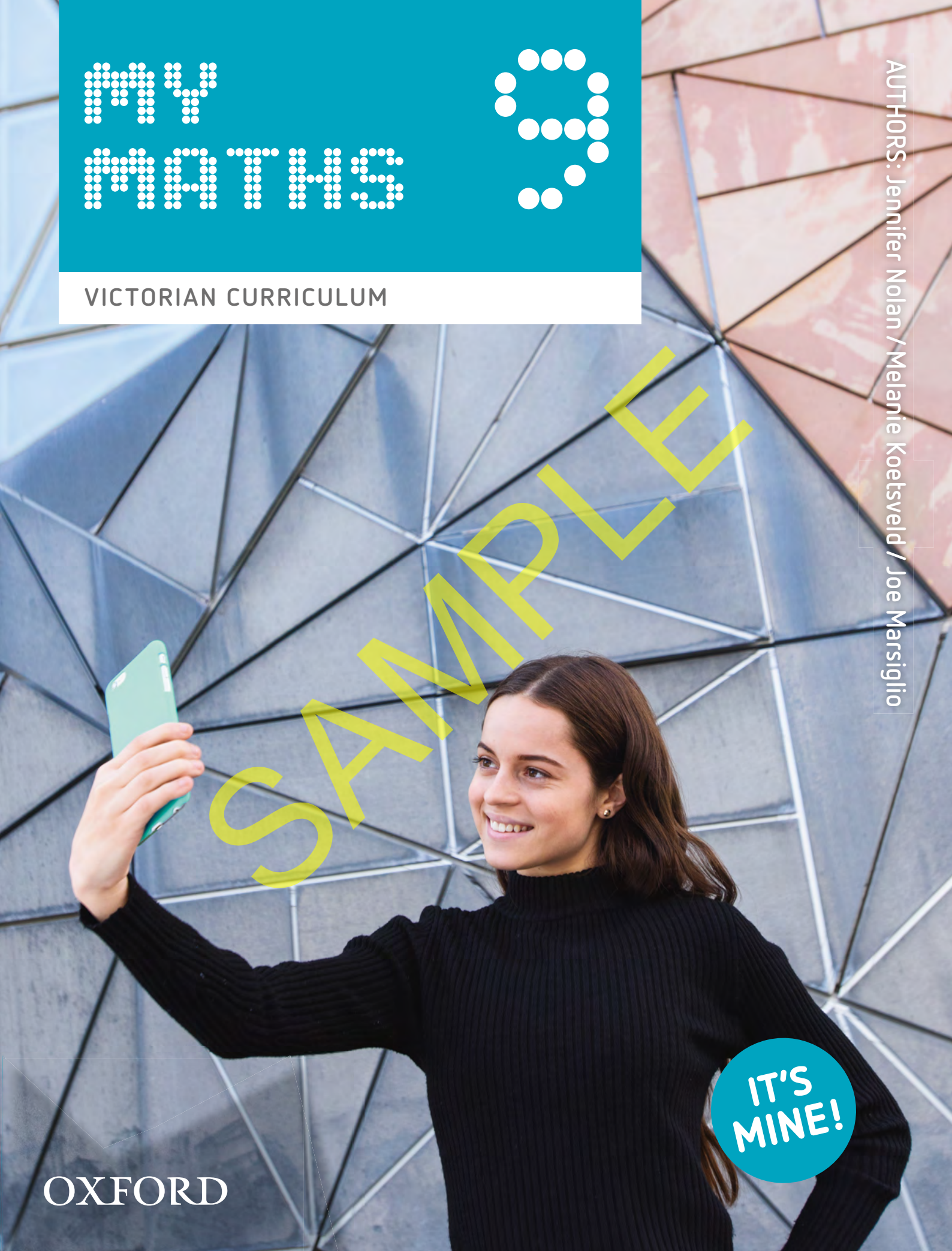
MY MATHS 3

VICTORIAN CURRICULUM

AUTHORS: Jennifer Nolan / Melanie Koetsveld / Joe Marsiglio



OXFORD

MEASUREMENT AND GEOMETRY

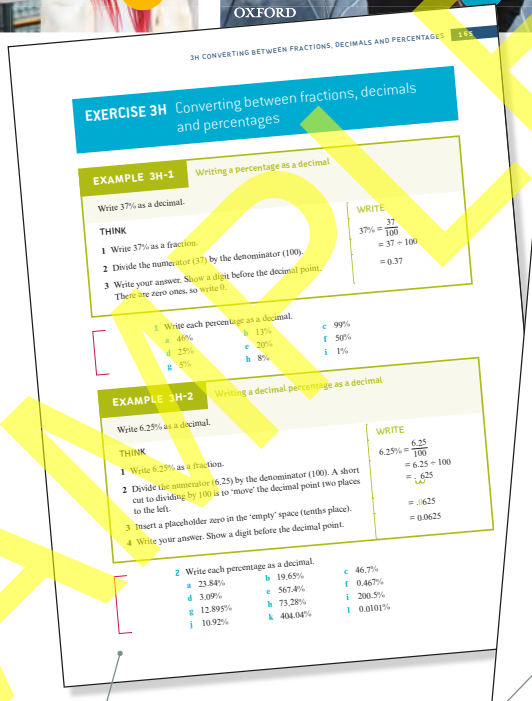
STATISTICS AND PROBABILITY

OXFORD MYMATHS VICTORIAN CURRICULUM

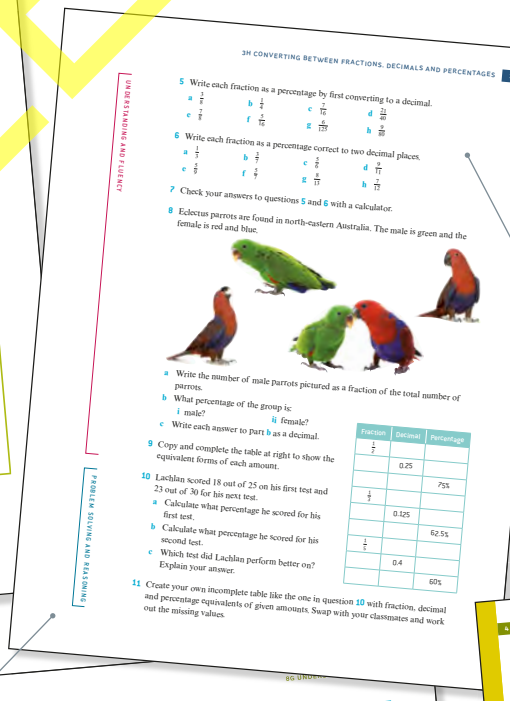
Oxford MyMaths Victorian Curriculum has been specifically developed to support students wherever and whenever learning happens: in class, at home, with teacher direction or in independent study.

STUDENT BOOK + OBOOK ASSESS

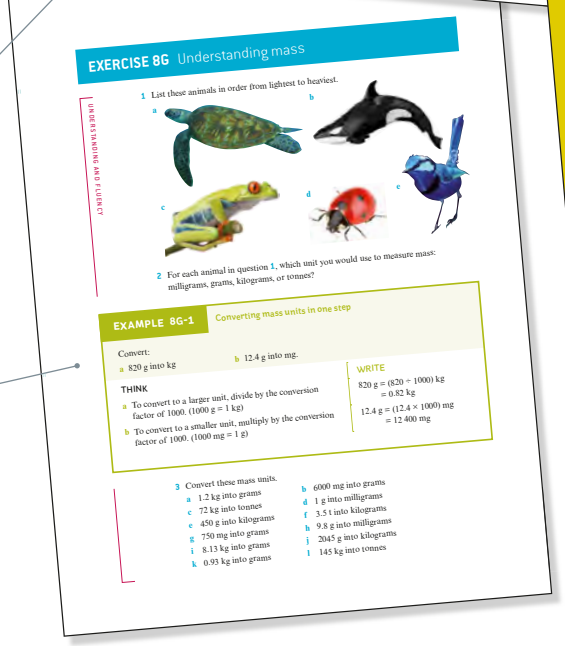
- Finely levelled exercises to ensure smooth progress
- Integrated worked examples – right where your students need them
- Learning organised around the 'big ideas' of mathematics
- Discovery, practice, thinking and problem-solving activities to promote deep understanding
- A wealth of revision material to consolidate and prove learning
- Rich tasks to apply understanding
- Highly accessible and easy to navigate
- Comprehensive digital tutorials and guided examples to support independent progress



The student book accurately and carefully delivers the course.

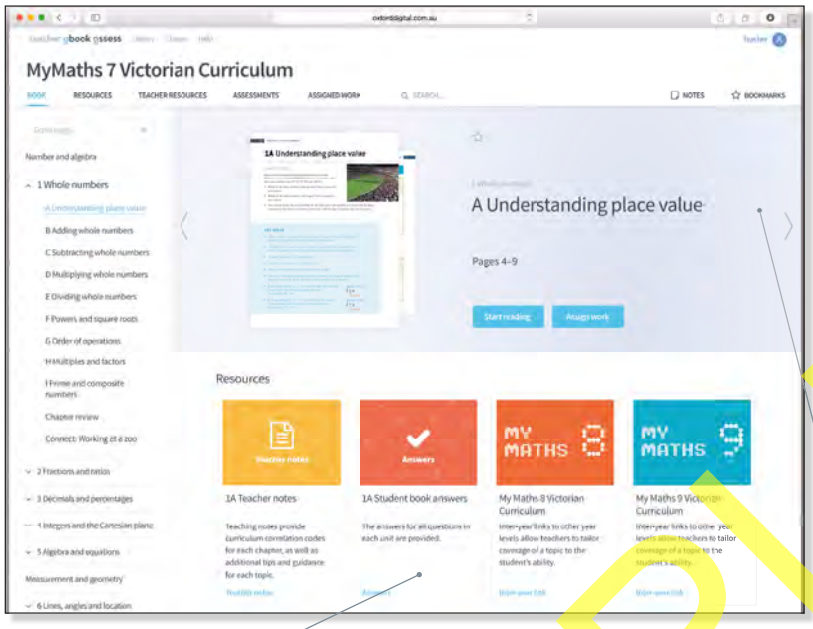


Every question is matched to the Victorian Curriculum proficiencies.



Worked examples are clearly laid out and located where students need them most.

YEAR 7–10 DIFFERENTIATION SOLUTION



TEACHER ⌀BOOK ASSESS

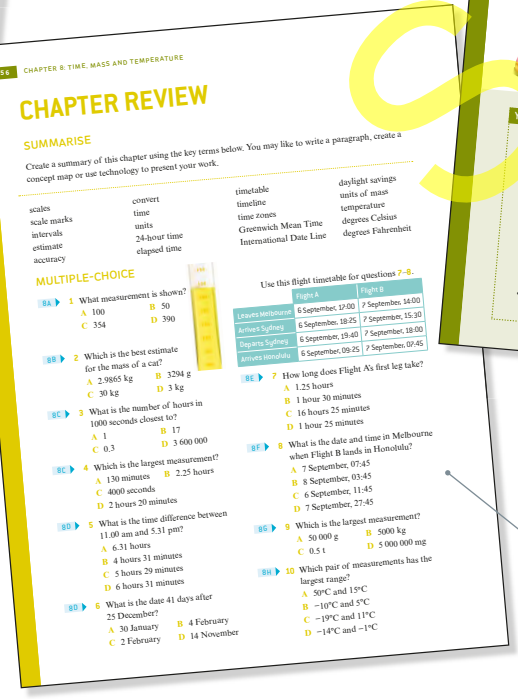
- Full access to all content and resources across Years 7–10: everything you need in one place!
- Select content and resources appropriate for each student in your class.
- Assign work and assessments; monitor student and class progress.

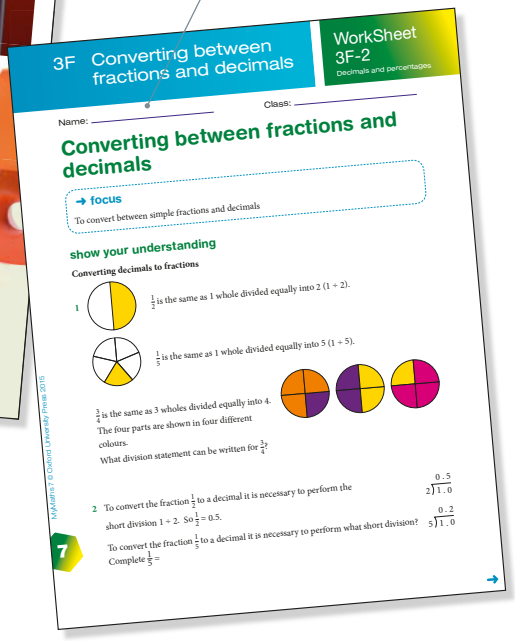
Interactive tutorials scaffold understanding of key concepts and build students' confidence.

Personalised learning: tailor the very best learning experiences for all.

Finely levelled content enables students to progress with ease.

Intervention and extension worksheets supplied for every topic.





Rich tasks where students can demonstrate understanding.

Ample revision to consolidate understanding and prove that learning has happened.

1 FINANCIAL MATHEMATICS

ESSENTIAL QUESTION

How can you make the best financial decisions?

Are you ready?

