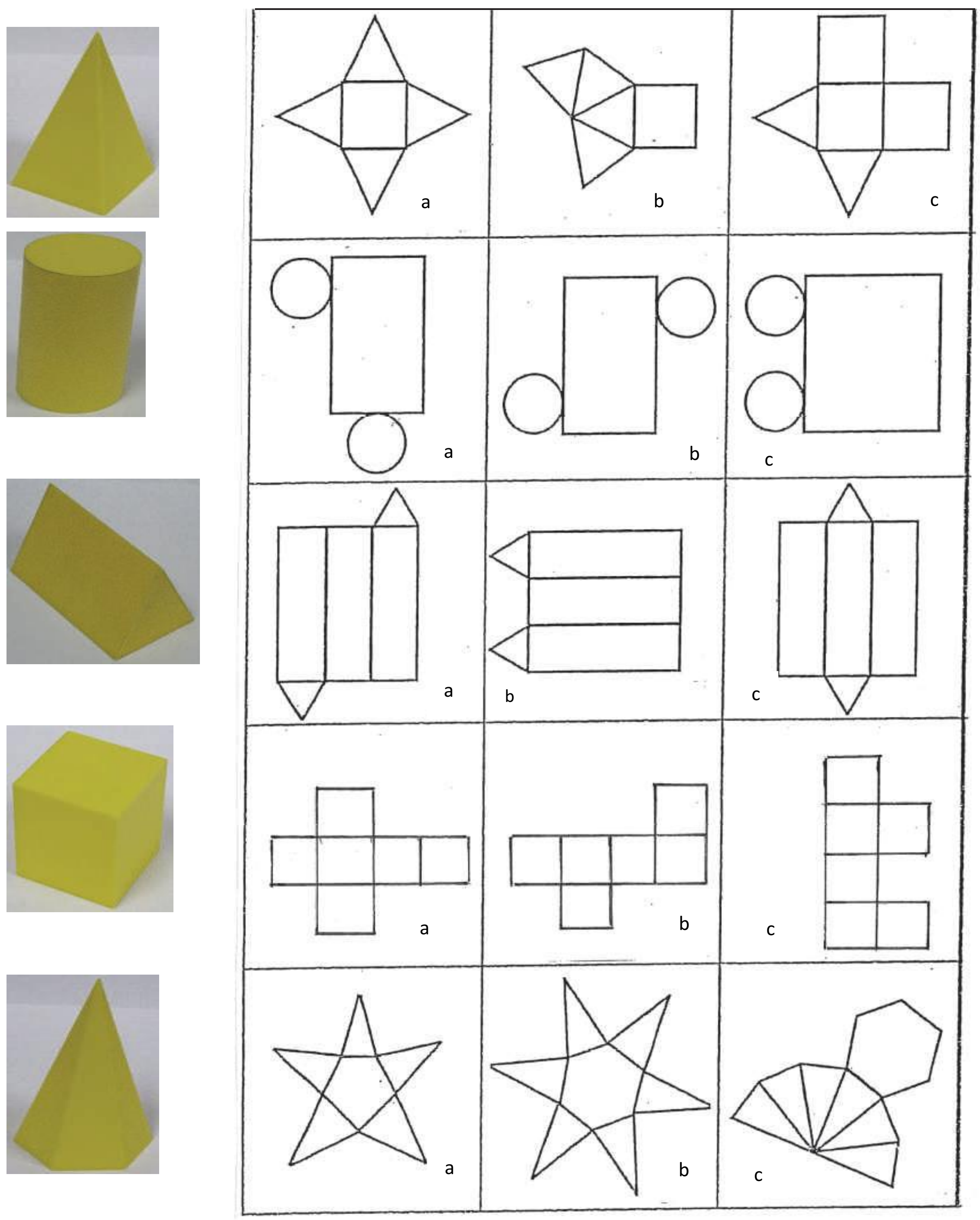
Using coloured card, carefully draw the exact net of the triangular prism. Cut out the template and construct the prism.

How could you check the accuracy of your package?

Compare your prism to your classmates. What changes, if any, are necessary to improve the triangular prism package?

Practice Exercise 3

1. Decide which net(s) in the row next to the object match each object. Tick the net that will make the object.



2. This box below is 26 cm wide, 4 cm high and 18 cm deep. Make a sketch of the box, using an appropriate drawing, so that you can show the dimensions. Do a rough sketch of the net of the box and show the dimensions. Now use square centimetre grid paper to draw the net to scale. Consider that every 2 cm of the real object could be represented by 1cm on the grid paper; that is use a scale of 2 cm to 1 cm.

3. Make sketch diagrams of a net for each object below. Open a Word document on your computer. Locate and press the Insert tab and the Shapes button on the toolbar. Insert and manipulate shapes to make a net of each object. Save, print and staple your diagrams to the side of this page.

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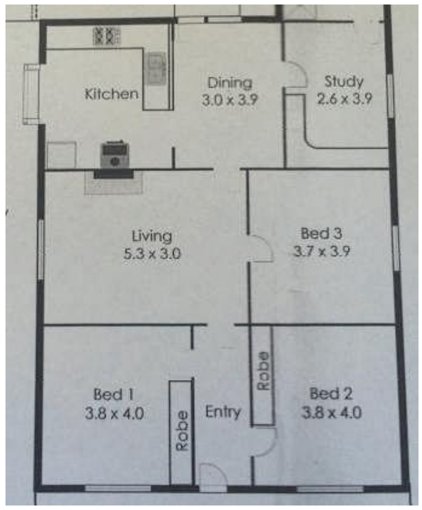
Whole Class Activity 4

Think: How can we use angle to orient ourselves and other shapes and objects?

The following scale diagram shows part of a house plan.



If you were standing in the middle of the Kitchen, facing the sink and you turned 90° in an anticlockwise direction, what would you be facing?

If you were standing in the middle of Bedroom 2 facing the window and turned anticlockwise 270°, what would you be facing?

If you were standing in Bedroom 1, facing the window and turned 180° in a clockwise direction and then another 180° in a clockwise direction, what would you be facing? How could you describe these two turns as one complete turn?

If you were standing in the middle of the living room facing the window, describe using clockwise and anticlockwise and the amount of turn, how you would get to the front door in the Entry.

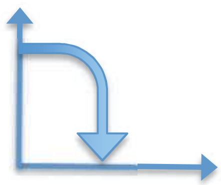
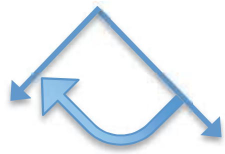
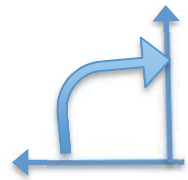
Compare your directions in the situation above, to a partner's directions. Were they the same? Why or why not?

If you were standing in the middle of the study facing a desk in front of the window, describe using clockwise and anticlockwise and the amount of turn, how you would carry the small desk into Bedroom 3.

Compare your directions in the situation above, to a partner's directions. Were they the same? Why or why not?

Practice Exercise 4

1. The following angles could all be described as turning in a clockwise direction 90°. This can also be described as turning in a right angle

Draw angles to represent:

a) Turning 180° in an anticlockwise direction

b) Turning a right angle in an anticlockwise direction

c) Turning 270° in a clockwise direction

d) Turning 360° in an anticlockwise direction

e) Turning 180° in a clockwise direction

f) Turning 45° in a clockwise direction

Reflection and Discussion

Circle the problems in question 1 that resulted in the same angle being drawn. Explain why different descriptions of direction rotated and degrees turned, can result in the same angle.

Compare your angle drawing with a partner. What was the same about your angles? What was different?

If your class was asked to draw an angle that started by facing north and turning in a clockwise direction of 90°, would the angles you all drew be the same or different? Explain.

Write instructions to match the following angle.

2. Follow these instructions:

a) Stand in front of your desk facing the front of the room.

b) Turn 90° in a clockwise direction and walk three paces.

c) Turn 270° in an anticlockwise direction and walk two paces

d) Turn 180° in a clockwise direction and walk three paces

e) Turn 90° in an anticlockwise direction and walk three paces

f) Where have you ended up in relation to your starting point?

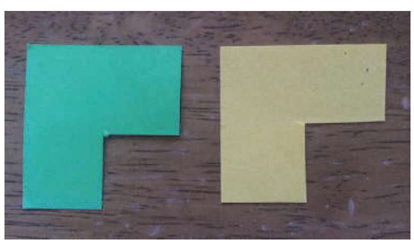
3. Choose an area in your school to write instructions for a planned walk for another class member. In your instructions, use compass bearings to orientate your partner. For example, 'stand in front of the water fountain facing north. Turn 90° toward East and walk for 10 paces'. Swap your instructions with those from your classmate. Complete your classmate's walk. Where did you end their walk? Did it match where your classmate intended you to end it?

4. Play the following game to practise estimating the amount of turn.
http://www.kidsmathgamesonline.com/geometry/angles.html

Whole Class Activity 5

Thuy, a student at Kalbarri District High School, was making a tessellation in class. A tessellation is a pattern where all shapes fit together with no gaps or overlaps. A common example of a tessellation is a brick wall.

Thuy cut out these two shapes to start her tessellation:



How can the two shapes be joined together so that there are no gaps or overlaps?

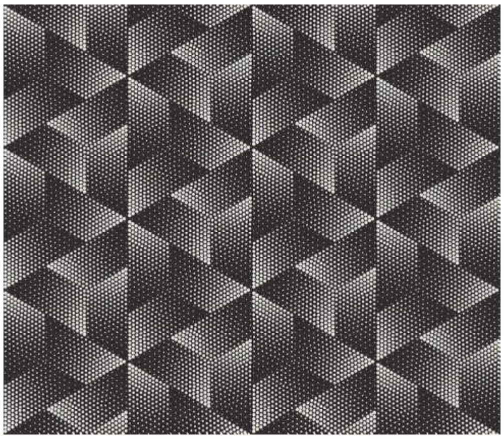
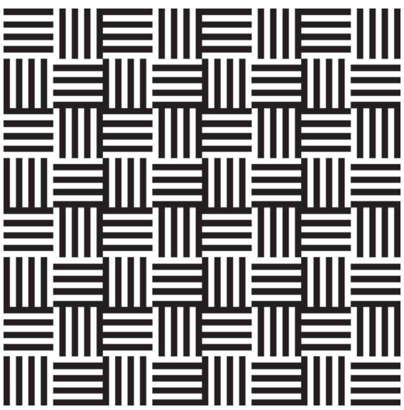
What angle would Thuy need to turn the lightest shape so as to fit exactly into the darkest shape?

