PEARSON

GENERAL MATHEMATICS

QUEENSLAND

STUDENT BOOK

11

UNITS 1 & 2

Pearson

Contents

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GENERAL MATHEMATICS

QUEENSLAND

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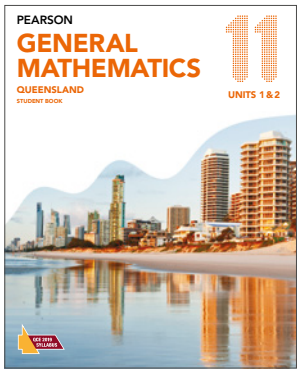
UNITS 1 & 2



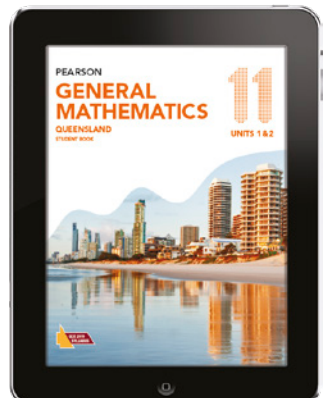
General Mathematics 11
Student book

Student book

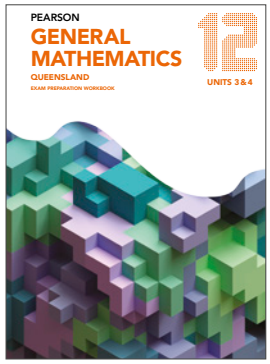
The student book has been authored by local authors, ensuring quality content and complete curriculum coverage for Queensland, enabling students to prepare with ease and confidence. We have covered the breadth of the content within our exercise questions, from simpler skills-focused questions to those using unfamiliar contexts and application of the theory learnt. The theory, worked examples and question sets are written in line with the assessment objectives, with the aim of familiarising students with QCE cognitive verbs in the process of dependent and guided instruction. Additional interactives that help explain the theory and consolidate concepts have been included throughout all chapters.

Pearson Reader+

Pearson Reader+ is our next-generation eBook. This is an electronic textbook that students can access on any device, online or offline, and is linked to features, interactives and visual media that will help consolidate their understanding of concepts and ideas, as well as other useful content developed specifically for senior mathematics. It supports students with appropriate online resources and tools for every section of the student book, providing access to exemplar worked solutions that demonstrate high levels of mathematical and everyday communication. Students have the opportunity to learn independently through the Explore further tasks and Making connections interactive widgets, designed to engage and support conceptual understanding. Additionally, teachers have access to syllabus maps, a teaching program, sample exams, problem-solving and modelling tasks, and additional banks of questions for extra revision.



General Mathematics 11
eBook



General Mathematics 12
Exam preparation workbook

Exam preparation workbook

Additional component for Year 12 only

The exam preparation workbook provides additional support in preparing students for the external exam. It has been constructed to guide students through a sequence of preparatory steps and build confidence leading up to the external exam.

How to use this book

Pearson General Mathematics 11 Queensland Units 1 & 2

This Queensland senior mathematics series has been written by a team of experienced Queensland teachers for the QCE 2019 syllabus. It offers complete curriculum coverage, rich content and comprehensive teacher support.

Additional information

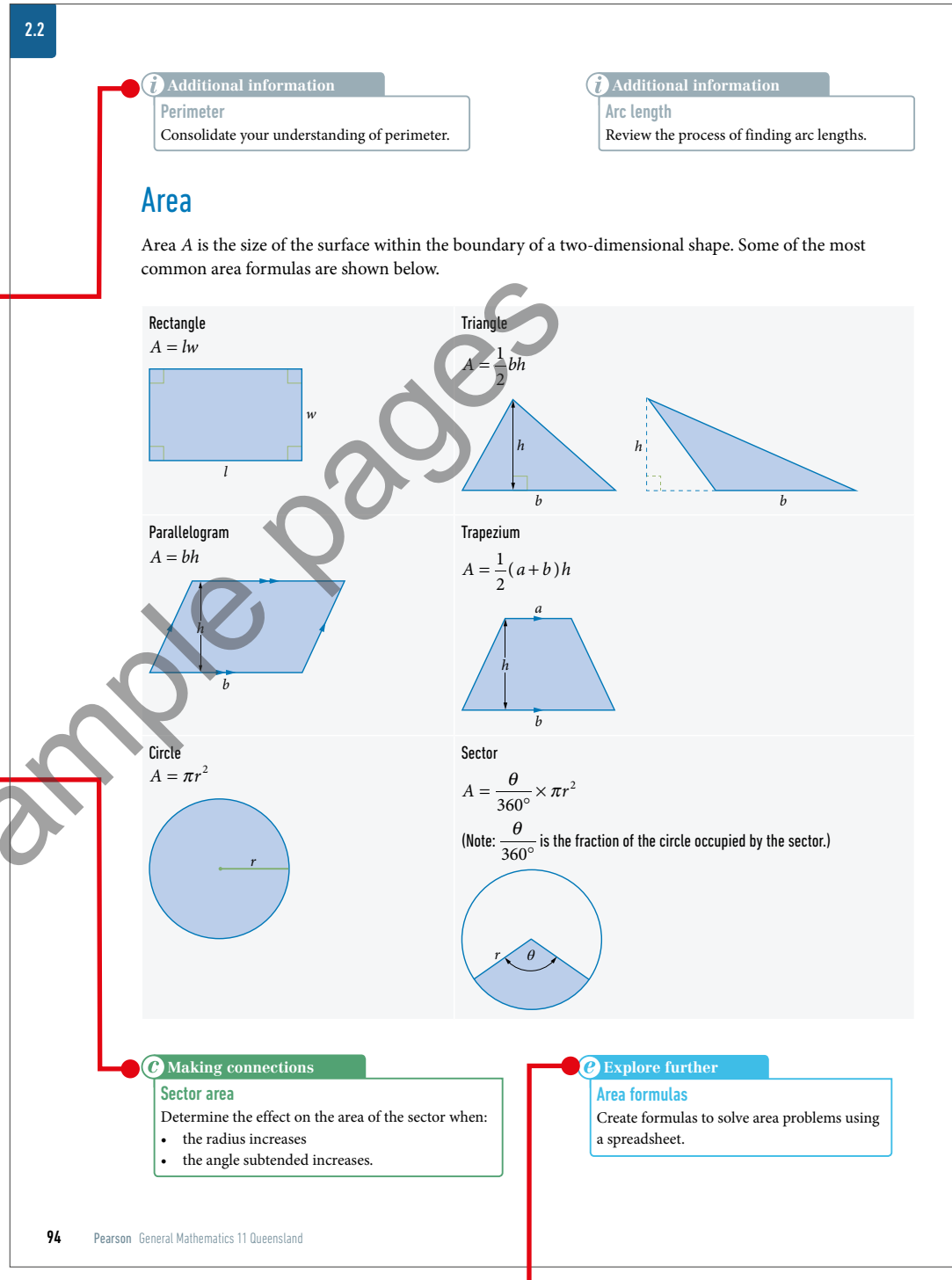
These interactives appear in the eBook in two forms, as videos explaining specific concepts or as interactive questions to check students' understanding.

Making connections

This eBook feature provides teachers and students with a visual interactive of specific mathematics concepts or ideas to aid students in their understanding.

Explore further

This eBook feature provides an opportunity for students to consolidate their understanding of concepts and ideas with the aid of technology, and answer a small number of questions to deepen their understanding and broaden their skills base. These activities should take approximately 5–15 minutes to complete.



To convert between square factors, use the square of the linear conversion factor.

$\times 1000^2$ $\times 100^2$ $\times 10^2$

km^2 m^2 cm^2 mm^2

$\div 1000^2$ $\div 100^2$ $\div 10^2$

Additional information

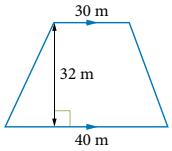
Converting units of length

Revise converting metric units of area.

7 Area

Determine the area of the shape, to 2 decimal places where necessary.

(a)



THINKING	WORKING
1 Recall the formula for the area of the shape.	The shape is a trapezium. $A = \frac{1}{2}(a+b)h$
2 Substitute the known measurements into the formula to calculate A.	$A = \frac{1}{2}(30+40)\times 32$ $= \frac{1}{2}\times 70\times 32$ $= 1120\,m^2$
3 Interpret the answer.	The area of the trapezium is $1120\,m^2$.

11 An Aussie cap has been discounted by 15% to a sale price of $21.25.

(a) Which alternative shows a correct calculation for finding the original price?

A $\$21.25\times 1.15$ B $\frac{\$21.25}{1.15}$ C $\$21.25\times 0.85$ D $\frac{\$21.25}{0.85}$

(b) Explain the common error in the first of the incorrect alternatives.

(c) Which alternatives give a value that is less than the sale price?

WARNING

A common error when determining the original price is to increase the discounted price by the given percentage.

From Worked example 5: $\frac{49.80}{0.83} \neq 49.80\times 1.17$.

Key information

Key information and rules are highlighted throughout the chapter.

Every worked example and question is graded

Every example and question is graded using three levels of difficulty, as specified in the QCE syllabus:

- simple familiar (1 bar)
- complex familiar (2 bars)
- complex unfamiliar (3 bars)

The visibility of this grading helps ensure all levels of difficulty are well covered.

Meeting the needs of the QCE syllabus

The authors have integrated both the cognitive verbs and the language of the syllabus objectives throughout the worked examples and questions.

Highlighting common errors

Throughout the exercises authors have integrated questions designed to highlight common errors frequently made by students. Explanations are given in the worked solutions.