1A **1** Perform each calculation.

a 456 + 812 **b** 873 − 238

c 8721 × 6 **d** 864 ÷ 6

1A **2** What is 200 × 4000?

A 800 **B** 8000

C 80 000 **D** 800 000

1A **3** What is 9000 ÷ 30?

A 300 **B** 900

C 2700 **D** 270 000

1A **4** What is 358 × 24?

A 1432 **B** 2148 **C** 8592 **D** 9592

1B **5** The answer to 45.687 × 64.12 will have how many decimal places?

A 2 **B** 3 **C** 4 **D** 5

1B **6** Perform each calculation.

a 3.157 + 35.6214

b 68.501 − 26.627

c 4.851 ÷ 3

d 8.6147 × 9

1C **7** Gabe contributed $30 to the cost of a computer game and his mate Jake contributed $40. The ratio of Gabe's contribution to Jake's in simplest form is:

A 30:40 **B** 40:30 **C** 3:4 **D** 4:3

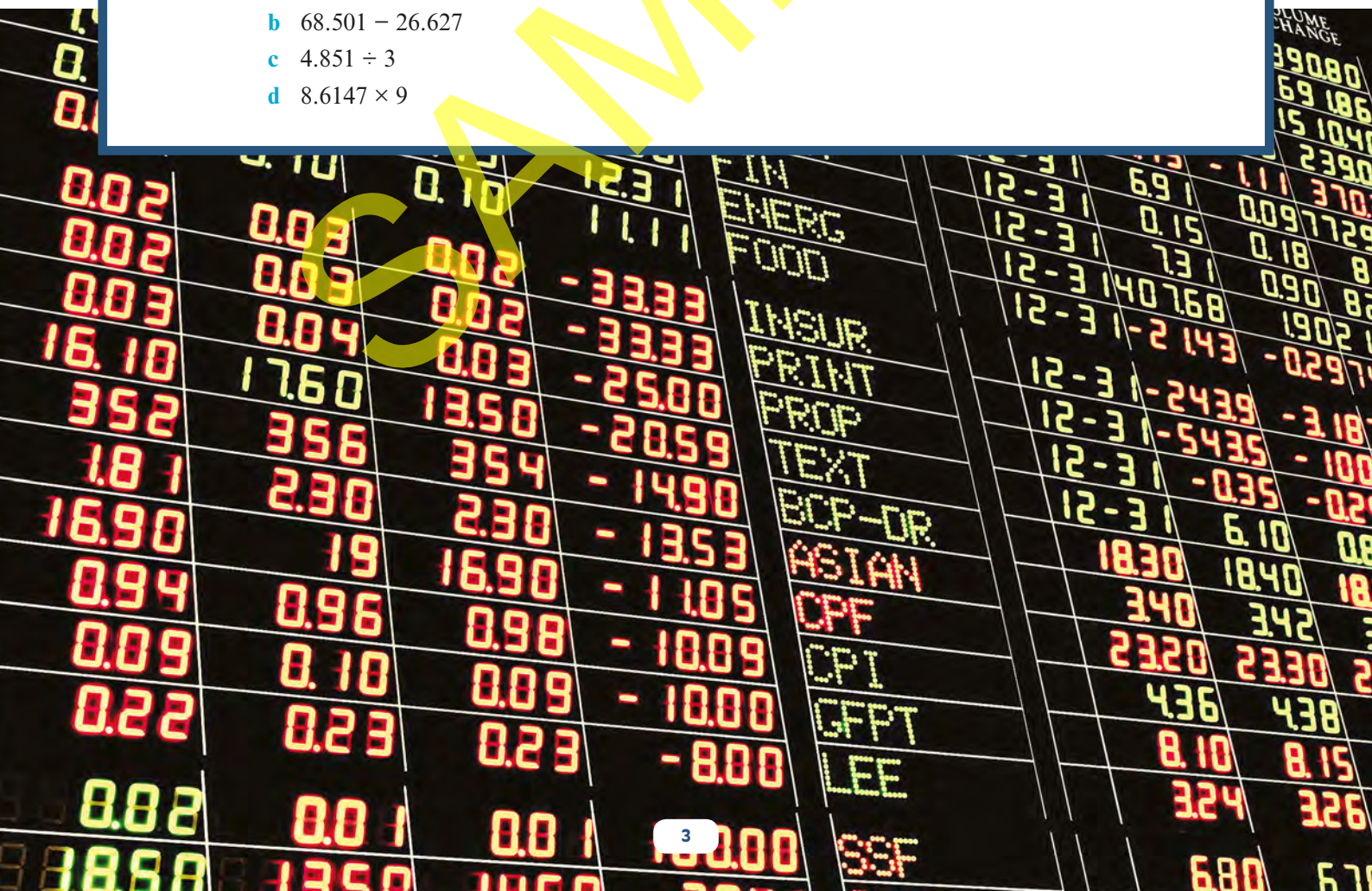
1D **8** Which of these represents the calculation of 20% of 150?

A 20×150 **B** $\frac{20}{150} \times 100$

C $\frac{20}{100} \times 150$ **D** $\frac{20}{100} \times \frac{2}{150}$

1F **9** How many years is 36 months equivalent to?

1G **10** What is the solution to the equation $x \times 5 = 50$?



1A Working with whole numbers

Start thinking!

The attendance figures at each match of the 2011 AFL final series is recorded in this table.

Adding all the values will provide the **exact value** for the attendance.

	Match 1	Match 2	Match 3	Match 4
Week 1 Qualifying and elimination finals	73 400	67 379	39 205	90 161
Week 2 Semi-finals	55 198	42 803		
Week 3 Preliminary finals	87 112	59 455		
Week 4 Grand final	99 537			

1 What was the exact attendance for the first week in the final series?

When an exact value is not required, and an **estimated value** is sufficient, then this value can be found by first **rounding** each number to the **leading digit**. Remember that the leading digit is the first digit in the number.

2 Make a list of the steps for rounding a number to its leading digit.

3 Round each of the attendance figures for each week of the finals to the leading digit and use these values to provide an estimated value for the attendance for each week.

4 Why do you think it may be appropriate to approximate calculations rather than calculating their exact value?

KEY IDEAS

- An approximate value for a calculation can be found by rounding each number to its leading digit before performing any operations.
- To round to the leading digit, consider the second digit in the number.
  - If the second digit is 0, 1, 2, 3 or 4, the first digit stays the same and the digits that follow are replaced by zero.
  - If the second digit is 5, 6, 7, 8 or 9, the first digit increases by one and the digits that follow are replaced by zero.
- Single-digit numbers are not changed when rounded.

EXERCISE 1A Working with whole numbers

1 Round each amount to its leading digit.

a $480	**b** $938	**c** $2940	**d** $1209
e $97	**f** $138	**g** $83 017	**h** $105 873
i $592 084	**j** $743 182	**k** $981 984	**l** $3 509 143

2 Perform each calculation.

a 10 000 + 9000	**b** 800 − 30	**c** 400 × 30	**d** 8000 ÷ 200
e 700 000 × 4000	**f** 30 000 ÷ 100	**g** 700 × 5000	**h** 60 000 ÷ 2000

EXAMPLE 1A-1 Estimating values for calculations using rounding

Estimate the result of each calculation by first rounding each number to its leading digit.

a $45 708 + $135 680 + $269 358 **b** 129 394 × $52 **c** $845 032 ÷ 36

THINK	WRITE
a 1 Round each number to its leading digit.	**a** $45 708 + $135 680 + $269 358 ≈ $50 000 + $100 000 + $300 000
2 Perform the addition.	= $450 000
3 Write your answer.	$45 708 + $135 680 + $269 358 ≈ $450 000
b 1 Round each number to its leading digit.	**b** 129 394 × $52 ≈ 100 000 × $50
2 Perform the multiplication.	= $100 000 × 10 × 5 = $5 000 000
3 Write your answer.	129 394 × $52 ≈ $5 000 000
c 1 Round each number to its leading digit.	**c** $845 032 ÷ 36 ≈ $800 000 ÷ 40
2 Perform the division.	= $80 000 ÷ 4 = $20 000
3 Write your answer.	$845 032 ÷ 36 ≈ $20 000

3 Estimate the result of each calculation by first rounding each number to its leading digit.

a $26 358 + $37 517 + $42 012	**b** $180 954 − $39 648		
c 436 027 × $62	**d** $936 038 ÷ 31		
e $42 658 + $92 467 − $38 513	**f** $814 318 + $103 687 − $751 355		
g 32 681 × $125	**h** $8 025 365 ÷ 390		

EXAMPLE 1A-2 Finding the difference between exact and estimated values

Find the difference between the exact value and the estimated value for the calculation 89 034 × $57.

THINK	WRITE
1 Calculate the exact value by performing long multiplication or using a calculator.	89 034 × $57 = $5 074 938
2 To calculate the estimated value, first round each number to its leading digit.	89 034 × $57 ≈ 90 000 × $60
3 Perform the multiplication.	= 9 × 10 000 × $6 × 10 = $54 × 100 000 = $5 400 000
4 State the estimated value.	89 034 × $57 ≈ $5 400 000
5 Subtract the two results to find the difference. Remember to subtract the smaller number from the larger.	$5 400 000 − $5 074 938 = $325 062
6 Write the answer.	The difference between the exact value and the estimated value is $325 062.

UNDERSTANDING AND FLUENCY

4 Find the difference between the exact value and the estimated value for each calculation.

a $97 361 + $18 658
b $739 871 − $438 698
c $368 654 + $45 681 − $249 360
d 102 365 × $27
e 648 367 × $32
f $814 360 ÷ 40
g $351 × 1463
h $150 960 ÷ 20

5 Copy and complete the table below.

	Calculation	Each number rounded to its leading digit	Estimated answer	Exact answer	Difference between exact and estimated answers
a	$358 248 – $214 358				
b	$92 674 + $195 647 + $590 159				
c	924 328 × $37				
d	$4 258 935 ÷ 15				
e	$21 × 27 851				
f	$625 384 + $84 372 – $489 325				

UNDERSTANDING AND FLUENCY

6 At a budget meeting, a salesperson predicted the company would sell 26 laptops throughout the next month.

- **a** Write an approximation for the number of laptops and the cost of the laptops by rounding each value to its leading digit.
- **b** Estimate the total amount raised from the sale of the planned number of laptops.

7 Alice has a new part-time job working at a supermarket where she earns $16 per hour.

- **a** Estimate her pay in a week in which she works 20 hours.
- **b** Calculate the difference between the estimated pay in part **a** and Alice's exact pay for the week.
- **c** Alice uses the estimate to budget her spending and savings. Is this the best strategy for Alice? Explain.

8 Carol works as a supervisor and has an annual salary of $60 424.

- **a** Write a mathematical statement using values rounded to the leading digit that will give an estimate of Carol's weekly pay.
- **b** Will Carol's actual weekly pay be higher or lower than the estimated value? Briefly explain your answer.

9 A group of eight people shared a major Lotto prize of $4 132 848.

- **a** Round the amount to its leading digit and estimate the size of each person's share.
- **b** Calculate the exact amount of each person's share.
- **c** What is the difference between the estimated amount and the exact amount?
- **d** Which value is more important for each person – the estimated value or the exact value?

PROBLEM SOLVING AND REASONING

10 A concert is attended by an audience of 12 947. Of these, 895 people paid the premium price of $185 per ticket. The remaining people each paid the standard $87 per ticket.

- **a** What is the exact number of people who paid the standard ticket price?
- **b** Round each of the ticket prices to its leading digit.
- **c** Round the number of people who paid the premium ticket price to its leading digit and estimate the total amount made from the sale of the premium tickets.
- **d** Round the number of people who paid the standard ticket price to its leading digit and estimate the total amount made from the sale of these tickets.
- **e** What is the exact amount of money made from the sale of all tickets at this concert?
- **f** What is the difference between the exact amount of ticket sales and the estimated amounts? (Hint: add the amounts from parts **c** and **d** to obtain the total estimated value.)

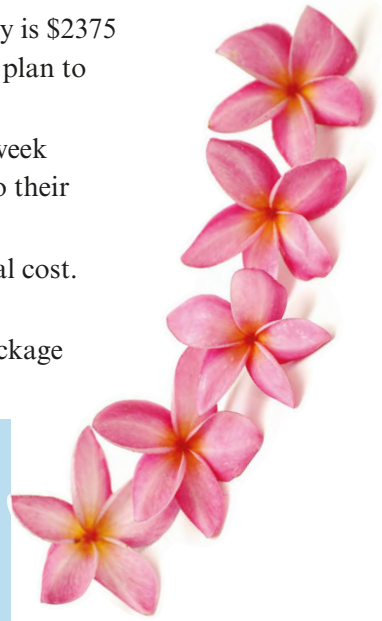
11 As an improving golfer, Stuart decided to buy himself a new set of golf clubs that would suit his game. He has been saving $90 per month for the past 18 months.

- **a** Estimate how much Stuart has saved by rounding the number of months to its leading digit.
- **b** Stuart decides on 13 golf clubs for his set, and these are priced at $169 per club. Round each of these values to its leading digit and estimate the cost of the new set of clubs.
- **c** Based on your estimated figures, has Stuart saved enough money to afford the new golf clubs?
- **d** If Stuart doesn't have enough money, estimate how many more months he needs to keep saving for.