Cut out two shapes exactly the same as Thuy's. Fit the two shapes together checking your thinking to your answers to the two questions above, as you go. Paste in the space below.

Using coloured A4 paper, complete a tessellation to completely cover the page. You may use Thuy's example or design another shape where the second shape must be turned to fit into the first.

Practice Exercise 5

1. In the table below are two examples of tessellations. Explain how the shapes within the tessellation have been turned to fit into each other and create a pattern.

TESSELLATION	EXPLANATION OF PATTERN
	
	

2. Use a search engine to find a tessellation creator such as the one below:
https://illuminations.nctm.org/Activity.aspx?id=3533
Create a tessellation using this software. Show your partner and describe how you built this tessellation.

3. a) Open a blank word document on your laptop or computer. Select *Insert* and then *Shape* and from the *Basic Shapes* category select a right angle triangle. Drag the right angle triangle into your blank word document and expand or dilate to your desired size. Copy your formatted triangle. Turn your copied triangle to fit into your first triangle.

b) How many degrees did you need to turn your copied triangle to fit into your first?
c) Complete this tessellation of right triangles. Save, print and staple to the side of this page.

Reflection on Learning

Use a search engine to find the plans for the following structures and complete the table below:

- The deck of a cruise ship that leaves the Fremantle port
- Perth Arena seating
- Floor plans of an apartment in Maylands

	Cruise Ship	Perth Arena	Maylands Apartment
Purpose of the plan			
Features on the plan			
How does the plan show scale and direction?			
Describe how to get from one section of the plan to another			

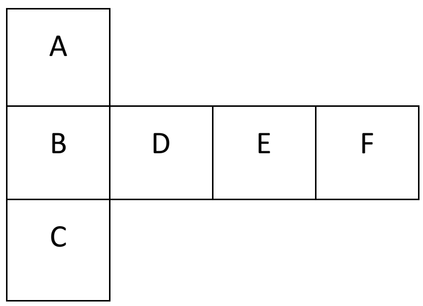
OLNA Practice Questions

1. This is a photo of Michael's kitchen. If Michael was facing the sink and he then turned 270° in a clockwise direction, he would most likely be facing the:

A. Refrigerator B. Stove C. Door D. Sink again

2. Dale folds this net to make a cube. Circle the face which is opposite F?

A. B. C. D. E.



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Answers

Section: The Four Operations - Whole Numbers and Money

Topic 1: Choosing an Operation to Solve Everyday Problems

PRACTICE EXERCISE I
1. Answers will vary. Check with a partner.
2. Problems best solved using addition or subtraction: (a), (c), (e), (f)
3a) A. 65 + 18 = ?; B. addition; C. 65 + 18 = ?
c) A. 19.78 + ? = 27.50; B. subtraction; C. 27.50 – 19.78 = ?
e) A. 50 - ? = 35.75 B. subtraction; C. 50 – 35.75 = ?
f) A. 14.25 + ? = 41.75; B. subtraction; C. 41.75 – 14.25 = ?
4. 6.25 – 4.85; 20 – 12.5; 237 – 115; 7 × 12.5; 54 – 23; 27 + 46

PRACTICE EXERCISE 2
1. Answers will vary. Check with a partner.
2. Problems best solved using multiplication or division: (a), (b), (d), (e), (f)
3a) A. 2 × 30 = ?; B. multiplication; C. 2 × 30 = ?
b) A. 16 × 7 = ?; B. multiplication; C. 16 × 7 = ?
d) A. 250 × ? = 55 440; B. division; C. 55 440 ÷ 250 = ?
e) A. 39 ÷ 13 = ?; B. division; C. 39 ÷ 13 = ?
f) A. 723 ÷ ? = 3; B. division; C. 723 ÷ 3 = ?
4. 190 × 172; 115 ÷ 23; 17 400 ÷ 145; 23 – 21.5; 2 × 21.5; 23 ÷ 6

PRACTICE EXERCISE 3
1.a) 161 ÷ 7 b) 161 – 7 c) 161 × 7 d) 161 + 7 e) 161 ÷ 7
2a) 320 × 160 b) 320 + 160 c) 320 – 160 d) 320 ÷ 160 e) 320 – 160
3. b) 138 × 26 =; multiplication; 138 × 26 =
c) 10 000 ÷ 52 =; division or multiplication; 10 000 ÷ 52 =
d) ? – 152 = 789.74; addition; 789.74 + 152 =
4.a) 30 ÷ 5 b) 8 + 3 c) 30 × 5 d) 8 – 3 e) 30 + 5
5a) 11 600 ÷ 8 b) 11 600 + 8 400 c) 42 ÷ 8 d) 11 600 × 8 e) 11 600 – 8 400 f) 42 × 8

REFELECTION ON LEARNING
A. Problems circled in blue; 2, 4, 5, 7
Problems circled in red; 1 , 3, 6, 8, 9, 10
B. ADDITION AND SUBTRACTION PROBLEMS
2. ? + 235 = 1 078

?	235
1 078	

1 078 – 235 =
4. 438 000 – 27 565 = ?

27565	?
438000	

438 000 – 27 565 =
5. 32 + ? = 47

32	?
47	

47 - 32 =
7. 745 + 659 = ?

745	659
?	

745 + 659 =
MULTIPLICATION AND DIVISION PROBLEMS
1. 6 × 35 = ?
SIZE OF GROUP ($35)
TOTAL (?) Number of groups (6)
6 × 35 =

3. 5 × 85 = ?
SIZE OF GROUP (85)
TOTAL (?) Number of groups (5)
3.5 × 85 =

6. 8 × ?= 3 880
SIZE OF GROUP ($?)
TOTAL (3 880) Number of groups (8)
3 880 ÷ 8 =

8. ? × 17 = 731
SIZE OF GROUP (?)
TOTAL (731) Number of groups (17)
731 ÷ 17 =

9. 14 × 11 = ?
SIZE OF GROUP (14)
TOTAL (?) Number of groups (11)
14 × 11 =
10. 52 ÷ 13 = ?
SIZE OF GROUP (?)
TOTAL (52) Number of groups (13)
52 ÷ 13 =

OLNA PRACTICE QUESTIONS
1. B 2. D

Topic 2: Choosing an Operation and Using Mental Strategies to Solve Everyday Problems

PRACTICE EXERCISE 1
1. Number sentences and strategies may vary. Check with your teacher if you have different answers.
a) Exact; Mental or jottings; Addition or Subtraction; ? + 25.55 = 50 or 50 – 25.55 = ?; 50 – 25 – 0.50 – 0.05 = $24.45; Yes
b) Exact; Mental or jottings; Addition; 135 + 85 = ?; 130 + 70 + 5 + 15 = 220; Yes
c) Approximate; Calculator; Addition or Subtraction; 20 – (9 + 4.50 + 6.60) = ?; 20 – (9 + 11.10) = 20 – 20.10; No, not enough money in wallet; Yes
d) Exact; Mental or jottings; Addition; 34 + 52 = ?; 30 + 50 + 4 + 2 = 86; Yes
2a) Exact answers. Banks deal with exact amounts.
b) Mentally with jottings if necessary. Numbers are straightforward.
c) Addition or subtraction

AMOUNT IN BANK	DEPOSIT	BALANCE
$70	$29	$99
$99	$19	$118
$118	$34	$152
$152	$70	$222
$222	$99	$321
$321	$87	$408
$408	$92	$500

d) Sarah's strategy of taking an amount from one number and adding it to another number in addition problems; Lauren's strategy of adding an amount to both numbers in a subtraction problem; Paddo's strategy of leaping along a number line; Jessie's strategy of counting forward for subtraction.
e) Use estimation and rounding
3a) 192 dollars b) 90 dollars c) 148 centimetres d) 95.05 dollars
e) 55.08 minutes f) 53.55 minutes

PRACTICE EXERCISE 2
1. Number sentences and strategies may vary. Check with your teacher if you have different answers.
a) Exact; Mental or jottings; Multiplication; 3 × 13 = ?; (3 × 10) + (3 × 3) = 30 + 9 = 39; Yes
b) Approximate; Mental or jottings; Multiplication; 6 × 3.19 ≈ 6 × 3.20; 6 × 3.20 = (6 × 3) + (6 × 0.20) = $19.20; Yes $20 is enough.
c) Exact; Mental or jottings; Multiplication or Division; 8 × ? = 64; 64 ÷ 8 = 8; Yes
d) Exact; Mental or jottings; Multiplication; 3 × 124 = ?; (3 × 100) + (3 × 20) + (3 × 4) = 300 + 60 + 12 = 372 minutes; Yes
2a) 104 dollars b) 9.1 m/sec c) 209 cm d) 23.96 dollars e) 42 photos
f) 4 kilograms
3a) $360 b) Thursday c) Monday d) 8 times

PRACTICE EXERCISE 3
1. Number sentences and strategies may vary. Check with your teacher if you have different answers.
a) Exact; Mental or jottings; Multiplication or Division; 3 × ? = 81; 81 ÷ 3 = ?; (60 ÷ 3) + (21 ÷ 3) = 27. Yes
b) Exact; Mental or jottings; Addition; 28 + 17= ?; 20 + 10 = 30, 8 + 7 = 15, 30 + 15 = 45; Yes
c) Exact; Mental or jottings; Addition or Subtraction; ? + 173.50 = 250 or 250 – 173.50 = ?; 250 – 170 – 3 - 0.50 = $76.50; Yes
d) Approximate; Mental or jottings; Multiplication; 1.47 × 19.99 = ? ≈ 1.5 × 20 = ?; $30; Yes
2. ADDITION (f) SUBTRACTION (d), (e) MULTIPLICATION (a), (b), (g) DIVISION (c), (h)
3a) Piotr would have saved $1 040 b) They would cost Amy $30.86
c) There would be 20 cups d) Milly would have 23 vintage records
e) Mia would have $670 in her account f) 88 bags of fruit
g) The rectangle would have an area of 1 824cm2 h) Each friend would receive $90
4.