Worked solutions

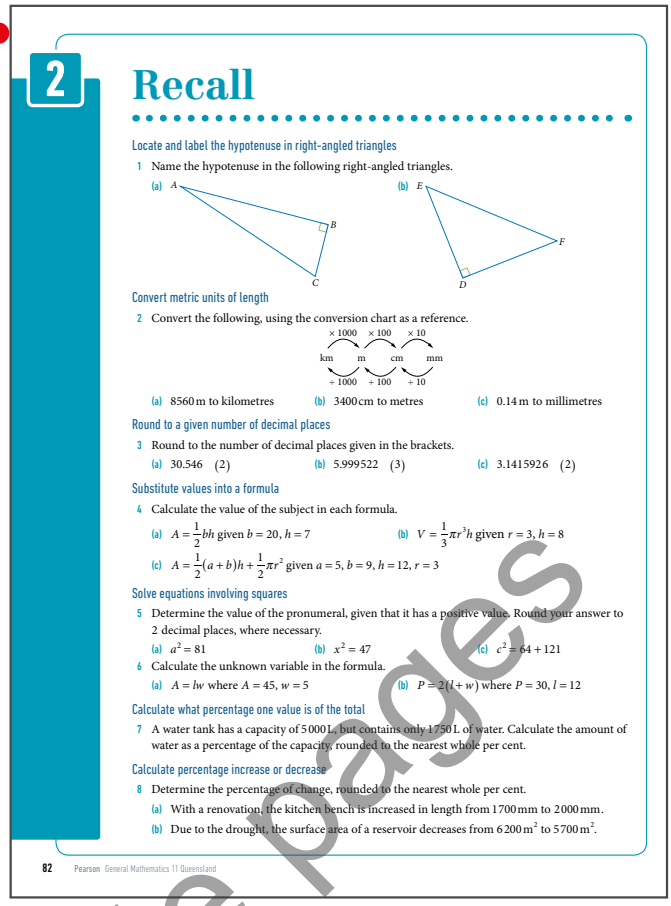
Fully worked solutions are provided for every question in the student textbook and can be accessed from the accompanying eBook.

Warning boxes

Warning boxes are located throughout the chapter to alert students to common errors and misconceptions.

Recall

Each chapter begins with a review of assumed knowledge for the chapter.



2

Recall

Locate and label the hypotenuse in right-angled triangles

1 Name the hypotenuse in the following right-angled triangles.

(a)

(b)

Convert metric units of length

2 Convert the following, using the conversion chart as a reference.

(a) 8560 m to kilometres (b) 3400 cm to metres (c) 0.14 m to millimetres

Round to a given number of decimal places

3 Round to the number of decimal places given in the brackets.

(a) 30.546 (2) (b) 5.999522 (3) (c) 3.1415926 (2)

Substitute values into a formula

4 Calculate the value of the subject in each formula.

(a) $A = \frac{1}{2}bh$ given $b = 20, h = 7$ (b) $V = \frac{1}{3}\pi r^3 h$ given $r = 3, h = 8$

(c) $A = \frac{1}{2}(a + b)h + \frac{1}{2}\pi r^2$ given $a = 5, b = 9, h = 12, r = 3$

Solve equations involving squares

5 Determine the value of the pronumeral, given that it has a positive value. Round your answer to 2 decimal places, where necessary.

(a) $a^2 = 81$ (b) $x^2 = 47$ (c) $c^2 = 64 + 121$

6 Calculate the unknown variable in the formula.

(a) $A = lw$ where $A = 45, w = 5$ (b) $P = 2(l + w)$ where $P = 30, l = 12$

Calculate what percentage one value is of the total

7 A water tank has a capacity of 5000 L, but contains only 1750 L of water. Calculate the amount of water as a percentage of the capacity, rounded to the nearest whole per cent.

Calculate percentage increase or decrease

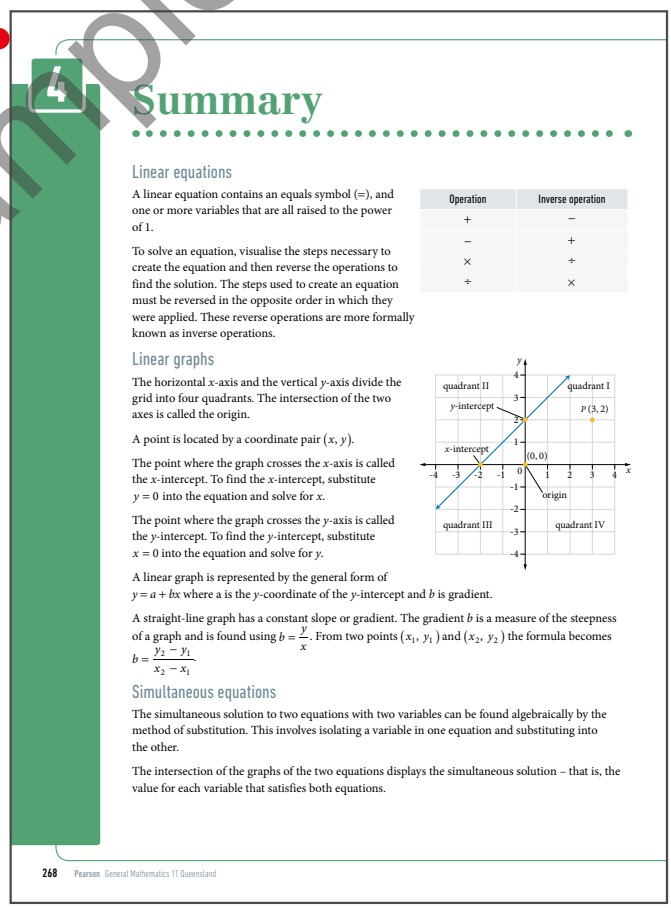
8 Determine the percentage of change, rounded to the nearest whole per cent.

(a) With a renovation, the kitchen bench is increased in length from 1700 mm to 2000 mm.

(b) Due to the drought, the surface area of a reservoir decreases from 6200 m^2 to 5700 m^2.

Summary

At the end of each chapter is a summary of the key facts and rules used in the chapter.



4

Summary

Linear equations

A linear equation contains an equals symbol (=), and one or more variables that are all raised to the power of 1.

To solve an equation, visualise the steps necessary to create the equation and then reverse the operations to find the solution. The steps used to create an equation must be reversed in the opposite order in which they were applied. These reverse operations are more formally known as inverse operations.

Operation	Inverse operation
+	−
−	+
×	÷
÷	×

Linear graphs

The horizontal x-axis and the vertical y-axis divide the grid into four quadrants. The intersection of the two axes is called the origin.

A point is located by a coordinate pair (x, y).

The point where the graph crosses the x-axis is called the x-intercept. To find the x-intercept, substitute $y = 0$ into the equation and solve for x.

The point where the graph crosses the y-axis is called the y-intercept. To find the y-intercept, substitute $x = 0$ into the equation and solve for y.

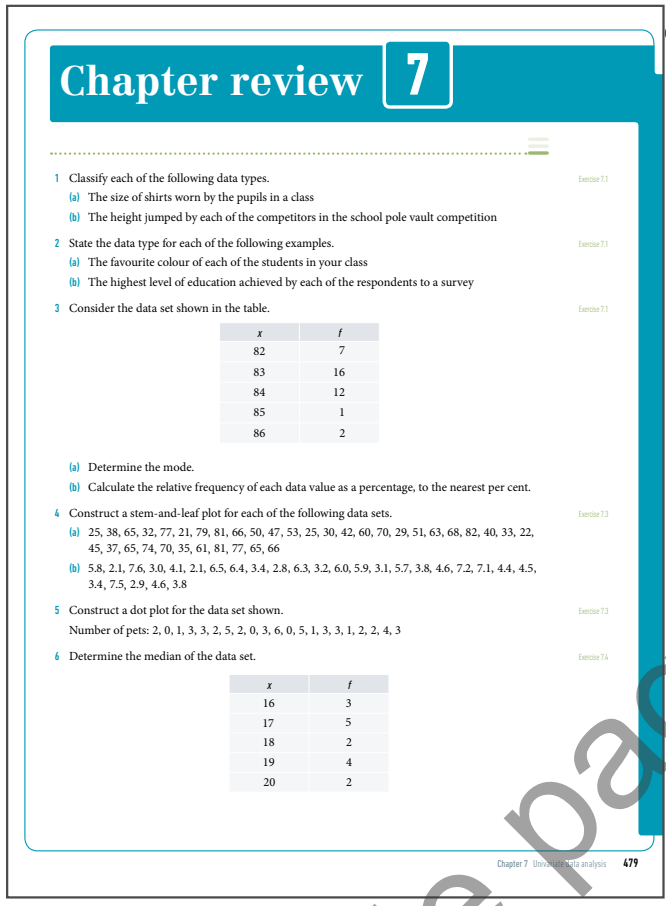
A linear graph is represented by the general form of $y = a + bx$ where a is the y-coordinate of the y-intercept and b is gradient.

A straight-line graph has a constant slope or gradient. The gradient b is a measure of the steepness of a graph and is found using $b = \frac{y}{x}$. From two points (x_1, y_1) and (x_2, y_2) the formula becomes $b = \frac{y_2 - y_1}{x_2 - x_1}$.

Simultaneous equations

The simultaneous solution to two equations with two variables can be found algebraically by the method of substitution. This involves isolating a variable in one equation and substituting into the other.

The intersection of the graphs of the two equations displays the simultaneous solution – that is, the value for each variable that satisfies both equations.