While investigating the best club options, Stuart also decides on a new golf bag and golf buggy. The bag is priced at $229 and the buggy is priced at $184.

- **e** What is the total estimated price that Stuart needs to pay for the clubs, bag and buggy?
- **f** Perform the calculation to determine the exact price Stuart needs to pay for the clubs, bag and buggy.
- **g** What exact amount of money has Stuart saved in 18 months?
- **h** How much more money does Stuart need to save in order to complete the whole purchase?
- **i** Is it possible to perform an exact calculation to determine how much longer Stuart needs to continue saving for or is it best to estimate? Provide a brief reason to support your answer.

12 A family of six prepare for a holiday to Hawaii. The cost for a return airline ticket is $885 per person and accommodation for the whole family is $2375 for five nights and $315 per night for any additional nights. They plan to allow $2000 to cover the cost of all meals for a week.



- **a** Estimate the total cost of the flight, accommodation for one week and food allowance by first rounding the appropriate values to their leading digit.
- **b** Compare the estimated cost for the holiday with the exact total cost. State the difference in price.

Before finalising their plans, the family investigate some other package deals. Two offers are shown below.

Option 1: Price includes airfare, seven-day accommodation and all meals: $1550 per person.

Option 2: Price includes airfare, accommodation for five nights and all meals: $1435 per person. Extra nights: $85 per person per night.

PROBLEM SOLVING AND REASONING

c Round each appropriate value to its leading digit and estimate the cost of both options.

d According to the estimated costs, which option appears to be the best option?

e Calculate the exact cost for each option.

f Compare the exact cost for each option with the estimated costs found in part **c**. Does the best exact price match the best estimated price?

g Why do you think there was such a difference between the estimated prices for both options.

h Considering all pricing options, should the family stick with the original plan or take one of the package deals?

13 The **average** weekly income of Australian workers is considered to be $1323.

a Round this amount to its leading digit.

b Round the amount to its second digit; that is, to the nearest hundred.

c Round the amount to its third digit; that is, to the nearest ten.

14 The Australian government's predicted future revenue is 405.2 billion dollars for the year. In the same year, they predict their expenses will be 399.0 billion dollars.

a **i** Round each amount to its leading digit.

ii Round each amount to its second digit.

iii Round each amount to its third digit.

b What degree of accuracy have the government figures been rounded to in part **a**? (Hint: have they been rounded to the nearest hundred, thousand, ten thousand etc.?)

c Provide a list of reasons as to why you think government figures are not written as exact values.

15 Reconsider the calculations in the table in question **5**.

i Round each value to its second digit and recalculate the estimates.

ii Round each value to its third digit and recalculate the estimates.

iii Compare each set of answers. Which method of estimating do you feel provided a result closest to the actual answers for each calculation?

CHALLENGE

16 Using the government figures in question **14**, write three examples of an amount that would:

a round to the predicted expense value when rounded to its leading digit

b round to the predicted revenue value when rounded to its second digit

c round to the predicted expense value when rounded to its third digit.

17 When estimating the results to calculations after rounding values to the leading digit, how can you predict whether the estimate will be higher or lower than the exact result? You may wish to provide numerical values to help explain your answer.

Reflect

What advantages and disadvantages do you feel rounding can have on estimating financial calculations?

1B Working with decimals

Start thinking!

When using decimal numbers to represent money, the whole number part of the decimal represents the dollar amount and the decimal part of the number represents the number of cents.

1 Why do you think decimal numbers representing money are written to contain two **decimal places**?

A keen tennis player, Jake is researching which tennis balls offer him the best value for money. He knows the **best buy** will be the one where the price per tennis ball is the cheapest. Jake has decided on the two canisters shown in the photo.

The cost for each canister can be written as a **rate statement**.
For the three-ball canister, the statement could be $7.99 for three balls or $7.99 per 3 balls.

2 Write the information provided with the second canister as a rate statement.

3 For a rate to be in simplest form, the second part of the statement (that is, the second of the two quantities being compared) must have a value of 1.

a The rate for the three-ball canister is $7.99 per 3 balls. What operation needs to be performed to make the second quantity have a value of 1?

b Copy and complete this calculation to write the rate in simplest form.
$7.99 per 3 balls = $_____ per 1 ball

c What is the cost of the ball to the nearest cent?

4 Complete question **3** for the four-ball canister.

5 Which option should Jake buy? Provide a brief explanation to help support your answer.

KEY IDEAS

- Decimals containing two decimal places can be used to represent money values.
- The rules for operations with decimals are also applied to calculations involving money.
- A rate compares two quantities that are of a different kind.
- For a rate to be in simplest form, the second of the two quantities being compared must have a value of 1.

EXERCISE 1B Working with decimals

UNDERSTANDING AND FLUENCY

1 Round each amount to the nearest five cents.

a $24.39	**b** $36.11	**c** $28.03
d $44.88	**e** $22.32	**f** $55.60
g $35.74	**h** $99.98	**i** $0.36
j $4.82	**k** $105.27	**l** $33.33

2 Perform each calculation.

a $37.84 + $156.32	**b** $352.36 − $87.84
c $523.68 + $364.62 + $92.65	**d** $17.80 × 8
e $110.40 ÷ 6	**f** $28.55 × 24
g 35 × $126.85	**h** $28.75 × 37.5
i $987.55 × 142.5	**j** $2045.68 ÷ 11.1

EXAMPLE 1B-1 Writing a rate statement

Write this statement as a rate with the appropriate unit.
$32.50 in each hour

THINK

1. As two different quantities (dollars and time) are being compared, the statement can be written as a rate.
2. Show the number of the first quantity (32.50) for one unit of the second quantity.
3. The word 'per' can be replaced with the symbol /.

WRITE

Rate is dollars per time.

rate = $32.50 per 1 hour

= $32.50/hour

3 Write each statement as a rate with the appropriate unit.

a $30 earned in each hour
b $1.35 for 1 L of petrol
c Hire cost of $55 for every hour
d Cost of $2.45 for every jar
e Call cost of 75 cents for every minute
f Cost of $12.99 for every kilogram
g Salary of $60 000 for every year
h Charge of $6.85 for each parcel mailed

EXAMPLE 1B-2 Writing a rate statement in simplest form

Write this statement as a rate in simplest form:
$196.65 for 9 hours work.

THINK

1 Write the two quantities as a rate statement.

2 For the rate to be in simplest form, the second quantity needs to be 1. To achieve this, divide both quantities by 9.

3 Write your answer.

WRITE

rate = $196.65 per 9 hours

$$= \frac{\$196.65}{9} \text{ per } \frac{9 \text{ hours}}{9}$$

= $21.85 per 1 hour

The rate is $21.85/hour.

UNDERSTANDING AND FLUENCY

4 Write each statement as a rate in simplest form.

- **a** $42 for 8 hours
- **b** $22.35 for 15 L of petrol
- **c** $39.20 for 5 kg of apples
- **d** 50 mL bottle of perfume costs $180.00
- **e** $56.28 for 42 L of petrol
- **f** $24.36 for a 14 minute mobile phone call
- **g** 200 g bag of chips costs $3.20
- **h** $768.60 for 36 hours' work

5 Write each statement as a rate in simplest form. Where necessary, round each amount to the nearest cent.

- **a** $38.45 for 7 kg of oranges
- **b** $156.00 for 6.5 hours work
- **c** $22 collected in 60 minutes
- **d** 5.5 m length of timber costs $45.50

6 Rafael works as a courier delivering parcels around the city. He earns $18.50 per hour.

- **a** Write the information as a rate with the appropriate units.
- **b** Calculate Rafael's wage for a week in which he works 20 hours.
- **c** In one particular week, Rafael's wage totalled $684.50 before **deductions**. How many hours did Rafael work in this week?

UNDERSTANDING AND FLUENCY

7 Lina works in research and earns an annual **salary** of $66 548.

- **a** Write the information as a rate with the appropriate units.
- **b** If Lina is paid monthly, write her monthly payment as a rate statement in simplest form.
- **c** If Lina is paid fortnightly, write her fortnightly payment as a rate statement in simplest form.

8 A **wage** is a payment made to workers based on a fixed hourly rate. A salary is an annual amount of money that can be paid on a fortnightly or monthly basis. What other payment methods can be used?

9 A person's pay before any deductions are subtracted is referred to as **gross income**. Examples of deductions include **income tax**, superannuation, union fees, payments to health benefits, and so on. The amount of pay after **deductions** have been subtracted is referred to as **net income**. Calculate the net income for each of these.

- **a** Gross income of $498.95; income tax $56.80; union fees $9.45.
- **b** Weekly wage: 36 hours at $25.70 per hour; income tax $187.50; health fund $38.90.
- **c** Annual salary: $91 200 (paid monthly); monthly deductions: income tax $1807.80, superannuation $380 and health fund $61.25.
- **d** Weekly wage: 37.5 hours at $18.50 per hour; income tax $86.80; superannuation $20.45.

PROBLEM SOLVING AND REASONING

10 Workers on a wage who work beyond the normal hours may be eligible for **overtime**, which means they receive a higher rate of pay for the extra hours worked. Common overtime rates used are **time-and-a-half** and **double time**.
Time-and-a-half means the worker is paid $1\frac{1}{2}$ times the normal hourly rate of pay.
Double time means the worker is paid twice the normal hourly rate of pay.
For each of these normal hourly rates, calculate:

- **i** the time-and-a-half rate
- **ii** the double time rate.

a $18 **b** $24
c $18.80 **d** $25.90
e $32.60 **f** $29.90

11 Ryan is a bricklayer and is paid a wage of $28.90 per hour for a standard 36.5-hour week. The first 8 hours' overtime are paid at time-and-a-half and any additional hours are paid as double time.

- **a** Calculate Ryan's gross income in a week in which he works 48.5 hours.
- **b** Ryan's deductions for this week include income tax at $372.40, union fees $18.90 and superannuation $82.60. Calculate his net income for the week.

12 Karen works as a casual barmaid and earns $22.50 per hour on weekdays. Time on Saturdays is paid at time-and-a-half until 9.00 pm and double time thereafter. Calculate Karen's gross income for the week she worked the hours shown.

Monday	9.00 am to 3.00 pm
Wednesday	12.00 pm to 4.30 pm
Thursday	11.00 am to 6.30 pm
Friday	4.00 pm to 11.00 pm
Saturday	10.00 am to 11.00 pm

13 For these calculations, round your answer to the nearest five cents.

a A bag of six cheese and bacon rolls is $5.94. What is the cost of one roll?

b 2.5 kg of pumpkin costs $11.90. What is the cost of 1 kg of pumpkin?

c A 24-can carton of soft drink sells for $14.88. What is the cost of one can?

d 300 g of shaved ham costs $7.98. What does it cost for 100 g?

14 April is a manager of a team of employees on a production line. Their hours worked are displayed in the table. The normal hourly rate of pay is $20.80.

	Total hours worked		
Employee	Normal rate	Time-and-a-half	Double time
Rodjay	36	0	0
Hansani	18	10	4
Anitya	28	0	12
Brendan	36	5	8

a Calculate the time-and-a-half rate of pay and the double time rate of pay.

b Use the information to determine each employee's gross income.

c Considering the total hours worked by each employee, how many hours at the normal rate is their total hours worked equivalent to?

15 Given the information in this table, calculate the net weekly income in each case.

	Normal rate of pay $	Hours worked			Deductions		
		Normal rate	Time-and-a-half	Double time	Income tax $	Superannuation $	Union fees $
a	12.40	20	0	0	19.90	0.00	0.00
b	25.00	35	6	8	326.00	35.00	24.50
c	35.60	28	5	0	255.10	30.00	0.00
d	19.90	10	1	3	34.90	0.00	8.75
e	26.80	36.5	3	4	269.90	78.25	21.80

PROBLEM SOLVING AND REASONING

16 Calculate the cost of the items listed in parts **a**–**d**. Write your answers correct to the nearest:

- **i** cent
- **ii** five cents.

a 5 kg of potatoes at $7.85 per kg

b 3.55 kg of apples at $4.90 per kg

c 0.825 kg of salad leaves at $7.20 per kg

d 2.6 kg of premium mince at $12.99 per kg

17 Consider the options for purchasing these strawberries.

a Represent each purchase option as a rate statement.

b In order to compare the two rates, the units must be the same. Convert the price of the punnet strawberries to an equivalent rate per kilogram and then compare. Which option represents the best buy?

c A friend tells you that the best buy is always the option with the lowest advertised price. Comment on the accuracy of this statement.

Option 1

Option 2

18 A trip to the supermarket offers many opportunities to investigate purchases that represent the best buy. Determine which of these represents the best buy.

a a 45-g bag of crisps for $1.40 or a 175-g bag of crisps for $3.24

b an 800-g box of cereal for $3.00 or a 500-g box for $1.90

c a pre-packed 750-g bag of salted peanuts for $16.90 or peanuts sold loose for $23.95 per kg

d a 425-g jar of pasta sauce for $2.80 or a 680-g jar for $4.00

e 1.7 kg of sausages costing $8.00 or 560 g of sausages costing $3.50

f a 2-L bottle of fruit juice for $6.94 or a 500-mL bottle for $3.57

19 A tennis club has two options to consider in determining the best value choice for their practice balls. They can purchase cases of 18 four-ball canisters for $198 per case or 50-ball boxes at $135 per box. Which option would you advise the tennis club to take?