POSITION	TEAM	WIN	LOSS	DRAW	POINTS
1.	Fremantle	16	2	0	64
2.	WC Eagles	13	4	1	54
3.	Hawthorn	13	5	0	52
4.	W Bulldogs	12	6	0	48
5.	Sydney Swans	12	6	0	72
6.	Nth Melbourne	11	7	0	44
7.	Richmond	11	7	0	44
8.	Geelong	10	7	0	40

a) 8 points b) 118 points in total c) They would expect to win 18 games
d) 68 points
5a) 141 liked white chocolate only b) 141 liked milk chocolate
c) True. 2 × 47 = 94 d) You would expect 141 to like both
6a) $5.40 b) $0.60 c) $16.20 d) 6 e) $20.40

REFLECTION ON LEARNING
Number sentences and strategies may vary. Check with your teacher if you have different answers.
SUBTRACTION AND A MENTAL STRATEGY
Question 5
840 – 50 = ?; 840 – 40 – 10 = 790; Jill had $790 left.
DIVISION AND A MENTAL STRATEGY
Question 2
64 ÷ 4 = ?; 40 ÷ 4 = 10, 24 ÷ 4 = 6, 64 ÷ 4 = 10 + 6 = 16. The side length is 16 cm.
ADDITION AND A MENTAL STRATEGY
Question 6

24.70 + 21.40 = ?; 24 + 21 = 45, 0.70 + 0.40 = 1.10, 45 + 1.10 = 46.10. Mr and Mrs Brown earned $46.10 combined.
MULTIPLICATION AND A MENTAL STRATEGY
Question 4
4 × 27 = ?; (4 × 20) + (4 × 7) = 108; Belinda travelled 108 km.

OLNA PRACTICE QUESTIONS
1. B   2. A

Topic 3: Using a Calculator or Spreadsheet to Solve Everyday Problems

PRACTICE EXERCISE 1
1. PROBLEMS BEST SOLVED BY CALULATOR: a, c, f; Reason - The problems have numbers that cannot easily be solved mentally and requires usually one, but sometimes a few steps on the way to a solution.
PROBLEMS BEST SOLVED BY SPREADSHEET: b, d, e; Reason – In the problems, we need to calculate a lot of data or data that sometimes needs to be changed or added to.
2a) In cell B8 will be $1824.20
b) $1913.30
c) It can be used to track changes to costs over time. Expenses can be added or deleted.
d) No. $1824.20 ÷ 52 = $35.08. This would leave Katie with very little money to do other things or for emergencies.
3a) Total in cell C7 is 24
b) The formula is the same as the Σ button.
c) Peter's total is 20; Leith's total is 18.
d) =B3 + C3 + D3
e) The total shots for each hole is filled.
f) Check your spreadsheet with your teacher or classmates.
g) Leith. She has the lowest total.
h) No. Leith is still the best golfer.
i) Yes. Peter is now the best golfer as he has the lowest total of 22.
j) Records of future golfing games can be kept over time. The totals can automatically be calculated.

PRACTICE EXERCISE 2
1a) Check your spreadsheet with your teacher or classmates.
b) He did not start the formula with an = sign.
c) He did not use the * symbol for multiplication.
d) $146.30 e) $146.45
f) $2, $1, $0.20, $0.50 and $0.10, $0.05. $2 had the largest value of $74.
g) Check your spreadsheet with your teacher or classmates.
h) Spreadsheet. You can change the data according to how many of each denomination in the money box and it will automatically calculate the amount.
2a) Check your spreadsheet with your teacher or classmates.
b) = 250/number of people
c) $25 d) $22.73
e) Check your spreadsheet with your teacher or classmates.
f) Check your spreadsheet with your teacher or classmates.
g) Yes. If $15 per ticket was charged, they would cover their costs with 250 ÷ 15 = 16.66 (i.e 17 people) attending.

PRACTICE EXERCISE 3
1a) 91 km b) $3.68/kg c) Check your spreadsheet with your teacher or classmates.
d) 21 rows e) 896 songs f) $289.48

REFLECTON ON LEARNING
1a) A: Division using a calculator, B: Multiplication using mental strategies, C: Subtraction using a spreadsheet, D: Addition using a calculator
b) Profit: $10 032
c) Check your spreadsheet with your teacher or classmates.
d) Losses were relatively small whereas profit was large. It was profitable but not EXTREMELY profitable.
2. Answers will vary but may include: 1. Setting up titles and headings
2. Entering correct formula 3. Using the Σ button 4. Inserting a new row or column 5. Using the 'Sort' button.

OLNA PRACTICE QUESTIONS
1. C   2. C   3. D

Topic 4: Solving Everyday Multistep Problems

PRACTICE EXERCISE 1
1a) A b) D   c) C   d) D   e) B   f) C
2a) 300 – (2 × 55)   b) (12 × 5) - (3 × 4)   c) (3 + 4) × 25   d) 30 – 4 + 7
e) 600 + (40 ×10)   f) (350 ÷ 5) × 6

PRACTICE EXERCISE 2
1. TOOTH HURTY   2a) (50 – 9) × 3; 123 b) 50 × 3 + 9^2; 231 c) 50 + 9 – 3; 56 d) 50 + (9 ÷ 3); 53 e) (9 + 3) × 50; 600 f) 3^2 + (3 × 9); 36
3. Answers will vary. Check with your teacher and classmates.

PRACTICE EXERCISE 3
1a) 198 – 16 × 12
b) It could be done mentally with jottings but in this case, a calculator would be quicker.
c) Mr Brown: 198 – 16 × 12 worked from left to right on a basic calculator with no brackets.
Mrs Brown: 198 – (16 × 12) on a basic calculator or 198 – 16 × 12 on a scientific calculator or phone.
Jasper: 198 – 12 × 16: worked from left to right on a basic calculator with no brackets.
d) Mrs Brown. She did the multiplication part of the problem before the subtraction part on a basic calculator or used a scientific calculator or phone.
2a) EXACT; 2 500 – 194.78 × 12; DIGITAL RESOURCE; Use
2 500 – (194.78 × 12) on a basic calculator or use a scientific calculator or phone, 162.64; Mia still has $162.64 to save.
b) APPROXIMATE; 3 000 ÷ 26 × 2; DIGITAL RESOURCE; Any calculator will get the correct answer, 230. 77; Jaxon will need to save AT LEAST $230.77 per fortnight.
c) EXACT ; 6 500 – (5 000 + 100 × 12); MENTAL; 6 500 – (5 000 + (100 × 12)) = 300; Jilly will not have enough. She will still need to save $300.
d) APPROXIMATE; 3 300 – (8 × 250); MENTAL; 3 300 – 2 000 = 1 300; Jackie will still need to save $1 300.

3a) Answers will vary between BASIC CALCULATOR, SCIENTIFIC CALCULATOR or PHONE
b) This would depend upon the type of calculator used. (a) would require brackets if using a BASIC CALCULATOR.

PRACTICE EXERCISE 4
1. Spreadsheets will vary. Check with your teacher and classmates. Terry will owe $47 600.
2. Spreadsheets will vary. Check with your teacher and classmates. Example below.

PERIMETER OF RECTANGLES		
LENGTH	WIDTH	PERIMETER
1	8	18
2	9	22
3	10	26
4	11	30
5	12	34
6	13	38
7	14	42
8	15	46

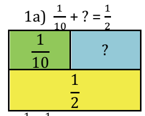
PRACTICE EXERCISE 5
1a) 4 m
b) $4 410
c) $515
d) Total minimum tyres is 724 in June. Total maximum tyres is 1 124 in April. The number of motorcycles being fitted with tyres is increasing.
e) 19 with one square left.
f) $1 075.50

REFLECTION ON LEARNING
1. Erin's score: C. 5 × 3 + 9 × 2 + 8 × 1; Tegan's score: H. 3 + 8 × 2
2. For Erin, scoring 5, 3 pointers is like scoring 3 + 3 + 3 + 3 + 3 (i.e. 3 is repeatedly added 5 times.) This is the same as 5 × 3. This is combined (added) to her 9, 2 pointers (9 × 2) and 8, 1 pointers (8 × 1) to give a total of 41 points. Tegan's total of 19 points is calculated in a similar way.
3. ERIN: 41 points   TEGAN: 19 points
4. Erin used a basic phone and calculated from left to right with no brackets. Her answer was wrong. Tegan used a phone which does rule of order. Her answer is correct.
5. Check your spreadsheet with your teacher or classmates.
6. = 3*B3+2*C3+D3
7. Ruby: 7 points, Julie: 28 points, Erin: 41 points, Sarah: 42 points, Lauren: 19 points, Maddie: 1 point, Tegan: 19 points, Jordan: 34 points
8. On the spreadsheet Erin scored 41 points and Tegan 19 points. These are the same answers as the mental calculation and by using a scientific calculator.
9. The SWC won the game 191 to 189.
10. Yes, the opposing team should have won as Jordan's points should have added to 26 points not 34 points.

