

TOPIC 11

Financial mathematics

11.1 Overview

Why learn this?

Unfortunately for most of us, money is not in endless supply. If we monitor our income and expenses we can make our money go further. Understanding budgets and investments can help us to keep track of our money and reach our financial goals.

What do you know?

assessment

- 1 **THINK** List what you know about financial mathematics. Use a thinking tool such as a concept map to show your list.
- 2 **PAIR** Share what you know with a partner and then with a small group.
- 3 **SHARE** As a class, create a thinking tool such as a large concept map to show your class's knowledge of financial mathematics.

Learning sequence

- 11.1 Overview
- 11.2 Salaries and wages
- 11.3 Special rates
- 11.4 Piecework
- 11.5 Commission and royalties
- 11.6 Loadings and bonuses
- 11.7 Taxation and net earnings
- 11.8 Simple interest
- 11.9 Compound interest
- 11.10 Review

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11.2 Salaries and wages

- Employees may be paid for their work in a variety of ways. Most employees receive either a **wage** or a **salary**.

Salaries

- A salary is a fixed annual (yearly) amount, usually paid fortnightly or monthly. A person who receives a salary is paid to do a job, regardless of the number of hours worked.

WORKED EXAMPLE 1

Susan has an annual salary of \$63 048.92. How much is she paid:

- a weekly b fortnightly c monthly?**

THINK

- a** **1** Annual means per year, so divide the salary by 52 because there are 52 weeks in a year.
- 2** Write the answer in a sentence.
- b** **1** There are 26 fortnights in a year, so divide the salary by 26.
- 2** Write the answer in a sentence.
- c** **1** There are 12 months in a year, so divide the salary by 12.
- 2** Write the answer in a sentence.

WRITE

- a** $63\,048.92 \div 52$
 ≈ 1212.48
- Susan's weekly salary is \$1212.48.
- b** $63\,048.92 \div 26$
 ≈ 2424.96
- Susan's fortnightly salary is \$2424.96.
- c** Monthly salary = $63\,048.92 \div 12$
 ≈ 5254.08
- Susan's monthly salary is \$5254.08.

Wages

- A wage is based on a fixed rate per hour. Hours outside the normal work period are paid at a higher rate.

WORKED EXAMPLE 2

Frisco has casual work at a fast-food store. He is paid \$12.27 per hour Monday to Saturday and \$24.54 per hour on Sunday. Calculate his wage for a week in which he worked from 5.00 pm to 10 pm on Friday and from 6 pm to 9.00 pm on Sunday.

THINK

- 1** Work out the number of hours Frisco worked each day. He worked 5 hours on Friday and 3 hours on Sunday.
- 2** Find the total amount earned.
- 3** Write the answer in a sentence.

WRITE

- Friday: $5 \times 12.27 = 61.35$
Sunday: $3 \times 24.54 = 73.62$
- $61.35 + 73.62 = 134.97$
- Frisco's wage was \$134.97.

Exercise 11.2 Salaries and wages

assess on

INDIVIDUAL PATHWAYS

PRACTISE

 Questions:
1–6, 8, 11, 13

CONSOLIDATE

 Questions:
1–6, 7, 9, 10, 12, 14, 15, 17

MASTER

 Questions:
1–6, 9, 12–20

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REFLECTION

What would be your preferred method of being paid and why?

FLUENCY

- 1 **WE1** Johann has an annual salary of \$57 482. How much is he paid:
 - a weekly
 - b fortnightly
 - c monthly?
- 2 Anna earns \$62 300 per annum. How much does she earn:
 - a weekly
 - b fortnightly
 - c monthly?
- 3 Find the annual salary of workers with the following weekly incomes.
 - a \$368
 - b \$892.50
 - c \$1320.85
- 4 How much is earned per annum by those paid fortnightly salaries of:
 - a \$995
 - b \$1622.46
 - c \$3865.31?
- 5 Which of each pair is on the higher salary?
 - a \$3890 per month or \$45 700 per annum
 - b \$3200.58 per fortnight or \$6700 per month
- 6 Find the hourly rate for these workers.
 - a Rahni earns \$98.75 for 5 hours.
 - b Francisco is paid \$54.75 for $4\frac{1}{2}$ hours.
 - c Nhan earns \$977.74 for a 38-hour week.
 - d Jessica works $7\frac{1}{2}$ hours a day for 5 days to earn \$1464.75.