CHALLENGE

20 Gary's net pay for a week was $1185.60. He had a deduction of $341.70 for income tax and $22.50 for union fees. He worked 30 hours at the normal rate, 8 hours at time-and-a-half and 6 hours at the double time rate. Calculate his normal hourly rate of pay.

Reflect

How do rates help to compare the prices of two items?

1C Working with ratios

Start thinking!

After contributing to their term charity, four students, Natalie, Daniel, Megan and Patrick discovered that they had contributed donations in the **ratio** 5:8:1:2.

1 There are four components in the given ratio, each representing the names listed in the given order. Is this ratio in simplest form or can it be simplified?

2 Adding all the numbers in the simplified ratio represents the total number of parts in the ratio. What is the total number of parts in this ratio?

3 The number of parts in the ratio that matches Natalie's contribution is 5. Natalie's contribution can be written as a fraction of the total number of parts in the ratio. Remember to always write the fraction in simplest form.

Write a fraction for each student's contribution to the charity.

Between them, the four students raised a total of $192 for the charity. Each person's actual contributions can now be determined by multiplying their fraction by the total amount raised.

4 Using the fractions from question **3**, calculate how much each person contributed.

KEY IDEAS

- When dividing a quantity in a given ratio, follow these steps.
  1. Find the total number of parts in the simplified ratio.
  2. Write each part of the ratio as a fraction of the total number of parts.
  3. Multiply each fraction by the quantity and simplify.
  4. Check your answer by adding the individual amounts and see that the result is the same as the original quantity.
- **Equivalent ratios** are formed by multiplying or dividing each part of a ratio by a whole number.
- Equivalent ratios can be used to find an unknown value.

EXERCISE 1C Working with ratios

UNDERSTANDING AND FLUENCY

1 Calculate the total number of parts for each ratio.

a 4:7	**b** 3:9	**c** 5:8	**d** 2:8
e 8:4:2	**f** 2:5:3	**g** 12:18	**h** 6:10:24
i 9:7:28	**j** 12:8:16	**k** 8:5:8	**l** 9:9:15

2 For each ratio in question **1**, write each part of the ratio as a fraction of the total number of parts in simplest form.

3 Identify the ratios from question **1** that are not in simplest form and write them in simplest form.

4 Complete these calculations.

a $\frac{1}{5} \times \$250$ **b** $\frac{3}{4} \times \$160$ **c** $\frac{5}{8} \times \$480$ **d** $\frac{2}{7} \times \$210$

EXAMPLE 1C-1 Dividing a quantity in a given ratio

Divide \$3600 in the ratio 3:6:1.

THINK

1 As the ratio is in simplest form, add the number of parts in the ratio.

2 Write each part of the ratio as a fraction of the total number of parts in simplest form.

3 Multiply each fraction by the quantity to be divided (\$3600) and simplify.

4 Answer the question, including the appropriate units. Remember to check your answer by adding the individual amounts. (\$1080 + \$2160 + \$360 = \$3600)

WRITE

3 + 6 + 1 = 10 parts

$\frac{3}{10}, \frac{6}{10} = \frac{3}{5}$ and $\frac{1}{10}$

$\frac{3}{10}$ of \$3600	$\frac{3}{5}$ of \$3600	$\frac{1}{10}$ of \$3600
$= 3 \times \$360$	$= 3 \times \$720$	$= 1 \times \$360$
= \$1080	= \$2160	= \$360

The ratio 3:6:1 divides \$3600 into \$1080, \$2160 and \$360.

5 Divide \$7200 in each given ratio.

a 1:5 **b** 4:5 **c** 2:7 **d** 1:2 **e** 1:6:2 **f** 2:5:3

6 Divide \$4800 in each given ratio.

a 4:6 **b** 7:5 **c** 4:8 **d** 3:6:3 **e** 4:6:2 **f** 7:5:4

7 Divide $10 500 in each given ratio.

a 3:7 **b** 2:5:3 **c** 1:4 **d** 3:5 **e** 2:6:4 **f** 7:5:3

8 Divide each amount in the given ratio. Where necessary, round to the nearest cent.

a $4500 (7:3) **b** $2950 (3:5) **c** $10 650 (2:3)
d $8486 (3:2) **e** $12 866 (6:1) **f** $4628 (4:5)
g $9837 (2:5) **h** $41 982 (2:3:4) **i** $5190 (2:7:1)
j $2718 (2:4:5) **k** $18 875 (4:6:5) **l** $105 784 (3:5:4)

EXAMPLE 1C-2 Finding an unknown value in an equivalent ratio statement

Find the value of a in the equivalent ratio statement $3:7 = a:84$

THINK	WRITE
	$3:7 = a:84$
1 Equivalent ratios are formed by multiplying or dividing each part of the ratio by a whole number. The number to multiply by is 12, since $7 \times 12 = 84$.	$7 \times 12 = 84$ $3 \times 12 = a$
	$3:7 = 36:84$
2 Identify the value for a.	$a = 36$

UNDERSTANDING AND FLUENCY

9 Use your understanding of equivalent ratios to find the value of each **pronumeral**.

a $2:7 = 24:a$ **b** $7:5 = b:35$ **c** $c:96 = 4:8$ **d** $54:d = 9:12$
e $6:13 = 24:e$ **f** $5:f = 55:33$ **g** $12:15 = g:60$ **h** $h:8 = 56:64$

10 Three friends went into business together and contributed the amounts of $10 000, $12 500 and $8000 to meet the initial costs, agreeing to divide all profits in the same ratio as their contributions. After their first six months, they made a profit of $7564. Divide this amount into the three agreed shares.

11 Gabby and Jo have been investing in a savings plan. For every $4 that Gabby invested, Jo invested $7. At the end of a year, they had $2288 and planned to divide the money in the same ratio as their contribution.

- **a** Write the comparison of Gabby's contribution to Jo's as a ratio.
- **b** Write each part of the ratio as a fraction of the total number of parts and find the value of each share.
- **c** Gabby thought her final share should be $\frac{4}{7}$ of the total amount. What do you think she has done incorrectly?

12 For their major fundraiser, a basketball club is running a raffle. The major prize is $15 000 and each ticket costs $50 to buy. Connor, Luke, Jaymee and Maddie decide to pool their money to buy a ticket and share the winnings in the same ratio as their contribution. If they win, Connor will receive $4200, Luke will receive $2250, Jaymee will receive $4650 and Maddie will receive the rest.

- **a** How much money will Maddie receive if they win?
- **b** What is the ratio of their contributions in simplest form?
- **c** How much did each person contribute to the cost of one ticket?

13 Ratios must contain whole number parts. If they don't, then each part of the comparison needs to be multiplied by the same number to produce whole numbers and keep the comparison equivalent. The decimal parts of a comparison can be written as whole numbers by multiplying them by an appropriate power of 10 (10, 100, 1000 ...).

Consider the comparison 10.4 to 4.2.

- **a** What power of 10 do both decimals in the comparison need to be multiplied by? Perform this multiplication.
- **b** Now that the equivalent comparison contains two whole numbers, write it as a ratio in simplest form.

14 When comparisons contain fractions, the fractions are best written in an equivalent form with common **denominators**. Multiplying each fraction by the common denominator will then result in whole number parts.

Consider the comparison $\frac{1}{10}$ to $\frac{3}{5}$.

- **a** Write each fraction in the comparison as an **equivalent fraction** with the same denominator.
- **b** Multiply each fraction by the common denominator value.
- **c** Now that the equivalent comparison contains two whole numbers, write it as a ratio in simplest form.
- **d** How would these steps change if one (or both) of the parts of the comparison is a mixed number?

EXAMPLE 1C-3 Writing a comparison as a ratio in simplest form

Write each comparison as a ratio in simplest form.

a 0.4 to 1.8 **b** $\frac{3}{4}$ to $\frac{3}{5}$

THINK	WRITE
a 1 Multiply each decimal by 10 to write the comparison with whole numbers.	**a** 0.4 to 1.8 = 4 to 18
2 Since the comparison now involves whole numbers, write as a ratio.	= 4:18
3 Simplify by dividing each part by the **highest common factor** (HCF) of 4 and 18. (HCF = 2.)	= 2:9
b 1 Write the comparison as equivalent fractions with a common denominator of 20.	**b** $\frac{3}{4}$ to $\frac{3}{5}$ = $\frac{15}{20}$ to $\frac{12}{20}$
2 Multiply each fraction by 20 to write the comparison with whole numbers.	= 15 to 12
3 Since the comparison now involves whole numbers, write as a ratio.	= 15:12
4 Simplify by dividing each part by the HCF of 15 and 12. (HCF = 3.)	= 5:4

PROBLEM SOLVING AND REASONING

15 Write each comparison as a ratio in simplest form.

a 3.2 to 2.1 **b** 5 to 2.5 **c** 3.22 to 2.44 **d** \$4.50 to \$3.00

e 5.6 to 2.92 **f** 1.84 to 6 **g** \$12.50 to \$3.70 **h** 17.1 to 14.2

i 4 to $\frac{1}{2}$ **j** $\frac{2}{3}$ to $\frac{1}{3}$ **k** $\frac{4}{5}$ to $\frac{1}{6}$ **l** $\frac{5}{7}$ to $\frac{2}{5}$

m $\frac{3}{4}$ to 6 **n** $\frac{1}{6}$ to $\frac{3}{4}$ **o** $\frac{1}{4}$ to $2\frac{1}{8}$ **p** $1\frac{2}{3}$ to $1\frac{3}{5}$

16 From her part-time job, Monika can earn a regular amount of \$120 per week. On average, she finds that she uses $\frac{3}{8}$ of her earnings on shopping, $\frac{2}{5}$ on iTunes, $\frac{1}{10}$ goes towards her mobile phone account and she saves the rest.

a What fraction of Monika's earnings can she save?

b On average, how much of Monika's weekly earnings goes towards each of the listed categories?

c Write a ratio for the average amount Monika contributes weekly to shopping, iTunes, mobile phone account and saving.

PROBLEM SOLVING AND REASONING

17 Jayden and Benjamin contribute to a computer game in the ratio 6:7. Jayden's actual amount is $24.

- **a** How much is Benjamin's contribution?
- **b** What is the total cost of the computer game?

18 Justin's weekly pocket money is one third of the amount his older brother Anthony receives.

- **a** Write the comparison of Justin's weekly pocket money to his brother's as a ratio.
- **b** Anthony's pocket money is $15 per week. How much money does Justin earn each week as pocket money?
- **c** Now write the comparison of Anthony's weekly pocket money to Justin's as a ratio. Briefly explain how this is interpreted.

19 Consider the amount of $1000 and the ratio 8:5. To increase $1000 in the ratio 8:5, you can use an equivalent ratio statement. Since you want to increase the amount, match the known amount with the smaller number in the ratio. Using x to represent the increased amount, the equivalent ratio statement is: x:1000 = 8:5.

- **a** Find the value of x.
- **b** Check that x is larger than 1000 (as you are increasing the value) and that x:1000 simplifies to 8:5 when x is replaced with your calculated value.
- **c** Now consider decreasing $1000 in the same ratio. This time, match the known amount with the larger number in the ratio. Using y to represent the decreased amount, the equivalent ratio statement would be 1000:y = 8:5 (or y:1000 = 5:8). Find the value of y.
- **d** Check that y is smaller than 1000 (as you are decreasing the value) and that 1000:y simplifies to 8:5 (or y:1000 simplifies to 5:8) when y is replaced with your calculated value.

CHALLENGE

20 Calculate each of these. (Hint: refer to the method shown in question **19**.)

- **a** Increase $200 in the ratio 5:4.
- **b** Decrease $5000 in the ratio 7:10.
- **c** Decrease $150 in the ratio 2:3.
- **d** Increase $4820 in the ratio 8:5.
- **e** Increase $14 000 in the ratio 4:3.
- **f** Decrease $7221 in the ratio 5:9.

21 As a shortcut, a student noticed that she could calculate the value for question **20a** by multiplying 200 by $\frac{5}{4}$.

- **a** Check to see if this gives the same result.
- **b** Using this shortcut method, what fraction would you multiply 5000 by to calculate the value for question **20b**? Check to see if this gives the same result.
- **c** Use this method to calculate the results for parts **c**–**f** of question **20**. Do you obtain the same results as before?
- **d** Why do both of these methods produce the same result?

22 To increase $1000 in the ratio 6:5, William wrote the equivalent ratio statement 1000:a = 6:5. Is this correct? Explain.

Reflect

How do ratios ensure that amounts can be divided correctly?

1D Percentage of an amount

Start thinking!

While shopping at the end-of-year sales, Kaveri notices that any advertised **discount** is given as a **percentage of an amount**, not as a dollar amount. She knows that it is important to perform an appropriate percentage calculation in order to determine the correct **selling price** (or **retail price**). Kaveri sees a shirt with an **original price** of $84. A store is advertising it for sale with a discount of 20%.

1 Briefly explain what is meant by the term 'discount'.

2 **a** The discount amount is an example of a percentage of an amount calculation. Use the given figures to write an **expression** to calculate the discount.

b Calculate the discount on the shirt.

c Now Kaveri knows the discount amount, how would she find the selling price of the shirt?

d Calculate the selling price of the shirt.