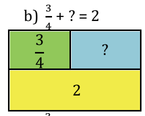
OLNA PRACTICE QUESTIONSS
1. D   2. B   3. A

Section 2: The Four Operations – Fractions and Decimals

Topic 1: Choosing an Operation to Solve Everyday Problems

PRACTICE EXERCISE 1
1a) $\frac{1}{10} + ? = \frac{1}{2}$


$\frac{1}{2} - \frac{1}{10} = ?$ 0.5 – 0.1 =

b) $\frac{3}{4} + ? = 2$


$2 - \frac{3}{4} = ?$ 2 – 0.75 =

2a) PART missing; Subtraction
b) WHOLE missing; Addition
c) WHOLE missing; Addition
d) PART missing; Subtraction
e) PART missing; Subtraction
f) WHOLE missing; Addition
3a) 3.35 – 2.64 = b) $3\frac{3}{4} + 2\frac{1}{2}$ = c) 2.23 + 0.91 =
d) $3\frac{3}{8} - \frac{1}{4}$ =   e) 3.45 – 0.91 = f) $6 - 3\frac{1}{8}$ =

PRACTICE EXERCISE 2
1a) $\frac{4}{5} \times 450 = ?$
SIZE OF GROUP (450)
0.8 × 450 = ?
TOTAL (?)   Number of groups ($\frac{4}{5}$)
b) 11 × ? = 13.24
SIZE OF GROUP (11)
13.24 ÷ 11 =
TOTAL (13.24)   Number of groups (?)

2 Problems will vary. a) 6.25 x 3.75 = ?, same; b) 1.40 x ? = 3.50, 3.50 ÷ 1.40 = c) ? x 0.4 = 6.40, 6.40 ÷0.4= d) ? x 3= 6 ½, 6 ½ ÷ 3 =
3a) 6.25 × 4; 6.25 × 4.75; 6.25 × 1.25; 6.25 × 0.75
b) In each of these cases the TOTAL price is missing. Therefore, we must multiply.
4a) 135.6 ÷ 4; 135.6 ÷ 2.5; 135.6 ÷ 0.75; 135.6 ÷ 0.625
b) In each of these cases the TOTAL weight is present. Therefore, we must divide.
5a) TOTAL present; Division b) TOTAL present; Division
c) TOTAL missing; Multiplication d) TOTAL present; Division
e) TOTAL missing; Multiplication f) TOTAL present; Division
6a) 2.5 × 10 = b) 125 ÷ 2.5 = c) 0.25 × 50 = d) 0.5 × 58.3 = OR 58.3 ÷ 2 =
e) 23.68 × 2.75 = f) 50 ÷ 1.8 =

PRACTICE EXERCISE 3
1. ADDITION AND SUBTRACTION PROBLEMS
b) WHOLE is missing; Addition e) WHOLE is present; Subtraction
MULTIPLICATION AND DIVISION PROBLEMS
a) TOTAL is missing; Multiplication c) TOTAL is missing; Multiplication
d) TOTAL is present; Division f) TOTAL is present; Division
2a) C, A, B, D, C b) D, B, C, A, D
3a) 8.3 – 5.73 = b) 4.6 ÷ 2.3 = c) 8.3 ÷ 4.15 = d) 8.3 × 1.5 =
e) 4.6 + 1.13 = OR 5.73 – 1.13 =

REFLECTION ON LEARING
1a) Multiplication/Division; Total present; Division
b) Addition/Subtraction; Whole missing; Addition
c) Multiplication/Division; Total missing; Multiplication
d) Addition/Subtraction; Whole missing; Addition
e) Multiplication/Division; Total present; Division
f) Multiplication/Division; Total present; Division
2. PATTIE

OLNA PRACTICE QUESTIONS
1. A 2. B 3. D

Topic 2: Using Mental Strategies to Solve Problems involving Fractions

PRACTICE EXERCISE 1
1a) $1\frac{3}{4}$ b) $\frac{1}{2}$ c) $3\frac{3}{4}$ d) $2\frac{1}{3}$ e) $3\frac{1}{6}$ f) $2\frac{9}{10}$
2a) $1\frac{3}{4}$ b) $\frac{1}{2}$ c) $1\frac{3}{4}$ d) $\frac{1}{6}$ e) $\frac{1}{2}$ f) $2\frac{1}{10}$
3. The following problems should be crossed out:
$3\frac{1}{4} - \frac{1}{2} = 3\frac{3}{4}$; $\frac{9}{10} + 2\frac{1}{2} = 2\frac{10}{12}$; $\frac{1}{10} + 2\frac{1}{2} = 3\frac{1}{10}$; $\frac{2}{3} + 1\frac{1}{2} = 1\frac{1}{6}$; $2\frac{1}{2} - \frac{1}{6} = 2\frac{1}{4}$
4a) $81\frac{1}{4}$ kg b) $2\frac{2}{3}$ kg c) $\frac{3}{5}$ hours d) $4\frac{3}{4}$ hours e) $\frac{1}{2}$ cup f) $2\frac{3}{4}$ m

PRACTICE EXERCISE 2
1a) 5 b) 15 c) 63 d) 154 e) 40 f) 300
2a) $\frac{1}{8}$ b) $\frac{1}{12}$ c) $\frac{3}{8}$ d) $\frac{1}{3}$ e) $\frac{3}{4}$ f) $15\frac{3}{4}$
3a) $330 b) 80 m c) 27 hours d) $1\frac{1}{4}$ cups e) 150 mL f) $\frac{1}{3}$ cup oil, $\frac{1}{8}$ cup vinegar

PRACTICE EXERCISE 3
1a) 8 b) 20 c) 18 d) 2 e) 11 f) 8
2a) 21 pieces b) 20 cm c) 12 bags d) 8 quarters e) $6/kg f) 15, 50c pieces

REFLECTION ON LEARNING
1a) $1\frac{1}{8}$ b) 23 c) 14 d) $\frac{1}{16}$ e) 20 f) $\frac{5}{6}$ g) $4\frac{1}{4}$ h) 9
2a) $45 b) $\frac{5}{6}$, $\frac{1}{6}$ of phonecalls c) $1\frac{1}{4}$, $11\frac{1}{2}$ mins d) 20 votes

OLNA PRACTICE QUESTIONS
1. B 2. $3\frac{1}{4}$

Topic 3: Using Mental Strategies to Solve Problems involving

PRACTICE EXERCISE 1
1. Glass Flippers!
2a) 49.7 + ? = 52.1or 52.1 – 49.7 = ; Jessie's but this may vary; 2.4
b) 0.08 + ? = 0.75 or 0.75 – 0.08 = ; Casey or Paddo's but this may vary; 0.67 c) 0.8 + 1.7 = ; Paddo's or Sarah's but this may vary; 2.5 d) 1.15 - ? = 0.45 or 1.15 – 0.45 = ; Casey or Paddo's but this may vary; 0.7 e) 1.23 + 0.4 = ; Casey or Paddo's but this may vary; 1.63 f) 52.1 – 9.5 = ; Lauren's but this may vary; 42.6

PRACTICE EXERCISE 2
1. A naughty frog 2a) 5 × 300.6 = ?; × 10 and halve; 1 503 L b) 3 × ? = 39.6 or 39.6 ÷ 3 = ; partitioning, 39 ÷ 3 = 13, 0.6 ÷ 3 = 0.2; Answer is 13.2 L c) 2.7 × 4 = ?; double and double again; Answer is 10.8% d) 2 × ? = 4.3 or 4.3÷ 2 = ; halving; Answer is 2.15 L e) 5.5 × 12 = ?; partitioning; 5 × 12 = 60, 0.5 × 12 = 6; Answer is 66 L f) 7.5 × 8 = ?; double, double and double again; Answer is 60 L

REFLECTION ON LEARNING
1a) 30 b) 9.1 c) 40 d) 0.85 e) 70 f) 6 g) 29.2 h) 0.6 i) 3.8 j) 28.82 k) 9.47 l) 0.7
2 Answers may vary. Check with your teacher and classmates
a) b, d, g, i, k, l b) a, h (may include f) c) e, j d) c, f
3a) 22.6° b) 0.37% c) 49.5 million tonnes d) 2.1%

OLNA PRACTICE QUESTIONS
1. B 2. 100 3. 15.63

Topic 4: Using a Calculator or Spreadsheet to Solve Everyday Problems

PRACTICE EXERCISE 1
The number sentences, the choice between fractions and decimals and strategies may vary for this exercise.
1a) 55 × 0.824 = ?; CALCULATOR b) $1\frac{1}{2} \times ? = 4\frac{1}{2}$ or $4\frac{1}{2} \div 1\frac{1}{2} = ?$; MENTAL AND/OR JOTTINGS c) 5.5 × 365 = ?; CALCULATOR d) 9.58 + ? = 9.69; 9.69 – 9.58 = ; MENTAL/ JOTTINGS e) $\frac{3}{4} - \frac{3}{10} = ?$ Best to think of as 0.75 – 0.3; MENTAL/ JOTTINGS f) 6.5 – 0.9 – 1.4 = ?; MENTAL/ JOTTINGS g) $\frac{1}{50} \times 3\,764 = ?$; CALCULATOR h) 0.25 × 480 = ? Best to think as $\frac{1}{4}$ of 480 = ?; MENTAL/ JOTTINGS

PRACTICE EXERCISE 2
1a) $1\frac{25}{36}$ b) $\frac{115}{208}$ c) $43\,389\frac{1}{2}$ d) $3\frac{3}{20}$ e) $5\frac{17}{42}$ f) $8\frac{1}{8}$ 2a) CALCULATOR; DIVISION; $13\frac{5}{7} \div \frac{5}{7} = ?$; Answer is $13\frac{1}{5}$ pieces (i.e. 14 pieces)
b) CALCULATOR; MULTIPLICATION; 1.625 × 7 = ?; Answer is 11.375 km
c) MENTAL; DIVISION; $4 \div \frac{1}{4} = ?$;How many quarters in 4?; Answer is 16 quarters d) CALCULATOR; MULTIPLICATION OR DIVISION; $1\frac{3}{4} \times \frac{1}{3} = ?$ OR $1\frac{3}{4} \div 3 = ?$; Answer is $\frac{7}{12}$ L in each beaker.
3a) $45.32 b) 3 m c) 2 007.5 days d) 0.11 seconds e) 0.45 or approx $\frac{1}{2}$ cup f) 4.2 m g) 75.28 mL h) $120
4a) $1\frac{1}{21}$ b) 3 times c) 3 cups d) $\frac{9}{16}$ cups e) $4\frac{1}{3}$ cups f) $\frac{53}{84}$ cup