UNDERSTANDING

- 7 Henry is a second-year apprentice motor mechanic. He receives the award wage of \$12.08 per hour. Jenny, a fourth-year apprentice, earns \$17.65 per hour.
 - a How much does Henry earn in a 38-hour week?
 - b How much more does Jenny earn in the same period of time?
- 8 **WE2** Juan has casual work for which he is paid \$13.17 per hour Monday to Saturday and \$26.34 per hour on Sundays. Calculate his total pay for a week in which he worked from 11 am to 5 pm on Thursday and from 2.00 pm to 7.00 pm on Sunday.
- 9 Mimi worked the following hours in one week.

Wednesday	5.00 pm to 9.00 pm
Thursday	6.00 pm to 9.00 pm
Friday	7.00 pm to 11.00 pm

 If her pay is \$21.79 per hour up to 9.00 pm and \$32.69 per hour after that, what is her total pay?
- 10 Who earns more money each week: Rhonda, who receives \$38.55 an hour for 38 hours work, or Rob, who receives \$41.87 an hour for 36 hours work?



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- 11 Glenn is a chef and receives \$1076.92 for a week in which he works 35 hours. What is his hourly rate of pay?
- 12 Julie is considering two job offers for work as a receptionist. Job A pays \$878.56 for a 38-hour working week. Job B pays \$812.16 for a 36-hour working week. Which job has the higher hourly rate of pay?
- 13 Russell and Gabrielle go to work in different department stores. Russell is paid \$981.77 per week. Gabrielle is paid \$26.36 per hour. How many hours must Gabrielle work to earn more money than Russell?
- 14 Calculate what pay each of the following salary earners will receive for each of the periods specified.
 - a Annual salary \$83 500, paid each week
 - b Annual salary \$72 509, paid each fortnight
 - c Annual salary \$57 200, paid each week
 - d Annual salary \$105 240, paid each month



REASONING

- 15 **MC** When Jack was successful in getting a job as a trainee journalist, he was offered the following choice of four salary packages. Which should Jack choose? Show your working.
 - A \$456 per week
 - B \$915 per fortnight
 - C \$1980 per calendar month
 - D \$23 700 per year
- 16 In his job as a bookkeeper, Minh works 38 hours per week and is paid \$32.26 per hour. Michelle, who works 38 hours per week in a similar job, is paid a salary of \$55 280 per year. Who has the higher paying job? Show your working.

PROBLEM SOLVING

- 17 A lawyer is offered a job with a salary of \$74 000 per year, or \$40 per hour. Assuming that they work 80 hours every fortnight, which is the greater pay?
- 18 Over the last four weeks, a woman has worked 35, 36, 34 and 41 hours. If she earns \$24.45 per hour, how much did she earn for each of the two fortnights?
- 19 An employee brags that he works a 40-hour week (8 hours a day, Monday–Friday) and earns \$62 000 p.a.
 - a What is this as an hourly rate?
 - b If the employee works on average an extra half an hour a day Monday–Friday and then another 4 hours over the weekend (for the same annual salary), how is his hourly rate affected?
 - c If the employee was earning the hourly rate for which he bragged about and was being paid for every hour worked, what would be his potential earnings for the year?

**CHALLENGE 11.1**

Mark saves \$10 per week. Phil saves 5 cents in the first week, 10 cents the second week and doubles the amount each week? How many weeks will it take for Phil to have more savings than Mark?

11.3 Special rates

- A normal Australian working week is 38 hours. Wage earners who work extra hours are 'working overtime'.
- Overtime** is paid when a wage earner works more than the regular hours each week. When an employee works overtime a higher rate is paid. This higher rate of pay is called a penalty rate. The rate is normally calculated at either time and a half, which means that the person is paid $1\frac{1}{2}$ times the normal rate of pay, or double time, which means that the person is paid twice the normal rate of pay, or double time and a half, which means that the person is paid $2\frac{1}{2}$ times the normal rate of pay.
- A person may also be paid these overtime rates for working at unfavourable times, such as at night or during weekends.
- To calculate the hourly rate earned when working overtime, we multiply the normal hourly rate by the overtime factor, which is $1\frac{1}{2}$ for overtime, 2 for double time and $2\frac{1}{2}$ for double time and a half.

WORKED EXAMPLE 3

Ursula works as a waitress and earns \$23.30 per hour. Last week she received the normal rate for 30 hours of work as well as time and a half for 3 hours of overtime and double time for 5 hours of work on Sunday. What was her total wage?

**THINK**

- 1 Calculate Ursula's normal pay.
- 2 Calculate Ursula's pay for 3 hours at time and a half.
- 3 Calculate Ursula's pay for 5 hours at double time.
- 4 Find the total amount.
- 5 Write the answer in a sentence.

WRITE

Normal pay: $30 \times 23.30 = 699.00$

Overtime: $3 \times 1.5 \times 23.30 = 104.85$

Sunday: $5 \times 2 \times 23.30 = 233.00$

Total = 1036.85

Ursula's total wage was \$1036.85.