Kaveri's father is a fabric importer and marks up the costs of all his materials by a percentage amount before he sells them to customers. The **wholesale price** for a roll of fabric is $96 and he plans to offer it for sale with a **mark-up** of 70%.

3 Briefly explain what is meant by the term 'mark-up'.

4 **a** The mark-up amount is also an example of a percentage of an amount calculation. Use the given figures to write an expression to calculate the mark-up.

b Perform the calculation to determine how much mark-up is added to the cost.

c Now that mark-up amount is known, how would he set the selling price of the fabric?

d Calculate the selling price of the fabric.

KEY IDEAS

For example:
$15\% \text{ of } 120 = \frac{15}{100} \times 120$

- To calculate a **percentage** of an amount, write the percentage as a fraction and multiply by the amount.
- The difference between the regular price and the lower price of an item is called a discount.
- The selling price following a percentage discount can be calculated by using the rule: selling price = (100 − percentage discount)% × original price.
- The amount added to the original price or wholesale price is called a mark-up.
- The selling price following a percentage mark-up can be calculated by using the rule: selling price = (100 + percentage mark-up)% × original price.
- The **unitary method** is used to find the original amount when a percentage of the original amount is known. It involves calculating 1% before finding 100% of the original amount.
- Besides wages and salaries, another form of payment is **commission** where a salesperson earns a percentage of the total amount of sales they make. Some sales people earn a fixed amount or **retainer** plus commission.

EXERCISE 1D Percentage of an amount

1 Calculate each of these.

a 10% of $360
b 25% of $4200
c 20% of $550
d 120% of $400
e 190% of $850
f 7% of $960
g 32% of $729
h 116% of $2950

EXAMPLE 1D-1 Calculating the selling price from a percentage discount

Calculate the selling price after a 45% discount is offered on a watch originally priced at $120.

THINK

1 Write a calculation for the selling price.
A percentage discount of 45% means you pay (100 − 45)% of the original price.
A discount of 45% means you pay 45% less; that is, 55% of the original price.

2 Perform the calculation by writing the percentage as a fraction and multiplying by the amount.

3 State the selling price of the watch.

WRITE

selling price = (100 − 45)% of $120
= 55% of $120

$= \frac{55}{100} \times \$120$
= $66

The selling price after a 45% discount is $66.

UNDERSTANDING AND FLUENCY

2 Calculate the selling price for each of these.

a 20% discount on $150
b 15% discount on $300
c 25% discount on $840
d 40% discount on $680
e 50% discount on $1238
f 12% discount on $460
g 45% discount on $855
h 30% discount on $124.50
i 70% discount on $2075

EXAMPLE 1D-2 Calculating the selling price from a percentage mark-up

Calculate the selling price after a 60% mark-up on a pair of jeans originally priced at $42.

THINK

1 Write a calculation for the selling price.
A percentage mark-up of 60% means you pay (100 + 60)% of the original price.
A mark-up of 60% means you pay 60% more.
That is, 160% of the original price.

2 Perform the calculation by writing the percentage as a fraction and multiplying by the amount.

3 State the selling price of the pair of jeans.

WRITE

selling price = (100 + 60)% of $42
= 160% of $42

$$= \frac{160}{100} \times \$42$$
= $66

The selling price after a 60% mark-up is $67.20.

UNDERSTANDING AND FLUENCY

3 Calculate the selling price for each of these.
- a 20% mark-up on $420
- b 50% mark-up on $668
- c 65% mark-up on $120
- d 18% mark-up on $924
- e 87% mark-up on $1348
- f 120% mark-up on $1600

4 For each of these, determine:
- i the selling price
- ii the mark-up or discount amount.

a A camera is purchased for $120 and sold later at a mark-up of 62%.

b A laptop originally marked at $1198 is offered for sale at a discount of 35%.

c Work tools each marked at $49.90 are offered for sale with a 15% discount.

5 Julia wishes to purchase a new pair of shoes at an end-of-year sale. She likes the pair shown which is originally priced at $184.
- a Calculate the amount of the discount.
- b Calculate the amount Julia will pay for the shoes.

6 The selling price of an item is also known as the retail price. Michael plans to buy a new external hard drive to store his movies on. The hard drive has a retail price of $157.95, but Michael receives a 12.5% discount because he has a customer loyalty card.

a If the discount is 12.5%, what percentage of the retail price will Michael pay?

b Calculate the price Michael pays after the discount? Round your answer to the nearest five cents.

7 The following represent the original prices and the percentage discount amounts offered on some goods. In each case, calculate:

i the selling price after the discount

ii the discount amount.

Where appropriate, round answers to the nearest cent.

a $500; 12% discount

b $179.50; 15% discount

c $249; 8% discount

d $895.95; 4% discount

e $624.60; 14% discount

f $29 995; 5.5% discount

g $12 680; 12.5% discount

h $1495.99; 17.5% discount

8 Melinda makes her own jewellery and adds an 85% mark-up to her costs when determining her retail prices. One of her popular selling items is jewelled earrings. Each earring contains a metal hook, which cost Melinda $8.50 each, and three decorative stones, each costing $4.60.

a How much does it cost Melinda to make each pair of these earrings?

b What is the value of the mark-up?

c How much would Melinda advertise these pairs of jewelled earrings for?

9 A manufacturer advertises their football boots for a wholesale price of $89.90. A sports store plans to sell these boots to the public at a mark-up of 110%.

a If the mark-up is 110%, what percentage of the wholesale price will a member of the public pay for these boots?

b Calculate the retail price for these boots to the nearest five cents.

10 The following represent the wholesale prices and the percentage mark-up amounts offered on some goods. In each case, calculate:

i the retail price after the mark-up

ii the mark-up amount.

Where appropriate, round answers to the nearest cent.

a $620; 24% mark-up

b $89.95; 45% mark-up

c $1269; 80% mark-up

d $450.50; 85.5% mark-up

e $6250; 140% mark-up

f $350.99; 125% mark-up

g $14 625; 112.5% mark-up

h $2295; 137.5% mark-up

11 A girl's bike is reduced to $198 following a 20% discount. To determine the original price (that is, the price before the discount) Jane reckons you need to calculate 20% of $198 and add the result to $198. Tim thinks that Jane has it wrong and that the calculation is more complex. Which person do you think is correct? Show working to support your answer.

12 Calculations involving a percentage of an amount where the original amount is not known can be solved using the unitary method. Consider a television that has a retail price of $765 after a discount of 15%.

a A discount of 15% means you pay 85% of the original price. That is: 85% of the original price = $765.

The unitary method requires you to find how much 1% represents (one unit). Calculate 1% of the original price. (Hint: divide the amount for 85% by 85.)

b The original price of the television represents the full amount, or 100%. Use your answer to part **a** to calculate 100% of the original price. (Hint: multiply the amount for 1% by 100.)

100% of the original price = $_____

c What is the original price of the television?

13 The method outlined in question **12** can also be applied to calculate the original amount after a mark-up has been applied. Consider a different television that retails for $1800 after an 80% mark-up. Calculate the wholesale price of the television. (Hint: a mark-up of 80% means you pay 180% of the original price.)

14 Reconsider the scenario in question **11**. What was the price of the bike before the discount?

15 Calculate the original price in each of these scenarios. Where necessary, round your answer to the nearest five cents.

a A mobile phone sells for $450 after a mark-up of 50%.

b A pair of sports shorts sells for $25 after a discount of 20%.

c Eyeliner sells for $11.85 following a 15% discount.

d A hardware store sells an electric chain saw for $169 after it is marked up by 95%.

e A furniture store offers a leather lounge suite for sale for $9995 after a discount of 12.5%.

f Fitness equipment retails for $1499 following a 140% mark-up.

16 Glenn sells cars and earns 2% commission on the total value of his sales. How much commission does he earn on the sale of a car that costs $22 490?

17 If you were a salesperson and your income was commission based, what do you think could be an advantage and a disadvantage of this form of payment?

PROBLEM SOLVING AND REASONING

18 Some salespeople are paid a fixed amount, or retainer, plus their commission. This method of payment ensures that money is still earned even if no sales are made. Erica is paid a retainer of $220 per week plus 5% commission on her sales. How much does Erica earn in a week in which the total value of her sales is $7255?

19 Barry works as a real estate agent and earns commission on the sale of each house he sells. He earns 2% commission on the first $300 000 and 1.75% on the amount greater than $300 000. How much commission does Barry earn on a house that sells for $485 000?

20 Maria and Paul plan to sell their house and are exploring which real estate agency to use. Their first agency charges a flat rate of 2.3% on the sale value of the house and a second agency charges 3.4% for the first $200 000, 1.8% for values between $200 000 and $350 000 and 1.2% for the value greater than $350 000. Which agency should they use if they plan to sell their house for $590 000?

21 Charlotte earns a retainer of $475 per week and 3.5% commission of the total value of her weekly sales. Calculate her earnings for a week with each of these total sales values.

a $500 **b** $8000 **c** $0 **d** $3029
e $2397.50 **f** $9480.95 **g** $12 095 **h** $25 800

22 Angelique is paid a commission of 2.5% of the total value of her sales. In one week, she earned $375 in commission. What was the total value of her sales?

23 Mark earns a weekly retainer of $325 plus 1.75% of all his sales. In one week, his earnings were $937.50. What was the total value of his sales in this week?

CHALLENGE

24 How can percentages be applied to calculate income tax amounts? You may wish to investigate different methods used by the Australian Government and explore who these methods are applied to.

25 In an earlier exercise, superannuation was listed as a possible deduction when calculating an employee's net income. What is superannuation and how can percentages be applied to superannuation contributions and entitlements?

Reflect

What different situations can a percentage of an amount be applied to?

1E Writing one quantity as a percentage of another

Start thinking!

Alexandra is saving for a new model hand-held game console, like the one shown here. So far, she has saved a total of $110.

1 Write the amount that Alexandra has saved as a fraction of the total amount needed for the game console. Write this fraction in simplest form.

2 Explain how the fraction can be represented as a percentage.

3 Write the fraction as a percentage. This calculation is equivalent to writing one quantity ($110) as a percentage of another ($200).

4 How does the percentage amount you have calculated relate to Alexandra's saving progress towards her game?

KEY IDEAS

- To write one quantity as a percentage of another, write the first value as a fraction of the second and multiply the fraction by 100%.
- A **profit** occurs when the selling price is higher than the original price.
- A **loss** occurs when the selling price is lower than the original price.
- Percentage profit (or loss) on the original price $= \frac{\text{profit (or loss)}}{\text{original price}} \times 100\%$.
- Percentage profit (or loss) on the selling price $= \frac{\text{profit (or loss)}}{\text{selling price}} \times 100\%$.
- Percentage profit and loss calculations are generally written in relation to the original price unless directly specified that it is in relation to the selling price.

EXERCISE 1E Writing one quantity as a percentage of another

EXAMPLE 1E-1 Writing one amount as a percentage of another

Write \$65 as a percentage of \$150.

THINK

1 Write the first quantity (\$65) as a fraction of the second (\$150).

2 Convert the fraction to a percentage by multiplying it by 100%.

3 Cancel common factors to the **numerators** and denominators and simplify.

4 Divide 130 by 3 and write the answer, rounding appropriately.

WRITE

$$\frac{65}{150}$$

$$= \frac{65}{150} \times 100\%$$

$$= \frac{65}{\cancel{150}_{3}} \times \frac{\cancel{100}^{2}}{1}\%$$

$$= \frac{65}{3} \times \frac{2}{1}\%$$

$$= \frac{130}{3}\%$$

$$= 43.3\%$$

UNDERSTANDING AND FLUENCY

1 Write these amounts as percentages.
- a \$45 as a percentage of \$225
- b \$60 as a percentage of \$80
- c \$36 as a percentage of \$144
- d \$120 as a percentage of \$80
- e \$99 as a percentage of \$600
- f \$123 as a percentage of \$400
- g \$67 as a percentage of \$90
- h \$468 as a percentage of \$96
- i \$2460 as a percentage of \$480

2 Determine the profit or loss amount for each of these.
- a original price \$35, selling price \$45
- b original price \$82, selling price \$68
- c original price \$92.50, selling price \$87.95
- d original price \$299.98, selling price \$145.50

EXAMPLE 1E-2 Calculating a percentage profit or loss

A television initially bought for $800 is later sold for $950.

a State if a profit or loss has been made and determine the amount.
b Write the profit or loss amount as a percentage of the original price.

THINK

a The selling price is more than the original price, so a profit has been made. Find the difference.

b 1 Write the profit amount as a fraction of the original price and multiply it by 100%.

2 Write your final answer.

WRITE

a profit = $950 − $800
= $150

b percentage profit = $\frac{150}{800} \times 100\%$
$= \frac{150}{800} \times \frac{100}{1}\%$
= 18.75%

The television sold for an 18.75% profit.

UNDERSTANDING AND FLUENCY

3 For each scenario:
- i state if a profit or loss has been made and determine the amount
- ii write the profit or loss amount as a percentage of the original price, correct to two decimal places where appropriate.

a Shoes are bought for $240 and later sold for $180.
b A greengrocer buys cherries for $2.50 per kilogram and sells them for $9.80 per kilogram.
c An investor buys shares for $5.20 and sells them for $4.80.
d A car is purchased brand new for $24 640 and sold for $19 250.
e Coins are purchased in a set for $120 and sold for $350.
f A novel is purchased for $29.95 and sold for $8.