PRACTICE EXERCISE 3
1a) 0.1 cm is too small for the cutting of cardboard. 0.5 cm is too big a difference and will result in too larger differences in surface area. 0.2 cm is the best increment.
b) The formula means 6 times the length times the length, which is how the surface area of a cube is calculated.
c) Check your spreadsheet with your teacher or classmates.
d) 12.90 cm
2a) Ayesha works $\frac{4}{7}$, Lilly works $\frac{2}{7}$ and Nat works $\frac{1}{7}$ of the week.
b) Check your spreadsheet with your teacher or classmates.
c) Entering Monday in the cell underneath 'DAY'. Placing the cursor on the RHS of the cell , holding and scrolling down.
d) Check your spreadsheet with your teacher or classmates.
e) =4/7* PROFIT
f) Lilly - =2/7* PROFIT; Nat - =1/7* PROFIT
g) Check your spreadsheet with your teacher or classmates.
h) Ayesha - $2 396.57; Lilly - $1 198.29; Nat - $599.14
i) Check your spreadsheet with your teacher or classmates.
j) Can have multiple entries for following weeks; can change fraction of profits if the girls alter the amount they work; can change profit if an error or unexpected expense occurs.
k) Answers may vary. Discuss with your classmates and teacher.
l) Yes it is a fair way of distributing the profit as it is based on how much each partner works.

REFLECTION ON LEARNING
A. a) Spreadsheet b) Calculator c) Mental
B. MENTAL STRATEGY PROBLEM
1. EXACT ANSWER 2. 16.8 + ? = 17.3 3. 17.3 – 16.8 = ?
4. 0.5 5. Yes. The bigger tile is 0.5 cm longer than the shorter tile.
CALCULATOR STRATEGY PROBLEM
1. EXACT ANSWER 2. $16\frac{3}{8} + 1\frac{1}{7} = ?$ 3. $16\frac{3}{8} + 1\frac{1}{7} = ?$
4. $17\frac{29}{56}$ 5. Yes. The base length of the second tile is $17\frac{29}{56}$ cm.
SPREADSHEET STRATEGY PROBLEM
1. EXACT ANSWER 2. =1/2*cell for BASE*18 3. Check your spreadsheet with your teacher or classmates 4. 16.5 cm 5. Yes. The base length of a triangle of height 18 cm and area 148.5 cm2 is 16.5 cm.

OLNA PRACTICE QUESTIONS
1. B 2. D

Topic 5: Using Estimation for solving Problems and Checking Reasonableness of Answers

PRACTICE EXERCISE 1
1. APPROXIMATE CALCULATIONS: a, c, d, e, f
EXACT CALCULATIONS: b.

PRACTICE EXERCISE 2
1a) In division, round both numbers up or both down to get the best approximation. Choose 6 ÷ 0.5 = 12
b) In multiplication round one up and one down to get the best approximation. Choose 1× 12 = 12
c) In addition round one up and one down to get the best approximation. Choose 2 + 3 = 5
d) In division, round both numbers up, or both down to get the best approximation. Choose 11 ÷ 0.2 = 55
e) In multiplication round one up and one down to get the best approximation. Choose 0.1 × 0.55 = 0.055
f) In subtraction round both numbers up, or both down to get the best approximation. Choose 5 – 3 = 2
2a) In division round both numbers down to get an overestimation. Choose 16 ÷ 4 = 4
b) In multiplication, round both numbers up to get an overestimation. Choose 3 × 54 = 162
c) In addition round both numbers up to get an overestimation. Choose 12 + 18 = 30
d) In multiplication, round both numbers up to get an overestimation. Choose 13.5 × 2 = 27
e) In subtraction round the first number up and the second number down to get an overestimation. Choose 6 – 1 = 5
f) In division round both numbers down to get an overestimation. Choose 11 ÷ 0.5 = 22
3. OVERESTIMATE: a; UNDERESTIMATE: b, d, e, f AS ACCURATE AS POSSIBLE: c
4a) It is best to overestimate in most measurement situations so as to ensure you have enough materials or time to complete the job. b) It is best to underestimate in grouping or sharing problems to ensure that everyone gets an equal amount even if there is some left over. 5a) 4 × 4 = 16 m of picture rail needed. b) 160 ÷ 40 = 4 mini pizzas each
c) 18 – 2 = 16 secs. The film is still too long. d) 16 ÷ 2 = 8. There would be 8, 1.78 m pieces. e) 9 + 12 + 11 = 32. Even by underestimating it is still too heavy for the trolley. f) 10 ÷ 0.5 = 20 bags of mince 6a) ≈ 660 mins b) ≈ 144 mins c) ≈ $18 d) ≈ 2° e) ≈ 6 kg f) ≈ 8 people

PRACTICE EXERCISE 3

1.

$2\frac{7}{8}$	3	2	3	$2\frac{1}{2}$	3	$2\frac{3}{4}$
1.3	2	1	1.5	1	1.5	1.25
$12\frac{2}{3}$	13	12	13	$12\frac{1}{2}$	$12\frac{3}{4}$	$12\frac{1}{2}$
7.8	8	7	8	7.5	8	7.75
$4\frac{3}{4}$	5	4	5	$4\frac{1}{2}$	5	$4\frac{3}{4}$
21.85	22	21	22	21.5	22	21.75
$29\frac{1}{5}$	30	29	29.5	29	$29\frac{1}{4}$	29
118.13	119	118	118.5	118	118.25	118
$107\frac{1}{3}$	108	107	107.5	107	$107\frac{1}{2}$	$107\frac{1}{4}$
64.62	65	64	65	64.5	64.75	64.5
98.88	99	98	99	98.5	99	98.75
$65\frac{4}{5}$	66	65	66	$65\frac{1}{2}$	66	$65\frac{3}{4}$

2. Answers may vary. Check with your teacher or classmates.
a) $0.25 \times 12 = 3$ b) $8\frac{1}{2} + 12 = 20\frac{1}{2}$ c) $8 \div 0.5 = 16$ d) $\frac{3}{4} \times 44.4 = 33.3$ e) $55.75 - 35.25 = 20.5$ f) $84 - 2\frac{1}{2} = 81\frac{1}{2}$

PRACTICE EXERCISE 4

1a) 0.5 m; Overestimate b) $\frac{1}{4}$ pizza; Overestimate c) $\frac{1}{4}$ hr; Underestimate; 0.25 kg, $0.10; Underestimate
2 Answers may vary. Check with your teacher or classmates.
a) $21.75 \div 3 = \$7.25$/kg b) $2\frac{2}{3} - \frac{1}{2} = 2\frac{1}{6}$ c) $7.5 \div 0.5 = 15$ bags
d) $11.4 - 3.9 = 7.5$ m e) $2\frac{3}{4} + 1\frac{1}{4} + 3\frac{1}{4} + 2\frac{1}{4} = 9\frac{1}{2}$ hours f) $0.75 \times 800\,000 = \$600\,000$

PRACTICE EXERCISE 5

1a) TRUE; This must equal a bit more than 1 b) FALSE; Must be greater than 12 as $3 \times 4 = 12$ c) TRUE; $2 \div 0.5 = 4$ so $2.25 \div 0.4 = 5.625$ appears correct d) FALSE; $\frac{1}{2}$ of 0.2 = 0.1 NOT 1.0 e) TRUE; $3 \div \frac{1}{4} = 12$ so $3\frac{3}{4} \div \frac{1}{4} = 15$ is reasonable f) FALSE; $5 + 0.45 = 0.45$
2a) > 1 b) < 1 c) <1 d) >1 e) >1 f) >1
3a) This is NOT reasonable. Sarah calculated $1\frac{7}{8}$ m + $\frac{3}{7}$ m. She added the numerators and added the denominators of the fractions to get $1\frac{10}{15}$ m. The answer needs to be more than 2.
b) This IS reasonable. $35 \div 22 = 1.59$. $1\frac{1}{2}$ cupcakes each, ensures everyone gets the same amount.
c) This is NOT reasonable. 0.65 kg of cashews at $17.99/kg would be less than $18 not more than $18. Magali has used division not multiplication to find her answer.
d) This IS reasonable. By rounding to the nearest kilogram 82 – 18 is approximately 64 kg.
e) This is NOT reasonable as the rounded dimensions 70×70 is 4 900 not 490 000 cm^2
f) This IS reasonable as $6\frac{5}{6} \div \frac{1}{3}$ can be rounded to $6\frac{2}{3} \div \frac{1}{3}$ which is 20 pieces.

REFLECTION ON LEARNING 1

Answers may vary. Check with your teacher or classmates.

REFLECTION ON LEARNING 2

1. APPROXIMATE; MENTAL, ADDITION; $2\frac{3}{7} + 1\frac{8}{9} + 2\frac{7}{8} + 2\frac{1}{4}$; Round down to nearest quarter - $2\frac{1}{4} + 1\frac{3}{4} + 2\frac{3}{4} + 2\frac{1}{4}$; This adds to 9 so there is just enough timber.
2. APPROXIMATE; MENTAL; DIVISION; $7.47 \div 1.48$; Round up to underestimate - $7.5 \div 1.5$; There will be 5 sheets of galvanized iron.
3. EXACT, CALCULATOR; MULTIPLICATION AND SUBTRACTION; $50 - (3 \times 7.47) = 27.59$; This would get rounded to $27.60 due to our monetary system not having 1 cent pieces.
4. APPROXIMATE; MENTAL; SUBTRACTION; $2\frac{3}{7} - 1\frac{5}{8}$; Round up to the nearest quarter metre to overestimate - $2\frac{1}{2} - 1\frac{3}{4} = \frac{3}{4}$ m. There is just enough left over.