Chapter review 7

Exercise 7.1

1 Classify each of the following data types.

(a) The size of shirts worn by the pupils in a class

(b) The height jumped by each of the competitors in the school pole vault competition

Exercise 7.1

2 State the data type for each of the following examples.

(a) The favourite colour of each of the students in your class

(b) The highest level of education achieved by each of the respondents to a survey

Exercise 7.1

3 Consider the data set shown in the table.

x	f
82	7
83	16
84	12
85	1
86	2

(a) Determine the mode.

(b) Calculate the relative frequency of each data value as a percentage, to the nearest per cent.

Exercise 7.3

4 Construct a stem-and-leaf plot for each of the following data sets.

(a) 25, 38, 65, 32, 77, 21, 79, 81, 66, 50, 47, 53, 25, 30, 42, 60, 70, 29, 51, 63, 68, 82, 40, 33, 22, 45, 37, 65, 74, 70, 35, 61, 81, 77, 65, 66

(b) 5.8, 2.1, 7.6, 3.0, 4.1, 2.1, 6.5, 6.4, 3.4, 2.8, 6.3, 3.2, 6.0, 5.9, 3.1, 5.7, 3.8, 4.6, 7.2, 7.1, 4.4, 4.5, 3.4, 7.5, 2.9, 4.6, 3.8

Exercise 7.3

5 Construct a dot plot for the data set shown.

Number of pets: 2, 0, 1, 3, 3, 2, 5, 2, 0, 3, 6, 0, 5, 1, 3, 3, 1, 2, 2, 4, 3

Exercise 7.4

6 Determine the median of the data set.

x	f
16	3
17	5
18	2
19	4
20	2

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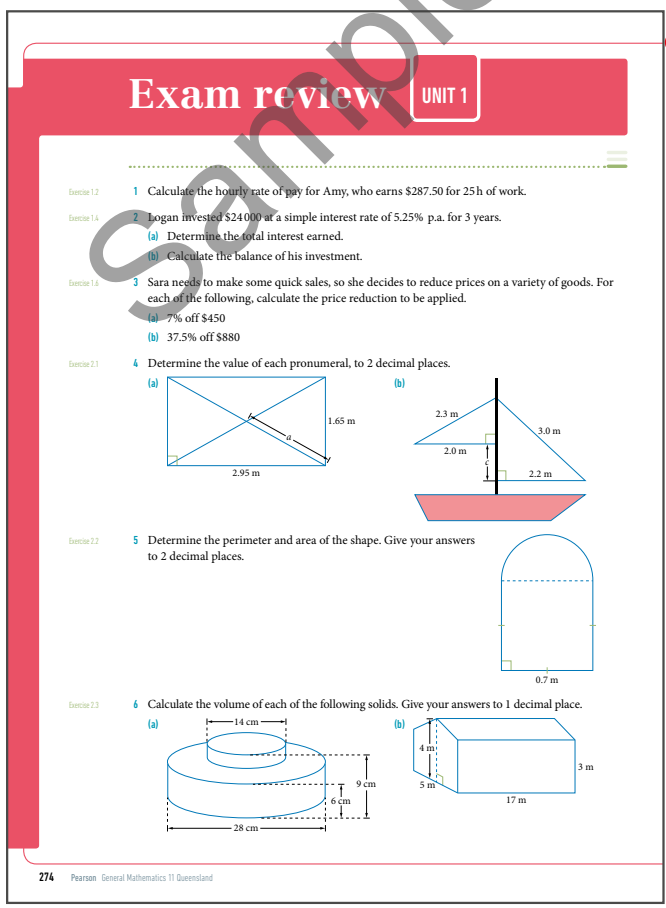
Chapter review

Every chapter review follows the QCAA examination proportions for levels of difficulty, which is 60% simple familiar, 20% complex familiar and 20% complex unfamiliar.



Exam review UNIT 1

Exercise 1.2

1 Calculate the hourly rate of pay for Amy, who earns $287.50 for 25 h of work.

Exercise 1.4

2 Logan invested $24 000 at a simple interest rate of 5.25% p.a. for 3 years.

(a) Determine the total interest earned.

(b) Calculate the balance of his investment.

Exercise 1.6

3 Sara needs to make some quick sales, so she decides to reduce prices on a variety of goods. For each of the following, calculate the price reduction to be applied.

(a) 7% off $450

(b) 37.5% off $880

Exercise 2.1

4 Determine the value of each pronumeral, to 2 decimal places.

(a)

(b)

Exercise 2.2

5 Determine the perimeter and area of the shape. Give your answers to 2 decimal places.

Exercise 2.3

6 Calculate the volume of each of the following solids. Give your answers to 1 decimal place.

(a)

(b)

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Exam review

Exam reviews give cumulative practice at content already covered, to prepare students for the end-of-year exam. They have been placed at the end of each Unit.

1

Consumer arithmetic

1 Recall

Convert a mixed number to an improper fraction

1 Convert the following mixed numbers to improper fractions.

(a) $2\frac{2}{5}$ (b) $1\frac{3}{8}$

Round to a given number of decimal places

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

(a) $0.6842\,(2)$ (b) $0.84559\,(3)$ (c) $9.897\,(2)$

Substitute values into a formula

3 Substitute the given values into the following formulas.

(a) Given $a = 2$, $b = 5$ and $c = 4$, determine the value of y if $y = 3a + bc$.

(b) Given $j = 5$, $k = 3$ and $l = 1$, determine the value of a if $a = j^2 - 2(k + l)$.

(c) Given $I = 500$, $P = 5000$ and $n = 2$, determine the value of i if $i = \frac{100\,I}{Pn}$

Calculate the mean of a group of numbers

4 Calculate the mean of each group of numbers.

(a) 4, 5, 6, 8, 12 (b) 15, 25, 30, 30, 45, 65 (c) 8.4, 0.5, 3.2, 1.7

Convert percentages to decimals

5 Convert the following percentages to decimals.

(a) 15% (b) 3.5% (c) 152% (d) 0.75%

Convert decimals to percentages

6 Convert the following decimals to percentages.

(a) 0.73 (b) 0.026 (c) 1.09

Percentages, decimals and rates

1.1

Percentages

You will use percentages throughout your life, such as in calculating:

- a pay increase
- a discount at a shop
- GST added to a purchase
- tax on your earnings.

You will recall that 'per cent' means 'out of 100' and the symbol for percentage is %.

1 Converting to a percentage

Express the following as a percentage, to 1 decimal place where necessary.

(a) $\frac{4}{5}$

THINKING	WORKING
Multiply the fraction by 100%.	$\frac{4}{5} \times 100\% = 80\%$

(b) 53 out of 78

1 Express the figures as a fraction.	$\frac{53}{78}$
2 Multiply the fraction by 100%. Include 1 more decimal place than is required in the answer.	$\frac{53}{78} \times 100\% = 67.94\ldots\%$
3 Round as directed.	$= 67.9\%$ (1 decimal place)

(c) 0.9465

1 Multiply the number by 100%.	$0.9465 \times 100\% = 94.65\%$
2 Round as directed.	$= 94.7\%$ (1 d.p.)

Additional information

Fractions, decimals and percentages

Practise converting between fractions, decimals and percentages.

2 Percentages greater than 100

Express the following as a percentage, to the nearest whole percentage.

(a) $2\frac{3}{8}$

THINKING	WORKING
1 Separate the parts of the mixed number.	$2\frac{3}{8} = 2 + \frac{3}{8}$
2 Multiply each part by 100%.	$2 \times 100\% + \frac{3}{8} \times 100\%$ $= 200\% + 37.5\%$ $= 237.5\%$
3 Round as directed.	$= 238\%$ (nearest %)

(b) 123 out of 65

1 Express the figures as a fraction.	$\frac{123}{65}$
2 Multiply the fraction by 100%. Include 1 more decimal place than is required in the answer.	$\frac{123}{65} \times 100\%$ $= 189.2\ldots\%$
3 Round as directed.	$= 189\%$ (nearest %)

(c) 34.067

1 Multiply the number by 100%.	$34.067 \times 100\%$ $= 3406.7\%$
2 Round as directed.	$= 3407\%$ (nearest %)

3 Calculating a percentage of a quantity

Determine the specified percentage of each quantity.

(a) 6.1% of \$280

THINKING	WORKING
1 Express the percentage as a decimal.	6.1% of \$280
2 Multiply the decimal by the quantity.	$= 0.061 \times \$280$
3 Calculate the answer.	$= \$17.08$

(b) 102% of 64 kg

1 Express the percentage as a decimal.	102% of 64 kg
2 Multiply the decimal by the quantity.	$= 1.02 \times 64$ kg
3 Calculate the answer.	$= 65.28$ kg

(c) 0.3% of 40 km

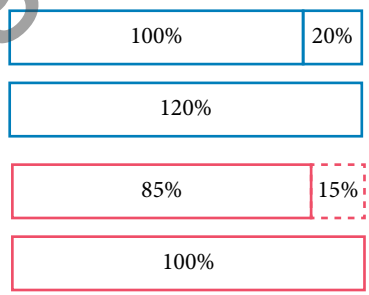
1 Express the percentage as a decimal.	0.3% of 40 km
2 Multiply the decimal by the quantity.	$= 0.003 \times 40$ km
3 Calculate the answer and change to a more appropriate unit, if necessary.	$= 0.12$ km $= 120$ m

Increasing or decreasing a quantity by a set percentage

There are two basic methods for increasing or decreasing a quantity by a set percentage.

Method 1: Percentage as a scale factor

If you consider the initial number as being 100%, then an increase of 20% will mean you now have 120% of the original number (a decimal ratio of 1.2).



Similarly, if a number is reduced by 15%, then 100% less 15% means you have 85% remaining (a decimal ratio of 0.85).