4 How do the percentage amounts calculated in question **3** change if the percentages are based on the selling price?

5 Calculate the percentage profit or loss on the original price for each part in question **2**.

6 Daniela pays $198 for her mp3 player and sells it to a friend for $150 when a new model comes out.

a Did Daniela make a profit or a loss?
b Write the amount in part **a** as a percentage of the original price.

7 As Benjamin became more successful at his BMX racing, he chose to sell his bike to buy a better model. The bike, which had cost him $240, was sold to a fellow competitor at a percentage profit of 5%.

- **a** How much did Benjamin sell the bike for?
- **b** The new bike Benjamin plans to buy will cost him $900. Write this as a percentage of the cost of his original bike.

8 For each of these:

- **i** state the value of the profit or loss
- **ii** write the profit or loss as a percentage of the original price (rounded to the nearest 1%).

- **a** original price $48, selling price $34
- **b** original price $112.50, selling price $240
- **c** original price $35.90, selling price $85.95
- **d** original price $1649, selling price $1238
- **e** original price $29 895, selling price $17 500
- **f** original price $156 985, selling price $425 850

9 John buys pears at the orchards for $2.95 per kilogram to sell at his market stall.

- **a** How much does John mark up the cost of the pears per kilogram (see photo)?
- **b** Write the mark-up amount as a percentage of the price John pays for the pears. State the mark-up as a percentage to the nearest 1%.

10 A wireless printer is initially priced at $249.95 and is offered for sale at a discounted price of $222.50.

- **a** State the amount of the discount.
- **b** Write the discount as a percentage of the initial price to the nearest 1%.

11 A goods and services tax (GST) is a 10% tax that is added to the cost of many goods and services. This means that prices are increased by 10%. Calculate the prices paid for these items after GST is added, rounding to the nearest cent where appropriate.

- **a** dining table and chairs $1285
- **b** services provided by a plumber $240
- **c** insurance purchased for a car $601.45
- **d** five 3-m lengths of timber at $6.50 per metre
- **e** electricity service and supply charge is $314.65
- **f** membership at a gymnasium at $72.95 per month

12 **a** For each of the items in question **11**, multiply the given value by 1.1. Compare your answers to those you obtained in question **11**. What do you notice?

- **b** Explain why a 10% increase is the same as multiplying by 1.1.

13 The following items each include the GST charge in the price. Calculate the pre-GST price, rounding to the nearest cent where appropriate. (Hint: find 100% if the given amount is 110% of the pre-GST price.)

- **a** telephone and Internet services $155.65
- **b** computer accessories purchased for $235.95
- **c** garden maintenance provide for $182
- **d** a necklace bought at a jewellery store for $120.50

14 **a** For each of the items in question **13**, divide each of the given values by 1.1. Compare the answers with those you obtained in question **13**. What do you notice?

- **b** Why do you think the pre-GST price can be determined by dividing the final price by 1.1?

15 Joseph sells remote-controlled cars in his toy store. He knows that identical cars are being sold by a competitor for $65. Joseph can purchase these cars from a wholesaler for $28 per car.

- **a** Joseph aims to make a 150% profit on the sale of each car and must add 10% for GST. Do you think this profit margin is a suitable pricing strategy? Briefly explain.
- **b** Using whole number values, what is the maximum percentage increase Joseph should apply to the wholesale price? Remember to add the GST charge.
- **c** Why is it necessary to consider a maximum percentage increase rather than any percentage increase Joseph wishes to apply?

16 A small share portfolio was purchased at a price of $1200 and sold 12 months later for $1500.

- **a** Write the increase in price as a percentage of the original price.
- **b** Write the final selling price as a percentage of the original purchase price.
- **c** Compare the percentage increase in part **a** with the answer in part **b**. Briefly explain how they are related.

17 A car is bought for $20 000 and sold six months later for $16 000.

- **a** Write the decrease in price as a percentage of the original price paid for the car.
- **b** Write the final selling price as a percentage of the original purchase price.
- **c** Compare the percentage decrease in part **a** with the answer in part **b**. Briefly explain how they are related.

18 What percentage increases or decreases match the following profit/loss amounts?

- **a** doubling your money
- **b** tripling your money
- **c** breaking even
- **d** halving your money
- **e** quadrupling your money
- **f** losing all your money

PROBLEM SOLVING AND REASONING

19 The finance report on the nightly news displays the daily movement in the cost of some common commodities. If the values given in this table represent the end-of-day trading figures, what were the values at the start of the day's trading?

Commodity	Final price $	Movement %
Gold	1732.95	↓0.5
Silver	33.56	↓1.4
Oil	102.46	↑0.3
Copper	3.71	↑1.2

↓ represents a decrease in price
↑ represents an increase in price

20 Omar and his family purchase a large block of land and plan to build four townhouses on the block. The land costs $645 000 and the cost for each house is $230 000 (including plans, permits and other related charges). The project takes 2 years to complete and Omar is charged rates of $2300 per year during this time. The amounts generated from the house sales were $485 000, $490 000, $472 000 and $461 000. The real estate agency earns a commission of 1.75% for the sale of each house.

a What were the total expenses accrued by Omar before the sale of the townhouses?

b From the total sales, how much of the money:

i goes to Omar and his family?

ii is earned as commission by the real estate agency?

c Does Omar make a profit or a loss?

d Write your answer from part **c** as a percentage of Omar's total expenses.

21 Mario runs a hairdressing business from his home and sells shampoos, hair treatment products and styling products to his customers. On all product sales, he plans to make a profit of 80% of the wholesale price he pays for the goods. On top of this, he knows he must add an additional 10% for GST. Mario believes he can determine the selling price by simply adding 90% to the wholesale price.

a A jar of styling gel has a wholesale price of $8.50. What will the price be after Mario's profit mark-up?

b What will the selling price be after GST is added?

c Increase $8.50 by 90% and compare your answer with the answer from part **b**. Is Mario's method of calculating the selling price correct? Why or why not?

CHALLENGE

22 **a** In question **21**, you learned that Mario likes to make a profit of 80% on his wholesale prices and then adds 10% for GST. What *single calculation* can Mario perform to determine his selling price for a jar of styling gel?

b A motorbike sells for $1200 after a mark-up of 60% and then GST is added. What single calculation can be performed to determine the wholesale price of the motorbike?

c GST is added to a price and then the item is discounted by 25% to sell for $400. What single calculation will determine the original price; that is, the pre-GST price?

Reflect

How important do you think it is to understand how percentages are applied to financial calculations?

1F Understanding simple interest

Start thinking!

When you borrow money from a bank, the total of your repayments is more than the amount borrowed. This additional repayment is known as **interest** and is charged by the banks for allowing you to have access to the money.

Alternatively, if you were to invest money with a bank rather than borrow it, interest can be paid to you on your **investment**. Banks do this for allowing them to have access to your money. (The banks use your money to lend to other customers.)

One form of interest calculation is known as **simple interest**. This calculation is based on the amount borrowed (for a **loan**) or the amount invested (for an investment). Simple interest is the most basic form of interest calculation and it forms the basis of a more advanced and more widely applied type of interest calculation, known as compound interest. (You will study compound interest next year.)

Consider an investment of $10 000 at an interest rate of 5% per annum (p.a.) for a period of one year.

1 The interest rate is stated as 5% per annum. Per annum means 'per year' and is often abbreviated to p.a. The interest earned on this investment is 5% of the amount invested. Calculate the interest earned in the year.

In interest calculations, the amount invested or borrowed is known as the **principal**. The interest rate is referred to as the **rate**, and **time** refers to the length of the investment or loan in years.

2 Use the example and the three key terms, principal, rate and time, to write a formula to calculate simple interest.

KEY IDEAS

- Interest can be an additional charge to a loan or a bonus payment to an investment.
- One type of interest calculation is called simple interest.
- Interest can be calculated using the formula: interest = principal × rate × time, or $I = P \times R \times T$, where
  - I = interest
  - P = principal (the amount borrowed or invested)
  - R = interest rate converted to a fraction or decimal. For example, 5% would be substituted as $\frac{5}{100}$ or 0.05.
  - T = time of the loan or investment in years.

EXERCISE 1F Understanding simple interest

1 Write these interest rates as:
i a fraction in simplest form **ii** a decimal.
a 7% **b** 11% **c** 8% **d** 6% **e** 10% **f** 12%

EXAMPLE 1F-1 Calculating simple interest

For an investment of $5200 at an interest rate of 6% p.a. for 4 years, calculate:
a the amount of simple interest **b** the value of the investment after 4 years.

THINK

a 1 Write the formula to use and identify the key terms. The rate must be written as a fraction or a decimal.

2 Substitute the values into the formula and calculate the result.

3 Write the answer.

b 1 The value of the investment after 4 years is the interest amount added to the principal.

2 Write your final answer.

WRITE

a interest = principal × rate × time
principal = $5200
rate = 6% = $\frac{6}{100}$
time = 4 years
interest = $5200 \times \frac{6}{100} \times 4$
= $1248

The simple interest earned in 4 years is $1248.

b value = $5200 + $1248
= $6448

The value of the investment after 4 years is $6448.

UNDERSTANDING AND FLUENCY

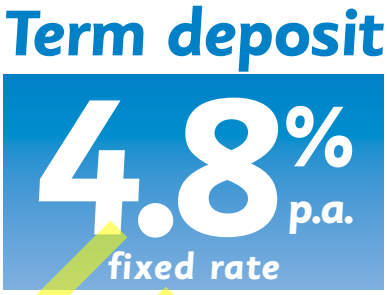
2 For each investment, calculate:
i the amount of simple interest
ii the value of the investment after the term.
a an investment of $5000 at an interest rate of 5% p.a. for 2 years
b an investment of $4800 at an interest rate of 4% p.a. for 3 years
c an investment of $12 500 at an interest rate of 8% p.a. for 5 years

3 For each loan, calculate:
i the amount of simple interest
ii the total amount to be repaid.
a a loan of $7500 at an interest rate of 5% p.a. over 3 years
b a loan of $10 800 at an interest rate of 12% p.a. over 5 years
c a loan of $25 000 at an interest rate of 7% p.a. over 8 years

4 Calculate the simple interest given each of these.

a $P = \$4000$, $R = 6\%$, $T = 5$ years
b $P = \$8650$, $R = 7\%$, $T = 4$ years
c $P = \$15\,000$, $R = 8\%$, $T = 10$ years
d $P = \$9200$, $R = 4\%$, $T = 3$ years
e $P = \$19\,999$, $R = 15\%$, $T = 6$ years
f $P = \$20\,000$, $R = 20\%$, $T = 5$ years

5 Christian invests $3500 in a bank that offers the interest rate shown. He plans to leave the money invested for 2 years.



a Identify the values for P, R and T.
b How much simple interest does Christian earn?
c What is the total value of Christian's investment after 2 years?

6 Jenna plans to start her business in massage therapy and needs to borrow $44 000 to assist with her set-up costs. She obtains an agreement with her lender to repay the money over 5 years with interest charged at 9.5% p.a.

a Identify the values for P, R and T.
b How much simple interest is Jenna charged?
c What is the total amount that Jenna repays?

7 **a** Consider each of these situations. Calculate the amount of simple interest in each case.
i $5000 is invested at 4.75% p.a. for 3.5 years.
ii $5000 is borrowed at 4.75% for 3.5 years.
b Compare each of the answers in parts **a i** and **a ii**. Briefly explain how the simple interest formula is used for investment and loan situations.
c Given that the simple interest calculations involving loans and investments are identical, how are the calculations different when they are interpreted?

8 Convert each time to years. Where appropriate, write the fraction in simplest form.

a 11 months
b 7 weeks
c 26 weeks
d 3 months
e 271 days
f 155 days
g 15 months
h 48 months
i 84 weeks
j 1241 days
k 30 months
l 286 weeks

9 An investment is made for 4 years and 3 months. Matthew thinks this is equivalent to 4.3 years while Lizzy is certain Matthew is wrong. How is 4 years and 3 months written as a decimal in years?

10 For the values given in the table at right, calculate:

- **i** the amount of simple interest
- **ii** the total amount at the end of the term.

	Principal $	Rate % p.a.	Time
a	9 000	6	3 years
b	10 500	4.5	6 months
c	7 500	9.8	130 weeks
d	29 000	3.2	90 days
e	8 600	6.4	35 days
f	155 570	12.5	11 months
g	19 999	19.9	25 weeks
h	45 950	14.05	2 years and 5 months
i	208 654	8.75	5 weeks and 4 days

11 Sade is investigating which is the best way to calculate her simple interest for a short-term investment. She invests $2400 for the month of June at an interest rate of 4.6% p.a.

- **a** Calculate the simple interest amount after writing the time as a fraction of the total number of months in the year.
- **b** Now calculate the simple interest amount after writing the number of days in June as a fraction of the total number of days in the year.
- **c** Which method of calculation would Sade be hoping would be used? Briefly explain why.
- **d** If the values given represented a short-term loan instead of an investment, which method of calculation would Sade prefer? Briefly explain why.

12 A bank is offering the interest rates advertised for its customers to invest in a term deposit. The interest is calculated at the end of the investment. Jasmine has $20 000 to invest and plans to invest it for 12 months.