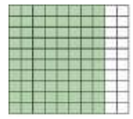
OLNA PRACTICE QUESTIONS

1. D 2. D

Section 3: Percentages Linked with Fractions and Decimals

Topic 1 Linking Percentages, Fractions and Decimals.

PRACTICE EXERCISE 1

1a)

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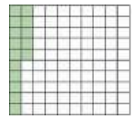
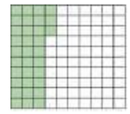
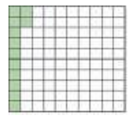
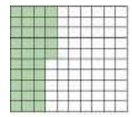
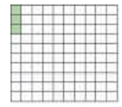
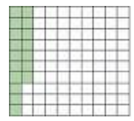
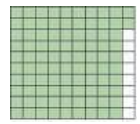
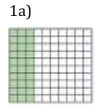

c)

d)

e)

f)

g)

h)


2. a) 12% b) 9% c) 45% d) 91% e) 66% f) 1% g) 51% h) 97%
3. a) $\frac{10}{100}$ b) $\frac{23}{100}$ c) $\frac{1}{100}$ d) $\frac{50}{100}$ e) $\frac{75}{100}$ f) $\frac{62}{100}$ g) $\frac{5}{100}$ h) $\frac{38}{100}$

PRACTICE EXERCISE 2

1. a) $\frac{50}{100}$ b) $\frac{20}{100}$ c) $\frac{5}{100}$ d) $\frac{10}{100}$ 2. a) $\frac{75}{100}$ b) $\frac{50}{100}$ c) $\frac{30}{100}$ d) $\frac{16}{100}$
3. a) $\frac{50}{100} = 50\%$ b) $\frac{40}{100} = 40\%$ c) $\frac{30}{100} = 30\%$ d) $\frac{40}{100} = 40\%$ e) $\frac{44}{100} = 44\%$ f) $\frac{75}{100} = 75\%$

PRACTICE EXERCISE 3

1.
1a)

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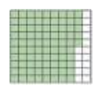
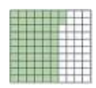

c)

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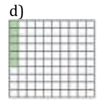
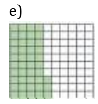
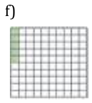
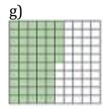
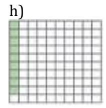
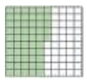
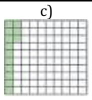
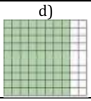
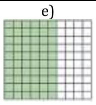
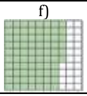

e)

f)

g)

h)


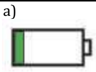
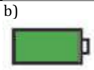
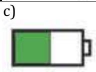
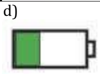
2. a) 10% b) 50% c) 65% d) 92% e) 3% f) 29% g) 9% h) 279%
3. a) 0.1 b) 0.23 c) 0.01 d) 0.75 e) 0.5 f) 0.25 g) 0.82 h) 1.23

4.

Grid	Fraction	Decimal	Percentage
a) 	$\frac{55}{100}$	0.55	55%
b) 	$\frac{5}{100}$	0.05	5%
c) 	$\frac{13}{100}$	0.13	13%
d) 	$\frac{4}{5}$	0.8	80%
e) 	$\frac{60}{100}$	0.6	60%
f) 	$\frac{75}{100}$	0.75	75%

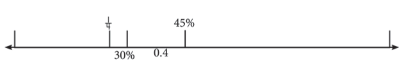
PRACTICE EXERCISE 4

1.

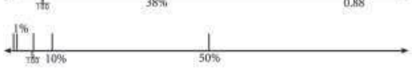
Shade the battery	Percentage	Equivalent fraction and decimal
a) 	10%	0.1 $\frac{10}{100}$
b) 	100%	1.0 $\frac{100}{100}$
c) 	50%	0.5 $\frac{50}{100}$
d) 	35%	0.35 $\frac{35}{100}$
e)	The percentage your device is on now. %	
f)	The percentage your friend's device is on now. %	

2.

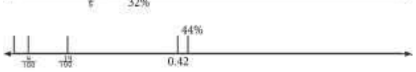
a) 

b) 

c) 

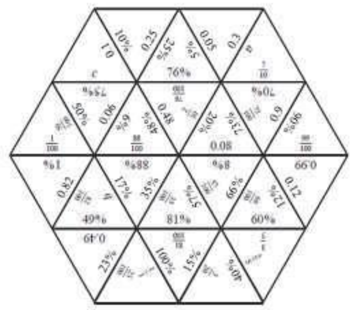
d) 

e) 

f) 

REFLECTION ON LEARNING 1

a) 30% or $\frac{30}{100}$ b) 0.17 or $\frac{17}{100}$ c) 0.75 or $\frac{75}{100}$



REFLECTION ON LEARNING 2

	Fraction	Decimal	Percentage
a)	$\frac{1}{2}$	0.5	50%
b)	$\frac{1}{4}$	0.25	25%
c)	$\frac{2}{4}$	0.5	50%
d)	$\frac{3}{4}$	0.75	75%
e)	$\frac{1}{5}$	0.2	20%
f)	$\frac{2}{5}$	0.4	40%
g)	$\frac{3}{5}$	0.6	60%
h)	$\frac{4}{5}$	0.8	80%
i)	$\frac{1}{10}$	0.1	10%
j)	$\frac{1}{100}$	0.01	1%

REFLECTION ON LEARNING 3

Answers will vary, please see your teacher.

OLNA PRACTICE QUESTIONS

1. B 2. D 3. C

Topic 2 Calculating Percentages Mentally

PRACTICE EXERCISE 1

1. a) 45 b) 30 c) 225 d) $30 e) 320 m f) 110 km
2. a) $36 b) $12 c) $21 d) $30 e) $80 f) $14
3. a) $36 b) $36 c) $42 d) $10 e) $320 f) $21

PRACTICE EXERCISE 2

1. a) $\frac{34}{100}$ = 34% b) $\frac{48}{100}$ = 48% c) $\frac{50}{100}$ = 50% d) $\frac{52}{100}$ = 52% e) $\frac{35}{100}$ = 35% f) $\frac{60}{100}$ = 60%
2. a) 27% b) 64% c) 50% d) 60% e) 72% f) 30%

PRACTICE EXERCISE 3

1. a) $42 b) 24 people c) $12 d) $27 e) 28 sales f) 330 people
2. a) 6 bookings b) $125 c) $16 200 d) $195.50 e) $384 f) 1 920 t

PRACTICE EXERCISE 4

1. a) $8 b) $1 200 c) $3.60 d) 1 584 m e) 372.40 minutes f) 808 km
2. a) $6.40 b) $442 c) $4 223 d) 3 210 burglaries e) $7 425 f) 2 303 tourists

PRACTICE EXERCISE 5

1. a) ≈$8 b) ≈210 kg c) ≈3 520 m d) ≈140 cm e)≈1080 flowers f)≈9 apples
2. a) Between 4 and 8 mL b) Between 16 and 18 minutes c) Between $40 and $45 d) Between 5 and 7 players e) between $120 and $130 f) Between 1 000 and 1 125 hours
3. a) REASONABLE b) REASONABLE c) UNREASONABLE, 300 people d) REASONABLE

REFLECTION ON LEARNING 1

a) FIND 1%, 22.4, ≈ 22 students
b) DENOMINATOR OF 100, 36%
c) FIND 10%, $378
d) COMMON FRACTIONS, 5 people
e) COMMON FRACTIONS or FIND 10%, $480
f) FIND 1%, 3960 passengers

REFLECTION ON LEARNING 2

b) Answers will vary, please see your teacher.

OLNA PRACTICE QUESTIONS

1. A
2. A

Topic 3 Calculating percentages using a calculator or spreadsheet

PRACTICE EXERCISE 1
1. a) 37.5% b) 66.6% c) 68% d) 66.3% e) 142.8% f) 234.4%
2. a) MENTAL, 30% b) MENTAL, 50% c) CALCULATOR, 167.4% d) CALCULATOR, 52.6% e) MENTAL, 75% f) MENTAL, 280%
3. a) 79.5% b) 74% c) 52.6% d) 67.9% e) 44.1% f) 21.6%

PRACTICE EXERCISE 2
1. a) $28.20 b) 190.95 c) 148.96 km d) 73.2 L e) 588 f) 30.48 kg
2. a) MENTAL, $13.50 b) CALCULATOR, $120.77 c) MENTAL, $43 d) MENTAL, $1200 e) CALCULATOR, 508.4 f) CALCULATOR, $14.63
3. a) 84.68 (85) goals b) 3.5 kg c) 2 480 000 people d) 75c e) 825 000 f) (i) $532 (ii) $1 435.26

PRACTICE EXERCISE 3
1. Add on 10% = multiply the whole by 1.1
Take off 25% = multiply the whole by 0.75
Find 36% = multiply the whole by 0.36
Add on 17% = multiply the whole by 1.17
Take off 55% = multiply the whole by 0.45
Find 9% = multiply the whole by 0.09
2.

Problem	% increase	% decrease	Multiply the whole by	Solution
a)		✓	0.75	$225
b)	✓		1.17	$1404
c)	✓		1.22	68.32 cm
d)		✓	0.86	103 People
e)	✓		1.15	$345
f)		✓	0.35	4200 People

3. a) 2662 members b) 5.04 m c) 487 students d) $35 100 e) 734.4 m² f) 12.08 kg

PRACTICE EXERCISE 4
1. Problems best solved using a calculator; a, c, f. Involve one calculation
Problems best solved using a spreadsheet; b, d, e. Involve ongoing calculations over time or situations where it is necessary to change the numbers.
2. a) Spreadsheets will vary. Check with your teacher.
b) $ $230.49 c) Yes. It performs the calculations quickly.
d) Spreadsheets will vary. Check with your teacher.
e) $1 766.04 f) 2.8% will result in $1629.56 after 3 years; 3.3% will result in $1653.45 after 3 years ; 4% will result in $1687.30 after 3 years
3. a) =base rate*1.25 b) $$2 068 c) $388
d) Spreadsheets will vary. Check with your teacher.