Method 2: Adding or subtracting a percentage of the original quantity

The second method is to find the stated percentage of the original quantity, then add or subtract this amount to calculate the new increased or reduced quantity.

See how both methods are used in the following worked examples.

4 Percentage increase and decrease

Change each amount by the specified percentage.

(a) Increase 125 by 20%.

METHOD 1

THINKING	WORKING
1 Create a mathematical expression that represents the problem.	$(100 + 20)\%$ of 125 $= 120\%$ of 125
2 Convert the percentage to a decimal by dividing by 100.	$= 1.2 \times 125$
3 Multiply the original quantity by the decimal.	$= 150$

METHOD 2

1 Calculate the stated percentage of the original quantity.	$20\% \text{ of } 125 = \frac{20}{100} \times 125$ $= 0.2 \times 125$ $= 25$
2 Add the amount to the original quantity.	Increased amount: $125 + 25 = 150$

(b) Decrease 420 by 14%.

METHOD 1

1 Write an expression that represents the problem.	$(100 - 14)\% \text{ of } 420$ $= 86\% \text{ of } 420$
2 Convert the percentage to a decimal by dividing by 100.	$= 0.86 \times 420$
3 Multiply the original quantity by the decimal.	$= 361.2$

METHOD 2

1 Calculate the stated percentage of the original quantity.	$14\% \text{ of } 420 = \frac{14}{100} \times 420$ $= 0.14 \times 420$ $= 58.8$
2 Subtract the amount from the original quantity.	Decreased amount: $420 - 58.8 = 361.2$

When given the increased or decreased value, you can use the percentage change to determine the original value.

5 Calculating the original value

After a 17% discount, a shirt is advertised for $49.80. Calculate the original price before the discount.

THINKING	WORKING
1 Construct an equation showing the discounted price as a percentage of the original price.	$(100 - 17)\%$ of original price = \$49.80
2 Convert the percentage discount to a scale factor, expressed as a decimal.	$83\% \times \text{original price} = 49.80$ $0.83 \times \text{original price} = 49.80$
3 Solve the equation to determine the value of the original price.	$\text{Original price} = \frac{49.80}{0.83}$ $= \$60$
4 Interpret the result.	The original price of the item (before the discount) was \$60.

WARNING

A common error when determining the original price is to increase the discounted price by the given percentage.

From Worked example 5: $\frac{49.80}{0.83} \neq 49.80 \times 1.17$.

Additional information

Percentage change

Watch the video and practise calculating percentage change.

The unitary method is another way of solving problems where backtracking is involved.

	Advertised price (83%)	1%	Original (100%)
Amount	\$49.80	\$49.80 ÷ 83 = \$0.60	\$0.60 × 100 = \$60

Rates

Whether you realise it or not, you deal with the mathematical concept of *rates* every day. Rates are when one quantity is expressed in terms of another. For example:

- call costs expressed as a cost per minute (cents/min)
- data charges expressed as a cost per megabyte (\$/MB)
- hourly rates of pay expressed as dollars per hour (\$/h)
- speed expressed in kilometres per hour (km/h).

Additional information

Rate, distance and speed

Watch the videos and practise using rates to solve problems.

6 Calculating a rate

Bernard takes his car on a road trip and drives for 5 h at an average speed of 85 km/h. Over the trip his car's fuel economy is 7 L per 100 km. Fuel costs \$1.45/L.

(a) Determine the distance travelled.

THINKING	WORKING
1 Interpret the rate.	85 km/h means 85 km travelled each 1 h
2 Multiply by the number of hours to give the distance in kilometres.	Distance travelled in 5 h: 85 km × 5 = 425 km

(b) Calculate the amount of fuel used over the trip. Use the distance travelled calculated in the previous part of the question.

1 Interpret the rate.	7 L per 100 km means: 7 L of petrol used for every 100 km travelled
2 Divide the distance by 100 km then multiply the number of lots of 100 km by 7 L.	$\frac{425\text{ km}}{100\text{ km}} \times 7\text{ L} = 29.75\text{ L}$

(c) Calculate the cost of fuel to the nearest dollar.

Multiply the number of litres used by the cost per litre.	\$1.45 × 29.75 = \$43.1375 = \$43 (nearest \$)

EXERCISE 1.1 Percentages, decimals and rates

Worked Example

1 Convert the following to percentages. Round your answer to 2 decimal places where necessary.

(a) $\frac{2}{5}$ (b) $\frac{4}{9}$ (c) $\frac{3}{8}$ (d) $\frac{7}{20}$

(e) 45 out of 50 (f) 68 out of 90 (g) 34 out of 55 (h) 3 out of 500

(i) 0.28 (j) 0.876 (k) 0.66666 (l) 0.00123

2 Convert the following to percentages. Round your answer to the nearest whole number where necessary.

(a) $\frac{12}{5}$ (b) $1\frac{2}{9}$ (c) $\frac{709}{20}$

(d) 3.43 (e) 24.567 (f) 7.8009

(g) 145 compared to 30 (h) 56 out of 25 (i) 75 out of 40

3 Determine the specified percentage of each quantity. Give your answer in the most appropriate units.

(a) 18% of 420 g (b) 68% of $45 (c) 2.4% of 30 m

(d) 115% of $35 (e) 105.6% of 400 m (f) 205% of 44 kg

(g) 0.5% of $3400 (h) 0.01% of 20 s (i) 0.11% of $500

4 Make the percentage change shown for each of the following. Round your answer to 2 decimal places where necessary.

(a) Increase 300 by 12%. (b) Decrease 25 by 20%. (c) Increase 42.5 by 15%.

(d) Decrease 83.5 by 16%. (e) Increase 0.08 by 50%. (f) Decrease 0.05 by 20%.

(g) Increase 23.6 by 4.5%. (h) Decrease 56.75 by 3.8%.

6 5 Trinh takes her car on a road trip and drives for 6 h at an average speed of 90 km/h. Over the trip the car's fuel economy is 7.2 L per 100 km.

(a) Determine the distance travelled.

(b) Calculate the amount of fuel used, to the nearest litre.

6 Calculate the hourly rate of pay for the following workers.

(a) Amy earns $287.50 for 25 h of work.

(b) Ben earns $740 for his 40 h week.

(c) Cathy is paid monthly and earns $6400 for 170 h of work.

(d) Danesh has a yearly income of $72 000 and works a 38 h week, assuming the pay is across all 52 weeks of the year.

7 A small dam on Brian's farm has a capacity of 2 million litres of water. Flooding rain comes and the dam is overflowing. The next morning Brian notices the rain has damaged the retaining wall of the dam at the bottom, and water is slowly leaking out. In 24 h the dam has lost 1000 L of water.

(a) Determine the rate at which the water is leaking, to 1 decimal place.

(b) From the moment when the dam began to leak, how long will it take for the dam to be completely empty?

8 Sara needs to make some quick sales, so she decides to reduce prices on a variety of goods. For each of the following, calculate the price reduction to be applied.

(a) 10% off $23.40 **(b)** 15% off $650 **(c)** 12.5% off $64

9 Gold has a current value of $825 per ounce. Determine the value of the price reduction if 5 ounces of gold is reduced by 17%.

10 Based on the information in this advertisement, what is the discounted price of a $450 suit?

11 An Aussie cap has been discounted by 15% to a sale price of $21.25.

(a) Which alternative shows a correct calculation for finding the original price?

A 21.25×1.15 **B** $\frac{\$21.25}{1.15}$ **C** $\$21.25 \times 0.85$ **D** $\frac{\$21.25}{0.85}$

(b) Explain the common error in the first of the incorrect alternatives.

(c) Which alternatives give a value that is less than the sale price?

Worked Example 5

12 Maria takes over a discount store and mistakenly throws out the original price tags, so the customer can only see what the percentage discount is. For each of the following items, determine the original price before the discount was given.

(a) discounted price $42.50, 15% discount **(b)** discounted price $52, 20% discount

(c) discounted price $24.23, 8% discount **(d)** discounted price $76, 5% discount

(e) discounted price $41.40, 8% discount **(f)** discounted price $67.68, 6% discount

(g) discounted price $3.15, 10% discount **(h)** discounted price $8.64, 20% discount

(i) discounted price $131.37, 14% discount

13 A DVD is advertised as 15% off the original price and you are charged $29.75.

(a) Calculate the original price of the DVD.

A $44.75 **B** $25.30 **C** $35 **D** $34.20

(b) Explain the common error made by a student who selected the last of the incorrect options.

14 Amena takes her American friends Cathy and Richard on a road trip to Central Australia. They travel a distance of 6400 km and use 450 L of fuel at a cost of $810.

(a) Calculate the rate of fuel consumption in litres per kilometre, to 2 decimal places.

(b) It is more usual to state the fuel consumption in L per 100 km to compare fuel efficiency. Calculate the rate of fuel consumption in L per 100 km, to 1 decimal place.

(c) Determine the average cost of fuel in dollars per litre.

15 Mosi and Liam are comparing their results during the year. This table shows their results for three mathematics tests.

	Mosi	Liam
Test 1	15 out of 20	17 out of 20
Test 2	43 out of 50	32 out of 50
Test 3	24 out of 30	28 out of 30

Answer the following questions, expressing all answers to 1 decimal place.

(a) Convert the result for each test to a percentage to complete the table at bottom right.

	Percentages	
	Mosi	Liam
Test 1		
Test 2		
Test 3		

(b) Calculate Mosi's mean percentage.

(c) Calculate Liam's mean percentage.

(d) Based on the mean percentages, which student has better results overall?

(e) The final mark is calculated by adding the individual test scores to obtain a mark out of 100. Calculate Mosi and Liam's final mark to determine who has the better result.