- **a** What interest rate will Jasmine receive for her investment?
- **b** How much interest does she earn?
- **c** Jasmine's brother informed her that she would have earned more interest if she invested the money for one day less than 12 months. Investigate whether this statement is true and show working to support your finding.

Term	Interest on investment amount		
	$5000 to <$10 000 %	$10 000 to <$50 000 %	$50 000 to <$100 000 %
1 to <2 months	2.5	2.5	2.8
2 to <6 months	3.25	3.25	3.25
6 to <12 months	5.5	5.55	5.5
12 to <24 months	5.3	5.25	5.2

13 Banks vary in the ways in which they calculate interest on savings and transaction accounts. Some accounts earn no interest while others attract bonus interest rates if certain conditions are met. If an account provides interest, it is most likely calculated on the daily account balance. Consider the account balances for the month of February shown.

Date	Transaction	Amount $	Balance $
01/02	Opening balance		640.90
08/02	Withdrawal at Handybank	100.00	540.90
15/02	Deposit	240.00	780.90
24/02	EFTPOS Purchase	125.40	655.50
28/02	Interest		

a The opening balance of $640.90 applies for the first seven days of the month as each new balance applies on the date the transaction is made. How many days does each balance on this account apply for?

b The account attracts interest at a rate of 2.1% p.a. For each new balance in the account, calculate the simple interest based on the number of days each balance applies.

c Add all the amounts from part **b** to calculate the total interest for the month.

d What is the account balance at the end of February, if the total interest is added to the account at the end of the last day of the month?

14 This bank statement shows the transactions made during the month of August. Interest is calculated daily at a rate of 1.8% p.a.

Date	Transaction	Amount $	Balance $
01/08	Opening balance		345.50
09/08	ATM Withdrawal	50.00	295.50
14/08	Deposit – Pay	370.00	665.50
16/08	ATM Withdrawal	120.00	545.50
19/08	EFTPOS Purchase	85.95	459.55
28/08	Deposit – Pay	370.00	829.55
31/08	Interest		

a How much interest is earned during the month?

b What is the final account balance?

15 A bank offers an interest rate of 1.5% p.a. on its savings accounts plus an extra 3.2% p.a. bonus rate if no more than one withdrawal is made in the month and the account balance has increased by at least $200 for the month. Consider each of the account statements shown.

A

Date	Transaction	Amount $	Balance $
01/09	Opening balance		1200.85
15/09	Deposit – Pay	450.75	
24/09	Deposit – at branch	820.00	
29/09	EFTPOS Purchase	245.85	
30/09	Interest		

PROBLEM SOLVING AND REASONING

B

Date	Transaction	Amount $	Balance $
01/01	Opening balance		1548.90
08/01	EFTPOS Purchase	246.20	
15/01	Deposit – Pay	1920.00	
29/01	EFTPOS Purchase	85.94	
31/01	Interest		

a Will any of these accounts receive the bonus interest rate? Provide a reason to support your answer.

b Calculate the total interest earned on each account. You will need to determine the account balances following each transaction first.

c State the final account balance for each statement at the end of the month.

CHALLENGE

16 Joel plans to buy a second-hand car for $12 500. He has saved $2500 and plans to borrow the remaining money from his bank at an interest rate of 8.5% p.a. over 3 years.

a The seller asks for a deposit of 15% of the selling price. Is Joel's savings enough to cover the deposit? (Note that a deposit is the first part of a payment often used as a promise to pay.)

b How much does Joel borrow to buy the car?

c Calculate the total amount, including interest, that Joel pays for the car.

17 You have $2000 and wish to double this amount over 3 years. You plan to explore some different options to earn the most amount of interest possible.

a What is the annual simple interest rate that will enable this investment to double in 3 years?

b Explore how this rate changes if the time of the investment increases to:

i 4 years **ii** 5 years **iii** 6 years.

c Explore how this rate changes if the time of the investment decreases to:

i 2 years **ii** 1 year.

18 Provide three different annual interest rates and their corresponding times that would result in an investment of $5000 earning $1250 in simple interest.

Reflect

What is the difference between interest on an investment and interest on a loan?

1G Working with simple interest

Start thinking!

So far, the use of the simple interest formula has been limited to calculating the amount of interest, given values for the principal, rate and time. Now consider calculations where the interest amount is known and you are asked to find the value of one of the other **variables**; that is, P, R or T.

Tony borrows $15 000 at an interest rate of 6% p.a. to buy a car. He needs to pay $3600 in simple interest.

1 From the simple interest formula, which variable do you not know the value of?

2 What variable does each of the given values represent?

3 Substitute the values into the simple interest formula and show that it simplifies to $3600 = 900 \times T$.

4 Solve the **equation** formed to determine the value for T.

KEY IDEAS

- The simple interest formula is $I = P \times R \times T$.
- Strategies for solving equations can be used to find the value for P, R or T.

EXERCISE 1G Working with simple interest

1 Calculate the simple interest in each case.

a $P = \$2000$, $R = 7\%$, $T = 3$ years
b $P = \$250$, $R = 11\%$, $T = 1$ year
c $P = \$8500$, $R = 5\%$, $T = 4$ years
d $P = \$25\,000$, $R = 4\%$, $T = 5$ years
e $P = \$100\,000$, $R = 9.5\%$, $T = 4$ years
f $P = \$16\,000$, $R = 6\%$, $T = 2.5$ years

EXAMPLE 1G-1 Calculating time

How long will it take for an investment of $4000 at an interest rate of 4% p.a. to earn $800 in simple interest?

THINK	WRITE
1 Write the simple interest formula and identify the variables. R should be written as a fraction or a decimal.	$I = P \times R \times T$ $I = \$800$ $P = \$4000$ $R = 4\% = \frac{4}{100}$ $T = ?$
2 Substitute the values into the formula and simplify.	$800 = 4000 \times \frac{4}{100} \times T$ $800 = 160 \times T$
3 Use the balance method to find the value for T.	$\frac{800}{160} = \frac{160 \times T}{160}$ $T = 5$
4 Write the answer.	It will take 5 years for the investment to earn $800 in simple interest.

UNDERSTANDING AND FLUENCY

2 Find the value for T in each of these.

a How long will it take for an investment of $8000 at an interest rate of 3% p.a. to earn $1200 in simple interest?
b How long will it take for an investment of $1250 at an interest rate of 4% p.a. to earn $350 in simple interest?
c How long does a loan of $15 000 at an interest rate of 9% p.a. take to earn $5400 in simple interest?
d How long will it take for an investment of $5600 at an interest rate of 5% p.a. to earn $1120 in simple interest?

EXAMPLE 1G-2 Calculating the principal value

How much needs to be invested at an interest rate of 6% p.a. for 3 years to earn $1440 in simple interest?

THINK	WRITE
1 Write the simple interest formula and identify the variables. R should be written as a fraction or a decimal.	$I = P \times R \times T$ $I = \$1440$ $R = 6\% = 0.06$ $T = 3$ years $P = ?$
2 Substitute the values into the formula and simplify.	$1440 = P \times 0.06 \times 3$ $1440 = P \times 0.18$
3 Use the balance method to find the value for P.	$\frac{1440}{0.18} = \frac{P \times 0.18}{0.18}$ $P = 8000$
4 Write the answer.	$8000 needs to be invested to earn $1440 in simple interest over 3 years.

UNDERSTANDING AND FLUENCY

3 Find the value for P in each of these.

- **a** How much needs to be invested at an interest rate of 8% p.a. for 5 years to earn $2000 in simple interest?
- **b** How much is borrowed at an interest rate of 10% p.a. over 4 years to earn $6000 in simple interest?
- **c** How much is borrowed at an interest rate of 9% p.a. over 5 years to earn $1800 in simple interest?
- **d** How much needs to be invested at an interest rate of 6% p.a. for 2 years to earn $576 in simple interest?

4 Find the unknown value in each of these.

- **a** $I = \$600$, $P = \$3000$, $R = 4\%$, $T = ?$
- **b** $I = \$1200$, $P = ?$, $R = 5\%$, $T = 4$ years
- **c** $I = \$450$, $P = ?$, $R = 9\%$, $T = 2$ years
- **d** $I = \$850$, $P = \$8500$, $R = 5\%$, $T = ?$
- **e** $I = \$1000$, $P = ?$, $R = 8\%$, $T = 4$ years
- **f** $I = \$5060$, $P = \$9200$, $R = 11\%$, $T = ?$

5 Jessica has invested $4500 in a bank that offers simple interest of 5.0% p.a. She plans to earn $675 in interest.

- **a** From the simple interest formula, which variable do you not know the value of?
- **b** What variable does each of the given values represent?
- **c** How long does the money need to be invested to earn $675 in simple interest?
- **d** At a higher interest rate of 7.5% p.a., how much sooner can Jessica earn $675 in simple interest?

6 Throughout the course of a simple interest investment, Stefan's money increased in value from $8400 to $8862. The interest was earned at a rate of 2.75% p.a.

a What is the total amount of interest earned on this investment?

b How many months was the initial amount of money invested for?

7 Up to this point, the simple interest formula has been used to calculate the amount of interest, or the principal amount, or the time period of the investment or loan. Now consider calculations requiring you to find the value of the interest rate.
Consider a loan of $6000 taken over 3 years. The amount of simple interest charged on the loan is $864.

a Substitute the values into the simple interest formula.

b Show that the formula simplifies to $864 = 18\,000 \times R$.

c Solve the equation in part **b** by dividing both sides of the equation by 18 000.

d The answer in part **c** represents the interest rate written as a decimal. What needs to be done to this decimal so that the value is written as a percentage amount?

e State the interest rate that was applied to this loan.

f Investigate what can be done to the simple interest formula so that, after substituting the values into the formula and solving, the rate will automatically be given as a percentage. Check that your modified formula produces the same answer you obtained in part **e**.

8 For the values given in the table, calculate the interest rate that applies.

	Simple interest $	Principal $	Time
a	1 640	8 200	4 years
b	420	3 500	2 years
c	985	9 850	48 months
d	1 680	12 000	30 months
e	3 936	18 000	3 years and 5 months
f	680	6 400	4 years and 3 months

9 Use the simple interest formula to determine the value for the missing amount in the table.

	Simple interest $	Principal $	Rate % p.a.	Time
a		3 700	5.6	4.5 years
b	234		4.8	13 months
c	42 532	70 000		6.2 years
d	3 549	19 500	5.2	

	Simple interest $	Principal $	Rate % p.a.	Time
e	1 711.00		14.5	48 months
f	2 631.60	15 480		130 weeks
g	56.88	948		1.2 years
h	1 534.40	13 700	6.4	

10 Craig borrowed a sum of money from his parents to help him buy his first car. They agreed to charge interest at a rate of 4% p.a. over a period of 3 years. The interest charge for the term of the loan is $1440.

- **a** From the simple interest formula, which variable do you not know the value of?
- **b** What variable does each of the given values represent?
- **c** How much money does Craig borrow from his parents?
- **d** Craig plans to pay his parents $350 each month for the 3 years and believes this will cover the agreed terms of their loan. Determine if Craig's plans are correct and show workings to support your finding.
- **e** What are the exact monthly payments Craig needs to make to repay his loan?

11 Although she has the savings to purchase the new iPad shown, Gabriella would rather let the interest earned from her investment cover the cost of the purchase.

- **a** One bank offers her a simple interest rate of 7.2% p.a. for her investment of $10 000. How long does this money need to be invested to earn enough money to pay for the iPad?
- **b** Gabriella decides on 12 months to reach her goal. At the same rate of interest, how much does she need to invest in order to fully pay for the iPad with the interest she earns?

12 Daniel has decided to learn the alto saxophone through his school music program. To encourage his development, his parents bought the saxophone shown through a purchase program arranged by his school. The repayment conditions involve quarterly payments over 3 years. The simple interest charged on the saxophone's cost is $162.

- **a** What is the annual interest rate charged?
- **b** What is the amount of each quarterly payment required?

13 An amount of $4000 is invested at 5.2% p.a. for a period of 3 years.

- **a** Calculate the amount of simple interest that is earned on this investment.
- **b** What is the value of the investment at the end of the 3-year term?

Investments involving simple interest result in the interest being passed on to the investor at maturity (at the end of the investment). Reconsider the investment of $4000 at 5.2% p.a. for 3 years, but now calculate interest during the investment period at yearly intervals and add these amounts to the principal.

- **c** How much interest is earned in the first year of the investment?
- **d** Add the interest amount from part **c** to the principal amount. This new amount is the principal for the second year of the investment.
- **e** Use the new principal value to calculate the interest earned in the second year of the investment.
- **f** Add the interest amount from part **e** to the principal amount for the second year. This new amount is the principal for the third year of the investment.
- **g** Use the new principal value to calculate the interest earned in the third (final) year of the investment.

PROBLEM SOLVING AND REASONING

h Add the interest amount from part **g** to the principal amount for the third year. This new amount is the final value of the investment.

i Compare your answer from part **h** with the answer you obtained in part **b**. Which method of calculation resulted in the higher value at the end of 3 years? Why do you think this is so?

14 The method of interest calculation you performed in question **13c–h** is known as compound interest, and you will study it in further detail next year.