REFLECTION ON LEARNING
1. Exact answer; Calculator; (26 000 – 18 200) × 19%; He needs to pay $1 482 in tax.
2. Exact answer; Mental; $\frac{15}{25} = \frac{?}{100}$; 25 × 4 = 100 so 15 × 4 = 60; Henry scores 60%
3. Exact answer; Spreadsheet; =1.062*amount at start of year; The shares will be worth $6 067.75 at the end of 8 years.
4. Exact answer; Calculator; 350 × 7% + 350 or 1.07 of 350; 374.5 mL of rain
5. Exact answer; Calculator; 789 – (35% of 789) or 0.65 of 789; The TV will cost $512.85

OLNA PRACTICE QUESTIONSS
1. D 2. D

SECTION 4: Location Time and Temperature

Topic 1: Location

PRACTICE EXERCISE I
1. Check your table with your teacher or classmates.
2. Check the compass points for each wall with your teacher or classmates.

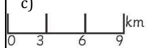
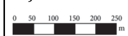
PRACTICE EXERCISE 2
1 a) North is a compass point that is independent of which way you are facing.
b) As a child you are mainly concerned with directions that relate to your body as left, right, clockwise, anticlockwise. It is a big jump to learn about compass points. Also the school worksheets might have always shown north to be pointing upwards.
2. Check your drawings and your compass points with your teacher or classmates.
3. Check your mud map, compass points and directions with your teacher or classmates.
4. Mudmaps and directions to Cable Beach will vary. Check with your teacher or classmates.
5. Answers will vary. Check with your teacher or classmates.

PRACTICE EXERCISE 3
1 a) The compass rose should indicate that the shaded lounge area is in the north, the entry is south, the stage is on the west and the foam pit is in the east. Walk west from the Carnival Rides to just near the toilets, then walk north to just past the Ultimate Experience. The shaded lounge area is to the east.
b) Justify your instructions to your teacher or classmates.
2 a) From the jetty walk west to the Visitors' Centre. Walks North along Vincent Way until you get to Raven Road. Walk south west until you see the Camping ground entrance to the north.
b) A variety of ways. You could walk North West along Vlamingh, then south west then west along McCallum until you get to Bedford. Walk north to Colebatch Avenue and continue walking north. The Dome is to the west.
c) East d) North west e) South west f) Answers will vary
3 a) Order - *Robin Warren Drive, which is accessible from Murdoch Drive, two sets of lifts found off the concourse, near entrances*
Distance – *near*
Direction - west to east, western or ocean side, eastern or desert side, Bed numbers are clockwise
b) – g) Check with your teacher or classmates.
4. Maps will vary. Check with your teacher or classmates.

PRACTICE EXERCISE 4
1a) Porpoise Bay b) Barker swamp c) Airport d) C, 15 e) B, 15 f) D, 11
2 a) (1.5, 11) b) (12.5, 11) c) (10.5, 5.5) d) (6.5, 1.7) e) Stingray
f) (5.5, 13)
3 Answers will vary. Check with your teacher or classmates.

PRACTICE EXERCISE 5

1.

Scale	What does it mean?	Conversion	
		Distance on map	Distance on the Earth
a) 1 cm = 500 m	Every 1 cm on the map refers to 500 m on earth	5 cm	2 500 m or 2 ½ km
b) 1 cm = 10 km	Every 1 cm on the map refers to 10 km on earth	11 cm	110 km
c) 	Every cm refers to 3 km on earth	7 cm	21 km
d) 	Every part of the scale is 50 m on the map.	2 cm	150 m
e) 1: 10 000	For every one unit on the map the measure on earth is 10 000 times bigger	4 cm	40 000 cm Which is 400 m
f) 1: 250 000	For every one unit on the map the measure on earth is 250 000 times bigger	8 cm	2 000 000 cm Which is 20 km

2

Map	Question	Distance on the map	Working out	Distance on Earth
a) Explicit	How far is it from Port Key to Port Lock?	3 ½ cm	1 cm is the same as 10 km	35km
b) Graphic	How far from Lake Ky and T?	2 cm	Every 2 cm is 15 km	15 km
c) Ratio	What is the length of Harissa Island?	6 cm	6 x 500 000	3 000 000 cm 30 km

3. Answers will vary. Check with your teacher or classmates

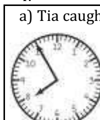
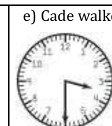
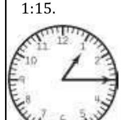
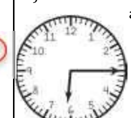
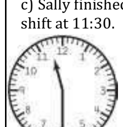
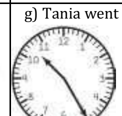
REFELECTION ON LEARNING
1 Answers will vary. Check with your teacher or classmates.
2 Answers will vary. Check with your teacher or classmates.

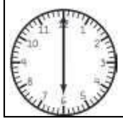
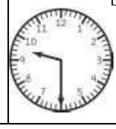
OLNA PRACTICE QUESTIONS
1. A
2. C

Topic 2: Time

PRACTICE EXERCISE 1
1 a) One o'clock or one pm or one am
b) Half past eleven or eleven thirty
c) A quarter to nine or eight forty five
d) A quarter past four or four fifteen
e) Twenty past six or six twenty
f) Nineteen past nine or nine nineteen
g) Twenty seven to six or five thirty three
h) One minute to four or three fifty nine.
2 a) 07:20 b) 21:05 c) 23:42 d) 00:07 e) 04:00
f) 00:50 g) 13:30 h) 16:25
3 a) 6:40 am b) 12:10 am c) 2:05 pm d) 5:23 am
e) 11:35 am f) 5:58 pm g) 8:00 pm h) 12:35 pm

4.

a) Tia caught the bus for school at 7:55.  am or pm 24 hour time: 07:55	e) Cade walked home from school at 3:30.  am or pm 24 hour time: 15:30
b) Max stopped to eat lunch at 1:15.  am or pm 24 hour time: 13:15	f) Tom started cooking dinner at 6:15.  am or pm 24 hour time: 18:15
c) Sally finished her evening shift at 11:30.  am or pm 24 hour time: 23:30	g) Tania went to bed at 10:25.  am or pm 24 hour time: 22:25

d) Wendy had Netball training at 6:00.  am or pm 24 hour time: 18:00	h) Monty met his brother for breakfast at 9:30.  am or pm 24 hour time: 09:30

5 a) 16th October b) 6:05 am or five minutes past six c) Four hours d) 7:40 pm or twenty to eight e) Five hours and ten minutes f) 10.05pm or five past ten.
6 To say the time in 12 hour time subtract 12 hours. The time is 2:30 pm.

PRACTICE EXERCISE 2
1 Answers will vary. Check with your teacher or classmates.
2 a) Fifty minutes, fifty five seconds and one tenth of a second.
b) 8 seconds c) fifty nine minutes forty five seconds and point three of a second. d) 18 seconds e) Bib 25
3 a) 55:25, 56:25, 1:00:38, 1:02:40, 1:25:05
b) 25:52, 51:05, 52:25, 1:05:50, 1:50:05
c) 3:33, 30:30, 3:03:03, 3:30:03, 3:30:30
d) 55:01, 55:45, 1:45:40, 5:04:50, 5:10:05
e) 10:01, 10:11, 11:10, 1:01:10, 1:10:01
f) 3:39, 6:09, 6:39, 9:03, 6:03:09
4 a)

Competitor Number	Time
610	1:00.38
703	1:01.30
711	1:01.72
404	1:02.20
405	1:02.80
104	1:02.84
308	1:03.39
609	1:03.75

b) 0.92 seconds
c) 3.37 seconds d) 1:02.20 e) 0.09 second

PRACTICE EXERCISE 3
1a) Tuesday, Thursday, Saturday, Sunday b) 10am c) 12.25pm
d) 9:10am, 1:00pm, 4:40pm e) One hour
2 a) The 10.20 am or 10.40 am ferry b) 3.42pm or 4.02pm c) 11am or 11.30am
d)1.05pm
3 Answers will vary. Check with your teacher or classmates.

PRACTICE EXERCISE 4
1a) 180 seconds b) 360 minutes c) 1 day and one hour
d) 49 days e) 1 hour 12 minutes f) 36 months g) 3 960 seconds
h) 3 hours and 30 minutes i) 10 fortnights j) 5 minutes
k) 1 minute and 30 seconds l) 336 hours
2 a) 77 minutes b) 130 minutes c) 20 ¾ hours or 3 hours and 45 minutes d) 6 hours and 10 minutes
3 a) 123 minutes, 2 hours and 5 minutes, 1 day, 27 hours
b) 10 minutes and 45 seconds, a quarter of an hour, 61 minutes, 1 hour and 3 minutes,
c) 2 minutes, 240 seconds, half an hour, 42 minutes,
d) $1\frac{1}{4}$ minutes, 80 seconds, 5 minutes, 45 minutes,

PRACTICE EXERCISE 5
1a) 7:15:00; 7:30:00; 6:30:00; 7:00:00; 6:30:00; 6:00:00
b) $161.68, $167.25, $144.95, $156.10, $144.95, $133.80
c) total time = 40:45 gross pay = $908.73 d) 28th November e) 24th November f) No
2 a) 5.20 pm b) 2hours 20 minutes c) 10:16pm or 22:16 d) 4 hours 11 minutes
e)11.30 pm or 23:30 f) 5.03 am or 05:03

REFLECTION ON LEARNING
Answers will vary. Check with your teacher or classmates.