(f) Explain the discrepancy between the two comparisons of overall results for Mosi and Liam.

16 Tim's boss offers him a choice: either a lump sum bonus of 15% of his current salary of $45 000, or a $100 per week pay increase for the whole of the year. Ignoring tax implications, determine which choice is better for Tim and by how much.

17 Answer the following questions based on the values shown in the table. Round your answers to the nearest whole percentage.

State or territory	Population (1000s)
Australian Capital Territory	397.4
New South Wales	7 480.2
Northern Territory	228.8
Queensland	4 703.2
South Australia	1676.7
Tasmania	510.0
Victoria	5 926.6
Western Australia	2 474.4
Total	23 397.3

(a) What percentage of the entire Australian population live in the Australian Capital Territory?

(b) What percentage of the Australian population live in Queensland, New South Wales or Victoria?

(c) What percentage of the Australian population live outside Queensland, New South Wales and Victoria?

18 FIT Fun and Fitness is having a grand opening sale.

Alina and Jonas are going to trial the centre and want to take advantage of the special introductory offers on a set of 5 or 10 discounted sessions. (Discounts are given on the price of casual passes.)

Classes with 10 discounted sessions:

Class	Original price (per session)	Discount
Personal training	$42	5%
Spin	$18	20%
Boxing	$35	10%

Classes with 5 discounted sessions:

Class	Original price (per session)	Discount
Gym and swim	$15	30%
HiiT Fit	$20	15%
Intervals and circuits	$16	25%

(a) Alina would like to try a class that runs for only 5 sessions. Compare the savings to determine which class she should try, in order to get the most value from the introductory discount.

(b) Alina enjoys the class and decides to sign up for a yearly pass for $1040. If on average she attends 5 sessions per week, calculate the cost per session for her yearly membership.

(c) Jonas wants to sign up for two different 10 discounted sessions to kick start his fitness program. Which sessions should he purchase to make the most of the discounts offered?

(d) After his trial, Jonas decides to purchase an annual membership to work with a personal trainer. The yearly subscription costs $1820. Jonas attends on average 5 sessions per week over the course of the year. Calculate the total cost per session for the year.

19 The table gives the area of Australian states and territories with their estimated populations, taken from the 2016 Census data. Use a spreadsheet or calculator to complete the following tasks. Give your answers in a table.

Region	Area (km^2)	Population (1000s)
Australian Capital Territory	2 280	397.4
New South Wales	800 642	7 480.2
Northern Territory	1 349 129	228.8
Queensland	1 730 648	4 703.2
South Australia	983 482	1676.7
Tasmania	68 401	510.0
Victoria	227 146	5 926.6
Western Australia	2 529 875	2 474.4
Total	7 691 603	23 397.3

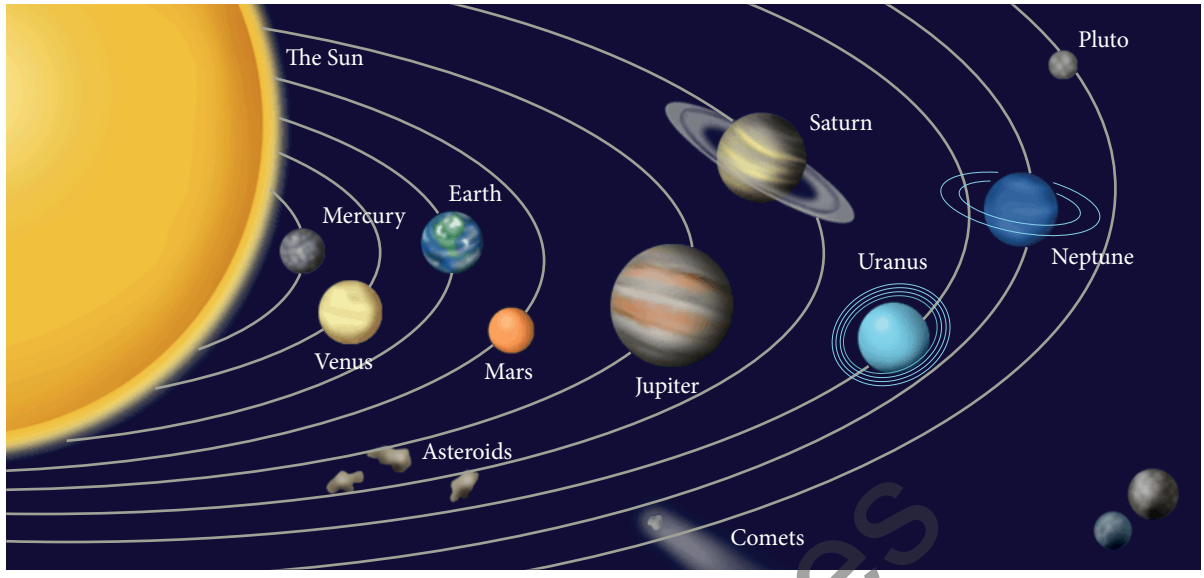
(a) (i) Calculate the percentage area of each state and territory relative to the whole of Australia. Calculate answers to the nearest whole percentage.

(ii) Determine the largest and smallest of the mainland states.

(b) (i) Calculate the population density (the rate of persons per km^2) for each state and territory and for the whole of Australia. Calculate answers to 1 decimal place.

(ii) Which state or territory has a population density closest to the average?

20 Use the information in the table of planets to answer the questions, to the nearest whole percentage.



Planet	Diameter (km)	Distance from the Sun (millions of km)	Length of year (Earth days or years)
Mercury	4 880	57.9	59 days
Venus	12 100	108.2	224.7 days
Earth	12 756	149.6	365.3 days
Mars	6 794	227.4	687 days
Jupiter	143 200	778.3	11.9 years
Saturn	120 000	1 427	295 years
Uranus	51 800	2 870	84 years
Neptune	49 500	4 497	165 years

(a) What percentage of the diameter of Mars is Earth's diameter?

(b) What percentage of the diameter of the largest planet is the smallest planet's diameter?

(c) Earth's distance from the Sun is what percentage of the distance from the Sun to Neptune?

(d) A year on Earth is what percentage of a year on Mercury?

(e) The Sun has a diameter of 1 391 000 km. What percentage is this of the largest planet's diameter?

(f) The Sun's diameter is what percentage of the distance from Neptune to the Sun? Give your answer to 2 decimal places.

(g) Do you think the diagram of the solar system shown is drawn to scale? Explain.

Making money

1.2

Wages and salaries

Incomes are earned in different ways. Workers most often earn wages or salaries. A salary is usually an agreed annual amount, whereas a wage may depend on the hours worked and may include extra income for overtime or work outside normal hours.

7 Calculate a weekly wage

Laura works as a music teacher and is paid a standard $55 an hour up until 6 pm and then overtime at time-and-a-half. ('Time-and-a-half' means that she is paid 1.5 times her hourly rate for every additional hour after 6 pm.)

(a) Calculate Laura's weekly wage if she works 30 standard hours.

THINKING	WORKING
Multiply the number of hours by the hourly rate.	Laura's weekly wage: $55 \times 30 = \$1650$

(b) Calculate Laura's weekly wage if she works 28 h at the standard rate and 4 h at the penalty rate.

1 Calculate the wage earned from the standard hours.	Amount for standard hours: $28 \times 55 = \$1540$
2 Calculate the hourly rate at time-and-a-half.	Rate for time-and-a-half: $1.5 \times 55 = \$82.50$ per hour
3 Calculate the wage earned at time-and-a-half.	Amount at time-and-a-half: $4 \times 82.50 = \$330$
4 Calculate the total wage.	$1540 + 330 = \$1870$
5 Interpret the answer.	Laura's total wage is $1870

Commission and piecework

Some employees get paid for each piece of work completed and others are paid on commission, i.e. they receive a percentage of the value of the work they produce once it is sold.

8 Other ways of calculating a wage

Olivia, Lachie and Cam all get summer jobs while they are waiting for Year 12 to start. Olivia picks fruit and is paid $40 for every 20 kg of fruit she picks, Lachie produces a short puppet play for the local shopping centre and is paid $50 per performance, while Cam sells ukuleles door to door and is paid 15% commission of his total sales.

(a) Calculate Olivia's weekly wage if she picks 340 kg of fruit for the week.

THINKING	WORKING
1 Determine the number of units she is paid for, by dividing the weight of fruit picked by the unit weight.	Number of units $= 340 \div 20$ $= 17$
2 Multiply the number of units by the price per unit.	Wage $= 17 \times 40$ $= \$680$
3 Interpret the answer.	Olivia's weekly wage is $680.

(b) Calculate Lachie's wage if the play is performed three times each weekday and once each day over the weekend.

1 Calculate the total number of performances.	Number of performances $= 5 \times 3 + 2$ $= 17$
2 Multiply the number of performances by the fee per performance.	Wage $= 17 \times 50$ $= \$850$
3 Interpret the answer.	Lachie's wage is $850.

(c) Calculate Cam's earnings if the total revenue from his ukulele sales is $3700.

1 Calculate the commissioned percentage of the total sales.	Wage = 15% of sales $= 0.15 \times 3700$ $= \$555$
2 Interpret the answer.	Cam's earnings amount to $555.

9 Commission with a retainer

Jasmin sells cars. She earns a weekly retainer of $400 plus a commission of 5% of her sales for the week. Calculate her earnings if she sells only one car in the week, valued at $32 000.

THINKING	WORKING
1 Determine the commission earned.	5% of 32 000 = 0.05 × $32 000 = $1600
2 Add the commission (the percentage of sales) to the weekly retainer.	400 + $1600 = $2000
3 Interpret the answer.	Jasmin earns $2000 for the week.