Time sheets and pay slips

- Employers often use records called *time sheets* to monitor the number of hours worked by each employee.
- Details of the hours worked and the rate of pay are given to each employee on a pay slip, which they receive with their wages.

WORKED EXAMPLE 4

Fiona works in a department store, and in the week before Christmas she works overtime. Her time sheet is shown below. Fill in the details on her pay slip.

	Start	Finish	Normal hours	O'time 1.5
M	9.00	15.00	6	
T	9.00	17.00	8	
W	9.00	17.00	8	
T	9.00	19.00	8	2
F	9.00	19.00	8	2
S				

Pay slip for: Fiona BLACK	Week ending December 21
Normal hours	
Normal rate	\$17.95
Overtime hours	
Overtime rate	
Total wage	

THINK

- Calculate the number of normal hours worked.
- Calculate the number of overtime hours worked.
- Calculate the overtime rate.
- Calculate the total pay by multiplying the number of normal hours by the normal rate and adding the overtime amount, calculated by multiplying the number of overtime hours by the overtime rate.
- Fill in the amounts on the pay slip.

WRITE

Normal hours: $6 + 8 + 8 + 8 + 8 = 38$

Overtime hours: $2 + 2 = 4$

Overtime rate = 1.5×17.95
= 26.93

Total pay = $38 \times 17.95 + 4 \times 26.93$
= 789.82

Pay slip for: Fiona BLACK	Week ending December 21
Normal hours	38
Normal rate	\$17.95
Overtime hours	4
Overtime rate	\$26.93
Total wage	\$789.82

Exercise 11.3 Special rates

assess on

INDIVIDUAL PATHWAYS

PRACTISE

Questions:
1–5, 6, 9, 10, 13–15

CONSOLIDATE

Questions:
1–5, 7, 9, 10, 13–16, 18

MASTER

Questions:
1–5, 8, 9, 11–21

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REFLECTION

In what situations would being paid according to time sheets be preferable to receiving a wage or salary?

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FLUENCY

- 1 Calculate the following special rates:
 - a time-and-a-half when the hourly rate is \$15.96
 - b double time when the hourly rate is \$23.90
 - c double time-and-a-half when the hourly rate is \$17.40.
- 2 Calculate the following total weekly wages:
 - a 38 hours at \$22.10 per hour, plus 2 hours at time-and-a-half
 - b 40 hours at \$17.85 per hour, plus 3 hours at time-and-a-half
 - c 37 hours at \$18.32 per hour, plus 3 hours at time-and-a-half and 2 hours at double time.
- 3 Julio is paid \$956.08 for a regular 38-hour week.
 - a What is his hourly rate of pay?
 - b How much is he paid for 3 hours of overtime at time-and-a-half rates?
 - c What is his wage for a week in which he works 41 hours?
- 4 **WE3** Geoff is a waiter in a restaurant and works 8 hours most days. Calculate what he earns for 8 hours work on the following days:
 - a a Monday, when he receives his standard rate of \$21.30 per hour
 - b a Sunday, when he is paid double time
 - c a public holiday, when he is paid double time-and-a-half.
- 5 Albert is paid \$870.58 for a 38-hour week. What was his total wage for a week in which he worked 5 extra hours on a public holiday with a double-time-and-a-half penalty rate?

UNDERSTANDING

- 6 Jelesa (aged 16) works at a supermarket on Thursday nights and weekends. The award rate for a 16-year-old is \$7.55 per hour. Calculate what she would earn for:
 - a 4 hours work on Thursday night
 - b 6 hours work on Saturday
 - c 4 hours work on Sunday at double time
 - d the total of the three days.
- 7 Jacob works in a pizza shop and is paid \$13.17 per hour.
 - a Jacob is paid double time-and-a-half for public holiday work. What does he earn per hour on public holidays? (Answer to the nearest cent.)
 - b What is Jacob's pay for a public holiday where he works 6 hours?
- 8 If Bronte earns \$7.80 on normal time, how much does she receive per hour:
 - a at time and a half
 - b at double time
 - c at double time and a half?



- 9 Copy and complete the following time sheet. Calculate the number of hours Susan worked this week.

Day	Pay rate	Start time	Finish time	Hours worked
Monday	Normal	9.00 am	5.00 pm	
Tuesday	Normal	9.00 am	5.00 pm	
Wednesday	Normal	9.00 am	5.00 pm	
Thursday	Normal	9.00 am	5.00 pm	
Friday	Normal	9.00 am	3.00 pm	

- 10 **WE4** Copy and complete Susan's pay slip for this week.