OLNA PRACTICE QUESTIONS
1. D 2. B

Topic 3: Temperature

PRACTICE EXERCISE 1
1a) Twenty three degrees Celsius b) Three degrees Celsius
c) One hundred and three degrees Celsius d) Zero point five degrees Celsius e) Minus four degrees Celsius
f) Minus ten point five degrees Celsius
2 a) 4 b) 5 c) 3 d) 1 e) 2
3) 30 degrees Celsius b) Minus 6 degrees Celsius
c) 36.6°C d) 5°C e) 19.1 °C F) 24.4°C
4 a) Fahrenheit b) Celsius. c) Fahrenheit d) Celsius
e) Celsius f) Fahrenheit

PRACTICE EXERCISE 2
1 Answers will vary. Check with your teacher or classmates
2a) 9° b)19° c)7° d) 15° e) 17° f) 9.2° g) 12.7° h) 9.9°
3 Answers will vary. Check with your teacher or classmates.
4 Answers will vary. Check with your teacher or classmates.
5 a) freezing, cold, chilly, cool,, mild, warm, hot, stinking hot, boiling hot
b) Temperatures will vary depending on where you live.
c) Answers will vary. Check with your teacher or classmates.

PRACTICE EXERCISE 3
1a) A food thermometer helps you make sure all potentially harmful bacteria have been destroyed through proper cooking.
b) 0 - 5°C c) 74°C
d) Because when you defrost outside of the fridge the outside of the food can get to the food danger temperature but the inside can still be frozen. That means that bacteria can be present on the outside of the food.
e) Between 5°C and 60°C
3c) 60°C to 65 °C d) Between 70 and 75°C

REFLECTION ON LEARNING
Answers will vary. Check with your teacher or classmates.

OLNA PRACTICE QUESTIONS
1. D
2. B

SECTION 5: Space and Design

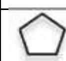
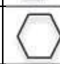
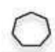
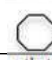
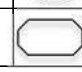
Topic 1

PRACTICE EXERCISE 1
1.

Term	Description
Polygon	A closed figure with three or more straight sides
Regular polygon	All sides and angles are congruent
Regular Triangle	A polygon with three sides and three angles congruent
Quadrilateral	A polygon with four sides
Rectangle	A quadrilateral with opposite sides congruent and all angles are right angles (90°)
Parallelogram	A four sided polygon with opposite sides parallel
Trapezium	A quadrilateral with one pair of parallel sides
Rhombus	A quadrilateral with congruent sides and opposite sides parallel

2 a) Parallelogram- 1, 2, 4, 5, 8, 9 11, 13; Trapezium – 7, 12, 14; Rhombus – 4, 5 and 10; Kite – 3, 6; Rectangle – 9, 15; Square -5, 13
b) A parallelogram is a quadrilateral with opposite sides parallel and congruent. A rectangle is a quadrilateral with opposite sides parallel and congruent and all angles are right angles. A square is a quadrilateral with opposite sides parallel, all sides congruent and all angles right angles.

3 a)

Number of sides	Name of shape	Regular	Irregular
5	Pentagon		
6	Hexagon		
7	Heptagon		
8	Octagon		

b) Regular shapes are polygons that have congruent sides and angles.

PRACTICE EXERCISE 2

1

Term	Description
Polyhedron	An object that has parallel congruent circles at opposite ends
Regular Polyhedron	A polyhedron with a polygon base and triangular faces that meet at a vertex
Prisms	A polyhedron with end faces parallel and congruent and all other faces rectangular
Pyramids	A polyhedron with congruent faces made up of regular polygons. Also known as a platonic solid.
Cylinder	A three dimensional circle where the points on the surface are at the same distance from the centre
Sphere	An object with flat faces

2a)

Label	Object Name	Number of faces	Number of Edges	Number of Vertices
C	Hexagonal Pyramid	7	12	7
E	Square Pyramid	5	8	5
F	Square Prism	6	12	8
G	Trapezoid Prism	6	12	8
H	Triangular Prism	5	9	6
M	Octahedron	8	12	6
N	Icosahedron	20	30	12
O	Tetrahedron	4	6	4
P	Cube	6	12	8

Answers will vary to "Have you seen this shape in real life? If so where?" Check with your teacher or classmates.
b) Prisms are named by the polygon that forms the two opposite ends.
c) Pyramids are named by the polygon base.

PRACTICE EXERCISE 3

1 a) Square Prisms- plastic wrap, oregano jar; Cylinders –olives, sausage, canned tomatoes, paper towel, rolling pin, main body of the pizza oven; Triangular Pyramid - grater; Rectangular Prisms- packet of flour, feta cheese, cutting board; Hemisphere - colander, bowl
b) See above
c) For example, grater is a triangular prism because it is strong, does not flex, and is stable. Flour and plastic wrap packet are prisms for easy stacking and packing. Bowl and colander are hemispherical to contain food. The pizza oven is based on a cylinder shape. It needs to house a round ceramic plate and allow the heat to circulate over the pizza.
d) The rolling pin has small cylinder spindle to enable the main roller to turn independently of the handle, the grater has a half sphere on the top with which to grip on to. The legs supporting the pizza oven are cylinders that has been dissected down the middle. The anchovy tin has a circular ring pull to be able to pull the lid off. Lids on glass jars are based on a cylinder shape to allow for screwing on and off.
2 Teapot- Cylinder body contains the tea, spout trimmed and moulded from a cone controls the flow of tea.
Suitcase- Rectangular body contains objects and stacks easily. Rectangular handle for gripping. It slides down behind the case when not in use.
Washing machine - Rectangular prism housing the motor stacks, packs and provides a working surface. Cylinder drum rotates to wash the clothes.
Barbecue kettle – Spherical kind of body contains the heat beads and allows heat circulation. Cylindrical legs for support and cylinder wheels for ease of movement.
Other answers will vary.
3. Answers will vary. Check with your teacher or classmates

REFLECTION ON LEARNING

1 a) Diagrams will vary. Check with your teacher or classmates
b) Diagrams will vary. Check with your teacher or classmates
c) A quadrilateral is a four sided polygon. A parallelogram is a quadrilateral with opposite sides parallel. A square is a regular quadrilateral with all angles right angles.

2.

	Polyhedrons	Regular Polyhedrons	Prisms	Pyramids	Cylinders
SKETCHES	Will vary.				
PROPERTIES All faces are polygons	✓	✓	✓	✓	
All faces congruent		✓			
End faces congruent and parallel			✓		✓
Side faces rectangles			✓		✓
Side faces triangles				✓	

3. Food processor- rectangular prism base to house the motor. Cylindrical bowl to enable the blade to rotate. Cylinder spout to feed food through. Most shapes are circular to enable a rotating movement.

Drums – cylinders are most common shape used for western music. The vibrations resonate in the shell of the drum and so width and depth of the cylinder affects the sound. The larger the diameter the lower the pitch. The larger the depth of the drum, the louder the volume.
Bike – the triangular frame provides strength and rigidity as triangles are rigid. Wheels are round for movement. Spokes create many smaller triangular sections within the wheel frame to provide strength and rigidity.

OLNA PRACTICE QUESTIONS

1. D
2. D

Topic 2 Drawing Three Dimensional Objects

PRACTICE EXERCISE 1

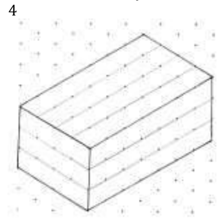
1 Answers will vary. Check with your teacher or classmates.
2 Answers will vary. Check with your teacher or classmates.
3 Answers will vary. Check with your teacher or classmates.

PRACTICE EXERCISE 2

1 Answers will vary. Check with your teacher or classmates.
2 Answers will vary. Check with your teacher or classmates.
3 Answers will vary. Check with your teacher or classmates.

PRACTICE EXERCISE 3

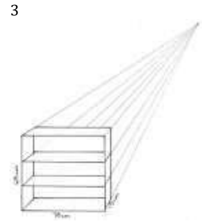
1 Answers will vary. Check with your teacher or classmates.
2 Answers will vary. Check with your teacher or classmate.
3 Answers will vary. Check with your teacher or classmates.
4



PRACTICE EXERCISE 4

1 Answers will vary depending on how you orient your block structure. Check with your teacher or classmates.
2 Answers will vary. Check with your teacher or classmates.

3



REFLECTION ON LEARNING

1a) Orthographic –Top, left and right side views
b) Perspective
c) Isometric
d) Perspective
e) Orthographic –Top, left and right side views
2 Answers will vary. Check with your teacher or classmates.
3 Answers will vary. Check with your teacher or classmates.

OLNA PRACTICE QUESTIONS

1. B 2. A

Topic 3 Interpreting and Drawing Diagrams, Plans, Angles and Nets

PRACTICE EXERCISE 1

1 a) A flat or a small apartment.
b) To give a sense of the use, arrangement and size of the different spaces.
c) Living room $2\frac{1}{2} \times 4\frac{1}{2}$ m; bedroom $3\frac{1}{2}$ m x $2\frac{1}{2}$ m; kitchen $3 \times 1\frac{1}{2}$ m.
2 Answers will vary. Check with your teacher or classmates.
3 Answers will vary. Check with your teacher or classmates.
4 Answers will vary. Check with your teacher or classmates.

PRACTICE EXERCISE 2

1a) Entrance 9
b) West to South- West
c) South
d) Subiaco Road
e) West and East ends
2 Walk through the building in a north easterly direction until you see the exit on the south eastern side of the building. Go east until you get to the clump of trees then walk north over the driveway. Walk in a north eastern direction to get to the assembly point.

PRACTICE EXERCISE 3
1 Square pyramid – a and b; cylinder- b; triangular prism –a or c; Cube –b; Hexagonal pyramid – b and c.
2 Nets will vary. Check with your teacher or classmates.
3 Nets will vary. Check with your teacher or classmates.

PRACTICE EXERCISE 4
1 Answers will vary. Check with your teacher or classmates.
2 Answers will vary. Check with your teacher or classmates.
3 Answers will vary. Check with your teacher or classmates.
4 Answers will vary. Check with your teacher or classmates.

PRACTICE EXERCISE 5
1 Answers will vary. Check with your teacher or classmates.
2 Answers will vary. Check with your teacher or classmates.
3 Answers will vary. Check with your teacher or classmates.

REFLECTION ON LEARNING
Answers will vary. Check with your teacher or classmates.

OLNA PRACTICE QUESTIONS
1. B
2. D