Calculate the final value of each of these investments by performing the interest calculations annually.

a an investment of $10 000 at 8% p.a. for 3 years

b an investment of $15 000 at 6.8% p.a. for 2 years

c an investment of $18 000 at 7.5% p.a. for 4 years

d an investment of $50 000 at 10% p.a. for 3 years

15 For each investment in question **14**:

i determine the amount of interest earned over the investment term

ii calculate how much more was earned by using compound interest rather than simple interest.

CHALLENGE

16 This bank statement is linked to a savings account and shows the transactions made during the month of April.

What is the annual interest rate (% p.a.) that applies to this account? (Remember that each new balance applies from the day of the transaction.)

Date	Transaction	Amount $	Balance $
01/04	Opening balance		2 905.60
03/04	Deposit – Pay	1 230.75	4 136.35
08/04	ATM Withdrawal	250.00	3 886.35
15/04	EFTPOS Purchase	499.95	3 386.40
17/04	Deposit – Pay	1 230.75	4 617.15
	Monthly interest	7.54	4 624.69

17 The statement shown is linked to a credit card where interest is charged from the day of purchase. To avoid additional charges, the total amount spent, plus interest is to be paid each month.

Date	Description	Amount $
06/07	BPAY to Electricity provider	290.00
08/07	Gym membership	72.00
11/07	Petrol	45.00
20/07	AFL tickets	85.00
21/07	Clothing store	189.95
24/07	Petrol	52.87
	Interest charge for the month of July	6.31

a How much needs to be paid at the end of the month to avoid any additional charges?

b What is the annual interest rate (% p.a.) that is charged to this credit account?

Reflect

Why is it important for the interest rate to be written as a decimal or fraction rather than the given percentage value?

CHAPTER REVIEW

SUMMARISE

Create a summary of this chapter using the key terms below. You may like to write a paragraph, create a concept map or use technology to present your work.

exact value	overtime	original price	loss
estimated value	time-and-a-half	discount	percentage increase
rounding	double time	mark-up	percentage decrease
best buy	income tax	retail price	simple interest
rate statement	deductions	wholesale price	principal
wage	ratios	commission	rate
salary	equivalent ratio statement	retainer	time
gross income	percentage of an amount	interest	investment
net income	selling price	profit	loan

MULTIPLE-CHOICE

1A **1** After rounding each amount to its leading digit, the estimate for $920 217 + $384 521 − $348 420 is:

A $1 000 000 **B** $956 318
C $1 600 000 **D** $900 000

1B **2** Which rate statement is in simplest form?

A earning $631.90 for 35.5 hours work
B paying $52.06 for 38 L of petrol
C being charged $10.32 for a 12-minute mobile phone call
D driving at a speed of 100 km per hour

1C **3** When $8400 is divided in the ratio 3:7, the size of the smallest share is:

A $840 **B** $2520
C $3600 **D** $5880

1D **4** A sport's store is selling children's tennis racquets at a discount of 20%. If the racquets are initially priced at $49.50, what will their sale price will be?

A $9.90 **B** $29.50
C $39.60 **D** $59.40

1E **5** A bike rider paid $240 for his bike and sold it 12 months later for $180. Which statement is *not* correct?

A The sale represents a loss of $60.
B The sale is a 25% loss on the original price.
C The sale is a 25% loss on the selling price.
D The selling price is 75% of the original price.

1F **6** $12 000 is invested at 4.2% p.a. simple interest for 18 months. Which values should be substituted into the simple interest formula?

A $P = 12\,000$, $R = 4.2$, $T = 18$
B $P = 12\,000$, $R = 0.042$, $T = 1.5$
C $P = 12\,000$, $R = 4.2$, $T = 1.5$
D $P = 12\,000$, $R = 0.042$, $T = 18$

1G **7** A loan of $4500 with simple interest 8.5% p.a. is charged $1530 in interest. Which simple interest variable do you *not* know the value of?

A interest **B** principal
C rate **D** time

SHORT ANSWER

1A ▶ **1** Find the difference between the exact value and the estimated value for each calculation.

a 368 983 × $45

b $865 478 + $921 854 − $328 456

c $3 058 057 ÷ 98 647

1B ▶ **2** Write each statement as a rate in simplest form.

a driving 185 km in 2 hours

b earning $193.80 for 8.5 hours work

c a 275 mL can of drink costs $2.50

1B ▶ **3** The hours worked by four employees are displayed in the table. The normal hourly rate of pay is $22.50. Use the information to determine each employee's gross income.

Total hours worked		
Normal rate	Time-and-a-half	Double time
24	5	1
30	0	6
14	6	10
0	15	10

1C ▶ **4** Simplify each ratio.

a 36:45 **b** 9:27:18

c 4:28:32 **d** 12:45:33:21

1C ▶ **5** Write each comparison as a ratio in simplest form.

a 15.1 to 11.3 **b** $10.50 to $4.80

c $\frac{1}{4}$ to $\frac{3}{4}$ **d** $\frac{2}{3}$ to $5\frac{1}{3}$

1C ▶ **6** Divide $5200 in each of the given ratios, rounding to the nearest cent where necessary.

a 4:6 **b** 7:3 **c** 4:8:1

d 2:3:5:3 **e** 8:4 **f** 7:5:3

1C ▶ **7** Two friends contributed donations of $180 and $240 respectively to their club.

a What is the ratio of the donations in the given order in simplest form?

b If next year's contribution is in the same ratio and the first friend contributes $150, what is the amount of the second part of the ratio?

1D ▶ **8** Calculate the price to be paid after:

a a 15% discount on $758

b a 22.5% discount on $84

c a 85% mark-up on $140

d a 155% mark-up on $68.

1D ▶ **9** Calculate the original price for:

a a mobile phone sold for $225 after a discount of 20%

b paint sold at $49.95 per can after a mark-up of 80%.

1E ▶ **10** For each of these:

i state if a profit or loss has been made and determine the amount

ii write the profit or loss amount as a percentage of the original price, correct to two decimal places.

a original price $35, selling price $50

b original price $104.50, selling price $85.85

c original price $199.95, selling price $245.65

1E ▶ **11** Write these amounts as percentages.

a $55 as a percentage of $275

b $80 as a percentage of $120

c $150 as a percentage of $60

d $145 as a percentage of $25

1F ▶ **12** Calculate the simple interest in each case.

a P = $3000, R = 5%, T = 4 years

b P = $6400, R = 2.5%, T = 3 years

c P = $35 000, R = 4.4%, T = 5 months

1G ▶ **13** Find the unknown value P, T or R when:

a I = $240, P = $2000, R = 4%

b I = $854.40, R = 8.9%, T = 2 years

c I = $1400, P = $16 000, R = 3.5%

d I = $630, P = $3500, T = 2 years

e I = $1011.50, P = $8500, T = 3.5 years

NAPLAN-STYLE PRACTICE

1 John's annual pay is $55 827. Which statement is an estimate for his fortnightly pay?

- ☐ $55 827 ÷ 26
- ☐ $60 000 ÷ 26
- ☐ $60 000 ÷ 30
- ☐ $50 000 ÷ 30

2 You can buy a 5 kg bag of apples for $14.50. Which rate statement is *not* true?

- ☐ $14.50 per 5 kg
- ☐ $2.90 per kg
- ☐ $9.50 per kg
- ☐ $7.25 per 2.5 kg

Questions **3** and **4** refer to this information.
Ainslee earns $15.80 per hour. In one particular week, she worked 14 hours at the standard rate of pay, 5 hours at time-and-a-half and 3 hours at double time.

3 Which calculation would determine her gross income?

- ☐ $14 \times \$15.80 + 5 \times \$15.80 + 3 \times \$15.80$
- ☐ $14 \times \$15.80 + 5 \times 1.5 \times \$15.80 + 3 \times 2 \times \$15.80$
- ☐ $14 \times \$15.80 + 5 \times 1.5 \times \$15.80 + 3 \times \$15.80$
- ☐ $14 \times \$15.80 + 5 \times \$23.07 + 3 \times \$31.06$

4 Ainslee has these items deducted from her pay in this week:
income tax: $54.20, union fees: $8.50, superannuation: $15.75.
What is her net income?

5 Three students contributed $54, $72 and $36 to a fundraising charity. What is the ratio of their contributions in simplest form?

- ☐ 54:72:36
- ☐ 36:54:72
- ☐ 3:4:2
- ☐ 6:12:4

6 An amount of $6400 is divided in the ratio 5:2:3. What is the size of the smallest share?

7 What is the value of a in the equivalent ratio statement $5:12 = 45:a$?

8 Shorts originally priced at $79.00 are offered for sale at a discount of 15%. Which represents the calculation for the discount amount?

- ☐ 85% of $79.00
- ☐ 15% of $79.00
- ☐ 115% of $79.00
- ☐ $79.00 − 15% of $79.00

9 The wholesale price on a television is $820. After a mark-up of 85%, what is the selling price of this television?

10 A refrigerator originally marked at $1245 is discounted by 17%. What is the selling price?

11 A novel sells for $15 after a discount of 20%. Which of these represents the original price before the discount was applied?

- ☐ $15 ÷ 80 × 100
- ☐ $15 + 20% of $15
- ☐ 80% of $15
- ☐ $15 × 80 ÷ 100

12 A salesman receives 2.4% of the total sales made during a week. What is his pay in a week where his total sales are $14 580?

13 What is $450 written as a percentage of $550? Round your answer to two decimal places.

Questions **14** and **15** refer to this information.
The original price for a coin set was $40. When sold some time later, the selling price was $150.

14 Which statement is correct?

- ☐ The coins were sold at a loss of $110.
- ☐ The coins were sold at a profit of $110.
- ☐ The coins were sold at a profit of $150.
- ☐ The percentage profit is 375%.

15 What is the profit or loss amount as a percentage of the original price?

Questions **16** and **17** refer to this information.
A loan of $12 500 is charged a simple interest rate of 8% p.a. for a period of 3 years.

16 How much interest is charged to the loan?

17 What is the total amount to be repaid?

Questions **18** and **19** relate to this savings account bank statement for the month of April.

Date	Transaction	Amount	Balance
		$	$
01/04	Opening balance		825.00
05/04	Withdrawal at Handybank	100.00	925.00
13/04	Deposit – Pay	740.00	1 665.00
25/04	EFTPOS purchase	225.00	1 440.00
30/04	Interest		

18 How many days does the highest monthly balance apply to this account?

19 Interest for this account is calculated daily at a rate of 3.0% p.a. How much interest is earned during the month?

20 How much needs to be invested at an interest rate of 5% p.a. for 4 years to earn $1000 in simple interest?

21 How long does a loan of $25 000 at an interest rate of 8% p.a. take to earn $7000 simple interest?

ANALYSIS

Julie manages a clothing store. She earns an annual salary of $42 432 and the normal hourly rate of $18.80 applies to her casual staff, although the opportunity for overtime is available. The store's rent is $1800 per week and Julie allows an extra $200 per week to cover other costs.

a Each week, Julie's deductions include $120.80 in income tax, $24.50 in superannuation and $8.50 in union fees. What is her weekly net income?

b One week, Julie has three staff working. Simone works 24 hours at the normal hourly rate, Melanie works 15 hours at the normal rate, 3 hours at time-and-a-half and 5 hours at double time, and Tahlia works 30 hours at the normal rate and 4 hours at time-and-a-half. Calculate the gross weekly income for each employee.

c What is the minimum amount of money that Julie's store must make in sales each week to cover the cost of staff pay and store costs?

d The store rental is to increase by 40% per week. How much extra money does Julie need to make to cover the increase?

Julie buys dresses for $12 each and plans to sell them for $45 each.

e What is the percentage mark-up that Julie plans to make on the sale of each dress?

f Julie notices that a rival clothing store sells identical dresses for $34. She changes her pricing so that she beats her rival's price by 10%. What is the retail price of the dresses now?

g What is the current selling price as a percentage of the initial price paid?

h What is the new percentage mark-up and how does it compare with the original percentage mark-up in part **e**?

The owners receive a quote for $48 000 to re-fit the store. They have half of this amount in savings and plan to borrow the remaining amount.

i The bank lends the money at a simple interest rate of 8.2% p.a. over 3 years. What is the total amount of money that must be repaid?

j If the money is repaid in equal monthly instalments, what is the amount?

k In total, how much did the store makeover cost?

CONNECT

The best purchase option

As they complete the furnishings for their new house, Jose and his family plan to purchase a complete home-theatre system for their theatre room. They are aware of some different options available to finance the purchase and plan to investigate each option to decide which one best suits their financial needs.

Your task is to perform calculations to determine the selling price of the home-theatre system the family are interested in and investigate whether it would be better to purchase the system through a store's purchase plan or financed by a personal loan from a bank (details of each are shown opposite).

Your task

Follow these steps to complete this investigation:

- Work out the selling price of the home-theatre system following the advertised discount.
- Calculate the costs associated with the store's purchase plan.
- Calculate the costs associated with the loan offered by the bank.
- Compare the options available and explore conditions for which each option could be the best.
- Investigate purchase plans offered by stores and loans offered by various lending banks.

BANK LOAN

Personal loan option

- Simple interest rate 6.5% p.a.
- 3-year term
- Monthly repayments

You may like to present your findings as a report. Your report could be in the form of:

- an advertising brochure
- a PowerPoint presentation
- a technology demonstration
- other (check with your teacher).