Pay slip for: Susan WHITE	Week ending 17 August
Normal hours	
Normal pay rate	\$25.60
Overtime hours	0
Overtime pay rate	\$38.40
Total pay	

- 11 Below is a time sheet for Jason, who works in a department store. Copy and complete the table.

Day	Pay rate	Start time	Finish time	Hours worked
Monday	Normal	9.00 am	5.00 pm	
Tuesday	Normal	9.00 am	5.00 pm	
Wednesday	Normal	—		
Thursday	Normal	1.00 pm	9.00 pm	
Friday	Normal	—		
Saturday	Time and a half	8.00 am	12.00 pm	

- 12 Copy and complete the pay slip for Jason for the week described in question 11.

Pay slip for: Jason RUDD	Week ending 21 December
Normal hours	
Normal pay rate	\$10.90
Overtime hours	
Overtime pay rate	
Total pay	

- 13 Brett does shift work. Copy and complete his time sheet.

Day	Pay rate	Start time	Finish time	Hours worked
Monday	Normal	7.00 am	3.00 pm	
Tuesday	Normal	7.00 am	3.00 pm	
Wednesday				
Thursday				
Friday	Normal	11.00 pm	7.00 am	
Saturday	Time and a half	11.00 pm	7.00 am	
Sunday	Double time	11.00 pm	7.00 am	

- 14 Copy and complete Brett's pay slip for the week.

Pay slip for: Brett SIMPSON	Week ending 15 September
Normal hours	
Normal pay rate	\$16.80
Time-and-a-half hours	
Time-and-a-half pay rate	
Double time hours	
Double time pay rate	
Gross pay	



REASONING

- 15 Calculate the following total weekly wages:
- a 38 hours at \$18.40 per hour, plus 2 hours at time and a half
 - b 32 hours at \$23.70 per hour plus 6 hours on a Sunday
 - c 38 hours at \$26.42 per hour, plus 2 hours overtime and 4 hours on a public holiday that incurred the maximum penalty rate.
- 16 Ruby earns \$979.64 for her normal 38-hour week, but last week she also worked 6 hours overtime at time-and-a-half rates.
- a Calculate how much extra she earned and give a possible reason for her getting time-and-a-half rates.
 - b What was Ruby's total wage?
- 17 **MC** A standard working week is 38 hours and a worker puts in 3 hours overtime at time-and-a-half and 2 hours at double time. To how many hours at the standard rate is her total work time equivalent?
- A 43 B $46\frac{1}{2}$ C $44\frac{1}{2}$ D 45

PROBLEM SOLVING

- 18 Glen works 32 hours per week at \$22/h and is paid overtime for any time worked over the 32 hours per week. In one week Glen worked 42 hours and was paid \$814. Overtime is paid at 1.5 times the standard wage. Was Glen paid the correct amount? (yes or no). If no, then provide the correct amount.
- 19 Joshua's basic wage is \$22 per hour. His overtime during the week is paid at time and a half. Over the weekend he is paid double time. Calculate his gross wage in a week when he works his basic 40 hours, together with 1 hour overtime on Monday, 2 hours overtime on Wednesday and 4 hours overtime on Saturday.
- 20 The table below shows the pay sheet for a small company. If a person works up to 36 hours, the regular pay is \$14.50 per hour.
For hours over 36 and up to 40, the overtime is time and a half.
For hours over 40, the overtime is double time.
Complete the table below.

	Hours worked	Regular pay	Overtime pay	Total pay
a	32			
b	38.5			
c	40.5			
d	47.2			

- 21** Vicki is a supervisor at a local factory. Each fortnight she calculates the wages of the employees. Overtime is paid to any employee who works more than 35 hours each week. The overtime rate is $1\frac{1}{2}$ times the hourly rate. The table below shows the number of hours worked and the hourly rates for three employees for one fortnight.

Employee	Hours worked	Hourly rate
Stewart	72	\$12.75
Helen	56	\$19.80
Amber	x	\$21.50

- Determine the total amount, in dollars, in wages for Helen and Stewart. Write your answer to the nearest cent.
- Amber worked for x hours including some overtime. Her fortnightly wage was \$1988.75.
 - Determine the number of hours she worked.
 - Was it possible for Amber to earn this amount if she did not do any overtime?
- Tax is charged at 45 cents in each dollar earned. Determine the amount of tax, in dollars, Amber pays for the fortnight. Write your answer correct to the nearest cent.

11.4 Piecework

- Piecework** is a system of payment by which a worker is paid a fixed amount for each job or task they complete.