10 Graduated commission

Elmar works in real estate and is paid monthly. He is paid a commission of 2% on the first $50 000 of the value of each house sold, 1% on the next $200 000 and 0.5% on the remainder of each house's value. Calculate Elmar's commission on a property he sold for $580 000.

THINKING	WORKING
1 Break down the total into the three graduated amounts.	$580 000 = $50 000 + $200 000 + $330 000
2 Calculate the commissions for each percentage bracket.	Commission = 2% of 50 000 + 1% of 200 000 + 0.5% of 330 000 = 0.02 × 50 000 + 0.01 × 200 000 + 0.005 × 330 000 = 1000 + 2000 + 1650 = $4650
3 Interpret the answer.	Elmar's commission is $4650.

Explore further

Graduated commission

Complete the spreadsheet to determine the total amount of commission earned. Add your own formulas to compare commission rates.

Government allowances and pensions

However money is earned, the total amount for a given time period is called the *gross* amount. From this gross amount, tax is paid. The amount remaining after tax is the *net* amount. Taxation and net income are explored in the next section.

The Australian government allocates money from taxes to pay allowances and pensions to people who qualify for short-term or long-term assistance. Such benefits include youth allowances, unemployment benefits, disability pensions and study allowances.

11 Government allowances

Rauna is a 17-year-old single apprentice, living at home. Use the table to answer the following questions, assuming that Rauna is eligible for the government allowance.

Students and Australian apprentices	If you earn \$437 – \$524, your fortnightly payment reduces by ...	If you earn more than \$524, your fortnightly payment reduces by ...	Your payment reduces to \$0 once your income reaches the maximum of ...
Single, under 18 years, at home	50 cents for each dollar you earn over \$437	\$43.50 plus 60 cents for each dollar you earn over \$524	\$857.17

(a) Calculate the fortnightly income that Rauna can claim from the government if his employer pays him \$250 per week.

THINKING	WORKING
1 Convert salary from the employer to a fortnightly amount.	Salary per fortnight $= \$250 \times 2$ $= \$500$
2 Find the column on the table that includes the fortnightly amount.	If you earn \$437 – \$524, your fortnightly payment reduces by 50 cents for each dollar you earn over \$437
3 Calculate the reduction.	Reduction $= (500 - 437) \times 50$ cents $= 63 \times \$0.50$ $= \$31.50$
4 Subtract the reduction from the maximum income.	Government allowance $= \$857.17 - \$31.50$ $= \$825.67$
5 Interpret the answer.	Rauna can claim \$825.67 from the government each fortnight.

(b) What would be Rauna's annual gross earnings if this situation continued for a full year?

1 Convert salary from the employer and allowance from the government to annual amounts and calculate the total.	Annual gross earnings $= \$825.67 \times 26 + \$250 \times 52$ $= \$21\,467 + \$13\,000$ $= \$34\,467$
2 Interpret the answer.	Rauna's annual earnings amount to \$34 467.

EXERCISE 1.2 Making money

Worked Example

1 Anora works in a music store and earns an hourly rate of $14. If she works on weekends or after 6 pm during the week, she is paid a penalty rate of time-and-a-half. 7

(a) Calculate her weekly earnings for a standard 35 h week.

(b) Calculate her weekly earnings for a standard 35 h week plus 8 h at time-and-a-half.

(c) Another employee leaves, so the shifts are rearranged. Anora now works from 3 pm to 8 pm on Monday, Tuesday and Wednesday, and from 9 am to 2 pm on Friday and Saturday. Calculate her wage for this week (assuming no unpaid breaks).

(d) Do Anora's new shifts earn her more or less than if she works a standard 35 hour week, and by how much per week?

2 Ben is offered three new holiday jobs. He can pack school books and be paid $6 per box, or he can collect trolleys at the local shopping centre for 50 c per trolley, or he can sell ice-cream and earn 25% of total sales. 8

(a) Calculate his weekly pay if he packs an average of 94 boxes per week.

(b) Calculate his weekly pay if he collects an average of 1250 trolleys per week.

(c) Calculate his weekly pay if the average ice-cream sales are $2460 per week.

(d) Which job will earn the most money if the average numbers are achieved?

3 Quon is paid a base amount of $500 per week plus a commission of 6% on all sales he makes for the week. In one week, he sells $300 worth of goods. What is his wage for the week? 9

4 Lindy works as a sales representative and is paid a weekly amount of $600 plus a commission of 12% of the sales she makes. Over 2 weeks, her sales total $31 450. Calculate her gross wage for the fortnight.

5 Christy has a summer job picking cherries. She is paid a daily rate of $40 plus an additional $0.60 for each punnet she fills on the day. The table shows the number of punnets she fills each day over a 2 week period. Tuesday of Week 1 was Christmas day, and the picking restarted on Boxing day with double pay for the day, including the rate per punnet.

	Week 1 (punnets)	Week 2 (punnets)
Monday	360	300
Tuesday	0	240
Wednesday	340	320
Thursday	320	280
Friday	350	290

(a) How many days did Christy work over the 2 weeks?

(b) Calculate her wage in week 1.

(c) Calculate her wage in week 2.

(d) Calculate Christy's average daily wage, to the nearest dollar.

6 Andrea is offered two salary packages. She could take a set wage of $1250 a week, or a base salary of $500 a week plus commission of 4% on her weekly sales. If her average sales are $27 000 per week, which package is better, and by how much?

7 Kate works as a laboratory assistant and is paid an annual salary of $65 000 plus any overtime she works. She is paid $40 per hour for overtime. If Kate works an extra 4 hours overtime each fortnight, which option is closest to her fortnightly wage? Assume there are 26 fortnights in a year.

A $1250 B $2500 C $2660 D $1410

8 A cafe employs Djaali, Bridie and Namish at a standard rate of $18 per hour. The workers have an unpaid break of half an hour after every 4 hour period worked. Time-and-a-half applies after 6 pm on weekdays and all day Saturday. The employer pays double-time on Sundays, even though this is no longer compulsory. The cafe is closed on Mondays.

Answer the questions below, based on the times worked in a particular week.

	Tue	Wed	Thu	Fri	Sat	Sun
Djaali	8 am–4 pm	8 am–4 pm	8 am–4 pm	8 am–4 pm		
Bridie		1 pm–9 pm	1 pm–9 pm	1 pm–9 pm	1 pm–9 pm	1 pm–9 pm
Namish				10 am–2 pm	10 am–2 pm	

(a) Determine the weekly wage for each employee.

(b) If Djaali were to swap shifts with Bridie on Wednesday to Friday, how much extra will he earn in the week?

(c) Namish actually worked until 9 pm on Friday but did not note the change on his time sheet. How much back pay will he receive when the issue is sorted out?

Worked Example 10

9 Tuan sells high-performance motor vehicles on commission. Each week she earns 5% on the first $40 000 of her sales for the week and 2% on her sales above that. In one week, she sells a sports car for $117 000. Calculate her commission for the week.

10 Sally is paid a base of $500 a week but earns an additional commission of 12% on all sales she makes for the week. Sally sets herself a goal of earning at least $1000 per week. Calculate the minimum sales (in whole dollars) she needs to achieve this goal.

11 A sales assistant earned $270 on the sale of a TV, which was 5% of the selling price.

(a) Which alternative shows a correct calculation for finding the selling price of the TV?

A 270×0.05 B $\dfrac{\$270}{0.05}$ C $\$270 \times 95$ D $\$270 \times 19.5$

(b) Which of the incorrect alternatives gives a reasonable answer? Demonstrate, by a check step, that this alternative is not correct.

12 A salesperson receives a commission of 6% on his weekly sales. His commission for the week is $1740. Calculate his total sales for the week, to the nearest dollar.

13 A commission of $15 500 is paid on total sales of $199 166. If 5% is paid on the first $120 000, calculate the rate paid on the remainder.

14 In a certain year, the Newstart Allowance for an unemployed single person over 22 with no children and very few assets is $492.60 per fortnight. An unemployed person can earn up to $62 a fortnight without affecting this payment. After that, the allowance is reduced according to the table below.

Extra fortnightly income	Allowance reduction
$0–62	No reduction
$62–250	50c for every $1 over $62
Greater than $250	$94 plus 60c for every $1 over $250

(a) Trevor is a single man with no children who was on the Newstart Allowance for 12 weeks while seeking full-time employment. If he did no other work, calculate to the nearest cent his income over the 12 weeks.

(b) Ellie is a single woman with no children who was on the Newstart Allowance for 8 weeks. During that time she found some part-time work and earned the amounts shown in the table.

Weeks	Earnings (part-time work)
1–4	$0
5 and 6	$150
7 and 8	$350

(i) Calculate her Newstart payment for weeks 1 to 4.

(ii) Calculate her Newstart payment for weeks 5 and 6.

(iii) Calculate her Newstart payment for weeks 7 and 8.

(iv) Calculate Ellie's total income for weeks 7 and 8.

15 In a certain year, seniors on the Age Pension are entitled to $712 per fortnight for a single person or $1317.40 per fortnight for a couple if they have no other income. All pensioners can also earn up to $250 a week, to a maximum of $6500 a year, without affecting the pension they receive.

(a) Calculate the total annual income of a single pensioner who relies solely on the pension.

(b) Calculate the annual income for a couple who both earn the maximum amount of extra income and maintain their full pension.

16 Garth produces sporting memorabilia in his workshop. His framed photographs sell for $230 each. He pays $480 each week in fixed expenses (rent and utilities) for the workshop, and each framed picture costs him $110 in materials.

(a) How many photos must Garth sell in a week to make at least $1200 profit?

(b) Each photograph takes Garth 1 h 15 min to produce. Calculate how much time it will take to produce the photographs required for the $1200 profit in the previous question.

(c) Calculate Garth's hourly rate of pay to the nearest 10c.

17 Alan and Nancy live on the Age Pension, which is $1317.40 per fortnight for a couple with no other income. Their pension is reduced by 50c for every $1 more than $268 that they earn. Alan earns 5% royalties on sales of his country and western album.

Calculate their pension in a fortnight when Alan sells $600 worth of albums and Nancy receives $300 for her part-time work.

18 Keaton sells digital devices in a pop-up store. He has two options to earn a weekly wage: 12% of total sales or 7% of total sales plus a retainer of $200 per week. What average amount of sales per week is needed for 'commission only' to be the better option?

1.3 Taxation and other government charges

All kinds of tax

Local, state and federal governments need money to provide services and infrastructure for the community such as roads, libraries and schools. The government collects money in the form of taxes, fines, stamp duty, and excises on alcohol, cigarettes and fuel. The system is quite complex, so in this section you will just look at the taxes most relevant to young people: the Goods and Services Tax (GST) and PAYG ('pay as you go') income tax. You will also look at the HELP scheme of repayments for tertiary education and training.

The GST

The GST is a 10% charge added to the cost of most goods and services. The provider of the goods or services forwards the GST amount to the Australian Taxation Office (ATO).

The GST-inclusive price adds 10% to the pre-tax price. The formulas shown at right are useful when solving problems.

GST = 10% of pre-GST price

$$\begin{aligned}\text{GST-inclusive price} &= (100 + 10)\% \text{ of pre-tax price} \\ &= 110\% \text{ of pre-tax price} \\ &= 1.1 \times \text{pre-tax price}\end{aligned}$$

$$\text{Pre-GST price} = \frac{\text{GST-inclusive price}}{1.1}$$

12 Adding GST

Calculate:

(a) the GST added to the cost of a massage with a pre-tax price of $35.

THINKING

Calculate 10% of the pre-tax price.
GST = 10% of pre-GST price.

WORKING

$$\begin{aligned}\text{GST amount} &= 10\% \text{ of } \$35 \\ &= 0.1 \times 35 \\ &= \$3.50\end{aligned}$$

(b) the GST-inclusive price of a bicycle with a pre-tax price of $345.

The GST-inclusive price is 110% of the pre-GST price.

$$\begin{aligned}\text{GST-inclusive price} &= 110\% \text{ of pre-tax price} \\ &= 1.1 \times 345 \\ &= \$379.50\end{aligned}$$

(c) the pre-GST price of a car advertised at $10 670 including GST.

Divide the GST-inclusive price by 110% to calculate the pre-GST price.

$$\begin{aligned}\text{Pre-GST price} &= \frac{\text{GST-inclusive price}}{1.1} \\ &= \frac{10\,670}{1.1} \\ &= \$9700\end{aligned}$$

Additional information

GST

Calculate the pre-GST price of several items.

Pay as you go (PAYG) income tax

Employees can earn up to $18 200 a year before they begin paying tax. If your wage indicates that you are likely to earn more than $18 200 in a year, your employer withholds some of your salary as tax and sends it straight to the ATO.

Tax rates

The rate of income tax increases as you earn more money, so lower-income employees pay a smaller proportion of their salary in tax than people earning a higher income. This table shows how the rate increases for each income bracket. (An 'income bracket' is a range of incomes that have been grouped together.)

Tax brackets and tax rates for the financial year 1 July 2017 to 30 June 2018

Taxable income	Tax on this income
$0 – $18 200	Nil
$18 201 – $37 000	19 c for each $1 over $18 200
$37 001 – $87 000	$3572 plus 32.5 c for each $1 over $37 000
$87 001 – $180 000	$19 822 plus 37 c for each $1 over $87 000
$180 001 and over	$54 232 plus 45 c for each $1 over $180 000

To keep things simple, the examples here don't include complications such as the Medicare levy or tax rebates. The following examples use the tax table shown here. If you want to work out your own approximate tax situation, you will need to find the tax table applicable to the year the tax was collected.

13 Calculating tax

Use the *Tax brackets and tax rates* table to calculate the annual tax, if any, that should be paid on each of these incomes.

(a) an annual taxable income of $77 000

THINKING	WORKING
1 Identify the correct tax bracket.	$77 000 is in the bracket $37 001 – $87 000.
2 Recall the formula shown in the table. Convert cents to dollars, e.g. 37 c = $0.37	The tax is $3572 + 32.5 c for each $1 over $37 000. 77 000 − 37 000 = $40 000 40 000 × $0.325 = $13 000 Total tax = 3572 + 13 000 = $16 572
3 Interpret your answer.	The tax payable for an annual taxable income of $77 000 is $16 572.

(b) a weekly income of $200.

1 Use the weekly wage to calculate the expected yearly salary.	Yearly salary $= 200 \times 52$ $= \$10\,400$
2 Identify the correct tax bracket.	$10 400 is in the bracket $0–$18 200.
3 Interpret your answer.	There is no tax payable.

(c) a weekly income of $540.

1 Use the weekly wage to calculate the expected yearly salary.	Yearly salary $= 540 \times 52$ $= \$28\,080$
2 Identify the correct tax bracket.	$28 080 is in the bracket $18 201–$37 000.
3 Recall the formula shown in the table.	The tax is 19c for each $1 over $18 200.
4 Convert cents to dollars and calculate the tax payable.	$(28\,080 - 18\,200) \times \$0.19 = \$1877.20$
5 Interpret your answer.	The tax payable for a weekly income of $540 is $1877.20 per year.

Tax calculators are available online to help employers work out the amount of PAYG tax to remove from workers' wages before giving them their *take-home* pay.

Explore further

PAYG

Complete the tax table in order to create your own tax calculator.

Tax returns

At the end of the financial year, taxpayers complete a *tax return* to allow an accurate tax assessment. If the assessment shows that too much tax has been paid already, then the ATO will give a refund. If not enough tax was paid, then the outstanding amount must be paid to the ATO.

Deductions and taxable income

The ATO recognises that some of the money people earn is spent on work-related expenses and should not be taxed. When completing a tax return, these legitimate work-related expenses are deducted from the *gross income* to calculate the *taxable income*, and the final tax is then calculated based on this (reduced) taxable income. Donations to recognised charities may also be deducted. In this way, the tax system rewards those who spend money on appropriate work expenses and those who donate to charities.

The classification of which expenses are tax-deductible is complex, and it varies depending on the type of work being done. For simplicity, consider all the claims made in the following examples and questions to be legitimate deductions unless otherwise stated.

14 Calculating the taxable income

Anna works part-time as a builder and had a gross income of $47 000 for the year. During the year she spent $250 on tools and $50 on safety gear, and she sponsored a child through a registered charity at a cost of $60 per month.

Calculate Anna's taxable income.

THINKING	WORKING
1 Calculate the total work-related expenses (that are tax-deductible).	Total work-related expenses $= 250 + 50$ $= \$300$
2 Determine the annual total of charity donations.	Total charity donations $= 60 \times 12$ $= \$720$
3 Add the deductions for expenses and for charity donations.	Total deductions $= 300 + 720$ $= \$1020$
4 Taxable income = gross income − deductions	Taxable income $= 47\,000 - 1020$ $= \$45\,980$

Tax refunds

For example, Ash normally earns $100 a week working Saturdays in a pet store. This is $5200 a year and below the threshold of $18 200, so no tax is withheld by the taxation office.

If Ash works extra shifts and earns $500 in one week, then she pays tax. At $500 per week her annual salary would be $26 000, above the $18 200 threshold.

At the end of the financial year, when Ash submits her annual tax return, the ATO will return any excess tax paid.

15 Calculating a tax refund or debt

Mayra works as a research biologist and had a gross income of $75 400 for the year. During the year she spent $250 on scientific journals, $80 on work-related phone calls, $45 on work-related internet data charges, $45 on the purchase of a lab coat and $2 each of 10 times the coat was cleaned. She also donated $200 to a fundraiser for a registered charity.

(a) Calculate Mayra's taxable income.

THINKING	WORKING
1 Calculate the total of work-related expenses and gifts to charities.	Total deductions $= 250 + 80 + 45 + 45 + 2 \times 10 + 200$ $= \$640$
2 Taxable income = gross income − deductions	Taxable income $= 75\,400 - 640$ $= \$74\,760$

(b) Calculate her tax to be paid for the year.

1 Refer to the *Tax brackets and tax rates* table to identify the correct tax bracket.	$74 760 is in the tax bracket: $37 001 – 87 000
2 Apply the formula shown in the *Tax brackets and tax rates* table.	The tax is $3572 + 32.5 c for each $1 over $37 000. 74 760 – 37 000 = $37 760 37 760 × $0.325 = $12 272 Total tax = 3572 + 12 272 = $15 844

(c) If Mayra's tax summary shows that she has already paid $16 430, calculate her tax refund or debt.

Subtract the tax to be paid from the tax already paid, as shown on the group certificate, and interpret your answer.	16 430 – 15 844 = $586 Mayra paid $586 too much tax and will get this refunded to her.

The HELP scheme

To allow more people access to tertiary studies, a loans scheme called HELP (Higher Education Loan Program) was introduced to pay for courses and allow students to repay the debt later, when they are working. Depending on the length of the course, the cost of delivering the subjects and the total number of units studied, a graduate may leave university with a HELP debt between $10 000 and $50 000. This debt will be automatically paid back via the tax system, although extra repayments can be made at any time.

The table shows that the rate of repayment is zero until an annual income of $55 874 is reached, and then the rate gradually increases to a maximum of 8.0% for an income over $103 766.

HELP repayment income thresholds for 2017–2018

Repayment income	Repayment rate (percentage of repayment income)
Below $55 874	Nil
$55 874 – $62 238	4.0%
$62 239 – $68 602	4.5%
$68 603 – $72 207	5.0%
$72 208 – $77 618	5.5%
$77 619 – $84 062	6.0%
$84 063 – $88 486	6.5%
$88 487 – $97 377	7.0%
$97 378 – $103 765	7.5%
$103 766 and above	8.0%

Source: © Australian Taxation Office for the Commonwealth of Australia

HELP repayment = repayment rate % of taxable income

16 Calculating HELP repayments

Penny studied for 5 years to become a primary school music and drama teacher. In that time she accumulated a HELP debt of $36 000. In her first full financial year of work, her taxable income was $57 560.

(a) Calculate the compulsory HELP repayment for that year.

THINKING	WORKING
1 Use the *HELP repayments* table to identify which repayment income bracket applies.	\$57 560 is in the following income bracket: \$55 874 – \$62 238
2 Identify the associated percentage repayment.	The percentage repayment is 4.0% of the taxable income.
3 Apply the rate to the repayment income to calculate the repayment amount.	HELP repayment = 4% of 57 560 $= 0.04 \times 57\,560$ = \$2302.40

(b) If the HELP repayments were spread over the whole year, how much would be deducted

(i) weekly?

Divide the annual total to be repaid by the number of weeks in a year. Round to the nearest cent.	$\text{Weekly repayment} = \frac{\text{annual amount}}{52}$ $= \frac{\$2302.40}{52}$ = \$44.28

(ii) monthly?

Divide the annual total to be repaid by the number of months in a year. Round to the nearest cent.	$\text{Monthly repayment} = \frac{\text{annual amount}}{12}$ $= \frac{\$2302.40}{12}$ = \$191.87

WARNING

A common error made when calculating a monthly amount is to multiply the weekly amount by 4. To calculate the monthly amount correctly, multiply the weekly amount by 52 to determine the annual amount and then divide the annual amount by 12.

EXERCISE 1.3 Taxation and other government charges

Worked Example 12

1 Calculate the following to the nearest cent.

(a) the GST to be added to the cost of a chair with a pre-tax price of \$85

(b) the GST-inclusive price of a sound system with a pre-GST price of \$564

(c) the pre-GST price of a motorbike advertised for \$5780

2 In the year 2000, Sydney hosted the Olympic Games and Australia introduced the GST. The GST replaced some existing taxes and introduced a flat rate of 10% on most goods and services, many being taxed for the first time.

Calculate the cost of the following items after 10% GST is added.

(a) a camera originally priced at $450

(b) a theatre ticket originally priced at $120

(c) a haircut originally priced at $28

3 Mette owns a roller door business and charges customers $650 for each door, including installation. The 10% GST is added to the bill. How much GST will Mette have to pay in a year if she averages 15 installations per week and takes 4 weeks annual leave?

Worked Example

13

4 Use the *Tax brackets and tax rates* table to calculate the annual tax, if any, that should be paid on each of the following.

(a) an annual income of $107 000

(b) an annual income of $46 000

(c) a weekly income of $300

(d) a weekly income of $1400

(e) a monthly income of $1120

(f) a fortnightly income of $3850

(g) a monthly income of $6500

(h) a fortnightly income of $585

(i) a weekly income of $1273

14

5 Bik works as a mechanic and has a gross income of $46 000 for the year. During the year his tax-deductible expenses were $400 on tools, $100 on work-related phone calls and a donation of $300 to the Children's Hospital. Calculate his taxable income.

6 Use the *HELP repayments* table to calculate the compulsory HELP repayment for the following taxable incomes.

(a) $85 200

(b) $52 100

(c) $68 900

(d) $101 600

(e) $22 064

(f) $56 713

16

7 Scott studied for 4 years to become a nurse. In that time he accumulated a HELP debt of $29 000. In his first full financial year of work his taxable income was $56 820.

(a) Use the *HELP repayments* table to calculate Scott's compulsory HELP repayment for that year.

(b) Calculate his weekly HELP repayment amount for that year.

8 Doug wants the final GST-inclusive price of his fishing lures to be no more than $20. Select the option that is closest to the maximum pre-tax price he can charge.

A $2 B $18.15 C $18.20 D $19.99

9 Select the option that is closest to the taxable income of a driver with a fortnightly income of $1860 and deductions of $865 annually.

A $47 495 B $48 360 C $95 855 D $96 720

10 An employee earns a gross weekly wage of $1285 and has annual deductions of $310.

(a) Determine the monthly taxable income to the nearest dollar.

A $4445.60 B $5258.33 C $5114.17 D $5542.50

(b) Explain the common misconception made by a student who selected the last of the incorrect options.

11 Use the *Tax brackets and tax rates* table to calculate the annual tax payable by a florist who has a weekly income of $1292 and annual deductions of $1022.

12 Explain the mistake that has been made in each of the following calculations, which are based on a taxable income of $70 000. Write the correct calculation each time.

(a) HELP debt rate: $68 603 – $72 207: 5.0%

HELP repayment: $(\$70\,000 - \$67\,369) \times 0.05 = \$131.55$

(b) Tax rate: $37 001 – $87 000: $3572 plus 32.5 c for each $1 over $37 000

Tax on taxable income: $\$0.325 \times 70\,000 = \$22\,750$

Worked Example 15

13 Than works as a school laboratory technician and had a gross income of $32 320 for the year. During the year she spent $70 on the purchase and cleaning of a lab coat, $20 on work-related phone calls, and donated $100 to registered charities.

(a) Calculate Than's taxable income.

(b) Calculate the tax to be paid for the year.

(c) According to Than's group certificate (official statement of income), she already paid $3345 in tax during the year. Calculate her tax refund or debt.

14 Before the GST was introduced, the price of a particular bicycle was $218.50, which included a 15% sales tax. The sales tax was abolished when the GST was introduced. Calculate the new GST-inclusive cost.

15 Gary owns a discount clothing store and imports his stock from overseas. He adds 100% mark-up to the cost of the item and then adds GST before putting the items out for sale.

(a) Calculate the selling price of a dress (cost $23).

(b) Calculate the selling price of a T-shirt (cost $6).

(c) Calculate the selling price of a jacket (cost $15).

16 Milosh is an electrician who earned $96 543 for the financial year. During the year his allowable deductions were the cost of a new trailer and tools ($2750), the purchase and cleaning of his work uniform ($320) and his union fees ($530). According to his group certificate, he has already paid $23 600 in tax.

(a) Calculate the taxable income.

(b) Calculate the amount of tax payable.

(c) Calculate the tax refund or debt.

17 Elise earned $68 754 for the year as an engineer. Her tax-deductible expenses are shown in the table.
According to Elise's group certificate, she has already paid $14 960 in tax.

How much is her tax refund or debt?

Tax-deductible expense	Amount ($)
Purchase of a new hard hat	75
Professional association membership	430
Travel between work sites	380
Purchase of a CAS calculator	210
Charity donations	500

18 After completing his final year of secondary school, Tamlyn starts work as a children's drama coach in February. He has not had any other employment before this. He earns a set rate of $18 an hour during the week and $25 an hour on weekends. His average working week is 25 hours during the week and 10 hours at the weekend.

(a) Calculate Tamlyn's average gross weekly wage (before tax).

(b) Calculate his yearly salary if he works a full 52 weeks.

(c) Calculate the tax to be paid if Tamlyn works a full 52 weeks.

(d) Calculate the amount of tax per week.

(e) Calculate his average net weekly wage (after tax).

(f) Calculate his earnings if he works only 21 weeks in the financial year.

(g) Calculate the tax payable if Tamlyn's total taxable income is that generated in 21 weeks of work.

(h) For those 21 weeks, Tamlyn's employer has taken tax out of each weekly wage at the rate calculated in part (d) for year-round earnings. Calculate the tax refund due.

19 Tony works as a gardener and has worked for three different companies throughout the year. The information from his group certificates is shown in the table.

Employer	Income ($)	Tax paid ($)
Greg's Garden Centre	24 876	4 870
Jan's Craft Cottage	31 009	5 740
Heathmead Primary School	6 256	1 245

His work-related tax-deductible expenses are shown in the table.

Tax-deductible expense	Amount ($)
Gardening gloves (10 pairs)	58
Union subscription	340
Tools maintenance and purchase	790
Sunscreen	45
Cleaning of work clothes	210

(a) Calculate the total (gross) income.

(b) Calculate the taxable income.

(c) Calculate the tax to be paid for the year.

(d) Calculate the tax refund or debt.

(e) Tony also has a HELP debt of $4300. Use the *HELP repayments* table to calculate his annual compulsory HELP repayment based on his taxable income, and use this to recalculate his refund or debt.

20 Fy has an annual taxable income of $85 400 and a HELP debt of $110 178. Determine Fy's net weekly income after her tax and HELP repayments.

21 The following questions should help you understand the *Tax brackets and tax rates* table more clearly.

(a) Calculate 19 c in the dollar (for each dollar) for $18 800.

(b) Calculate 32.5 c in the dollar for $43 000.

(c) Calculate 37 c in the dollar for $100 000.

(d) Compare your answer to part (a) with the figures in the *Tax brackets and tax rates* table.

(e) Add your answers to parts (a) and (b) and compare this with the figures in the *Tax brackets and tax rates* table.

(f) Add your answers to parts (a), (b) and (c) and compare this with the figures in the *Tax brackets and tax rates* table.

(g) Explain how the *Tax brackets and tax rates* table is organised.