WORKED EXAMPLE 5

Mitchell has a job washing cars in a car yard. He is paid \$5.20 per car washed. Calculate the amount Mitchell earns in an afternoon when he washes 24 cars.

THINK

- Multiply the number of cars Mitchell washes by the amount paid for each car.
- Write the answer in a sentence.

WRITE

$$\begin{aligned}\text{Amount earned} &= 24 \times 5.20 \\ &= 124.80\end{aligned}$$

Mitchell earns \$124.80.

- A person may also be paid on a sliding scale where the pay rate increases as the number of completed tasks increases.

WORKED EXAMPLE 6

Angelica is a machinist in a clothing factory. Each week she is paid \$4.28 per garment for the first 180 garments, and \$5.35 per garment thereafter. What will she be paid if she produces 223 garments?

**THINK**

- 1 Calculate the number of 'extra' garments Angelica makes.
- 2 Calculate her total payment by adding the payment she receives for the first 180 garments to the payment she receives for the extra garments.
- 3 Write the answer in a sentence.

WRITE

$$\begin{aligned}\text{Extra garments} &= 223 - 180 \\ &= 43\end{aligned}$$

$$\begin{aligned}\text{Payment} &= 180 \times 4.28 + 43 \times 5.35 \\ &= 1000.45\end{aligned}$$

Angelica earns a total payment of \$1000.45.

- In some cases, piecework is paid for multiple rather than single units. For example, for letterbox deliveries you may be paid per 1000 deliveries made.

WORKED EXAMPLE 7

Holly is delivering brochures to letterboxes in her local area. She is paid \$43.00 per 1000 brochures delivered. Calculate the amount Holly will earn for a delivery of 3500 brochures.

THINK

- 1 Calculate the number of thousands of brochures Holly will deliver.
- 2 Multiply the number of thousands of brochures delivered by 43 to calculate what Holly will earn.
- 3 Write the answer in a sentence.

WRITE

$$3500 \div 1000 = 3.5$$

So Holly will deliver 3.5 thousand brochures.

$$\begin{aligned}\text{Holly's pay} &= 3.5 \times 43.00 \\ &= 150.50\end{aligned}$$

Holly will earn \$150.50.



Exercise 11.4 Piecework

INDIVIDUAL PATHWAYS

REFLECTION

What are the advantages and disadvantages of being paid by piecework?

PRACTISE

Questions:
1–5, 7

CONSOLIDATE

Questions:
1–5, 6, 7, 9

MASTER

Questions:
1, 2, 4, 6–11

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FLUENCY

- 1 **WE5** Hitani is paid 65 cents for each teacup she decorates. How much is she paid for decorating 150 teacups?
- 2 **WE6** Jack makes leather belts. The piece rate is \$1.25 each for the first 50 belts and \$1.50 thereafter. What is his income for a day in which he produces 68 belts?
- 3 A production-line worker is paid \$1.50 for each of the first 75 toasters assembled, then \$1.80 per toaster thereafter. How much does she earn on a day in which she assembles 110 toasters?
- 4 **WE7** Rudolf earns \$42.50 per 1000 leaflets delivered to letterboxes. Calculate what Rudolf will earn for a week in which he delivers 7500 leaflets.

UNDERSTANDING

- 5 Dimitri earns \$7.20 for each box of fruit picked.
 - a How much does he make for picking 20 boxes?
 - b How many boxes must he pick to earn at least \$200?
 - c If he takes 4 hours to pick 12 boxes, what is his hourly rate of pay?
- 6 Pauline uses her home computer for word processing under contract to an agency. She is paid \$3 per page for the first 50 pages, \$4 per page from 51 to 100 pages, and \$5 per page thereafter. Calculate her total pay for a period in which she prepares:
 - a 48 pages
 - b 67 pages
 - c 123 pages.



REASONING

- 7 Rani delivers bills to letterboxes and is paid \$43 per thousand.
 - a How much does she earn for delivering 2500 items?
 - b How many thousand must she deliver to earn \$1000?
 - c If she takes 6 hours to deliver each thousand on average, what is her hourly rate of pay?

- 8 Georgio delivers pizzas. He is paid \$3 per delivery from 5 pm to 9 pm and \$4 per delivery after 9 pm.
- How much does he earn on a night in which he makes 12 deliveries by 9 pm and 4 deliveries between 9 pm and 10.30 pm?
 - What are his average earnings per hour if he has worked from 5 pm to 10.30 pm?



PROBLEM SOLVING

- 9 A shoemaker is paid \$5.95 for each pair of running shoes he can make.
- If the shoemaker made 235 pairs of shoes last week, what was the amount paid?
 - The shoemaker is offered a bonus of 5% if he can make more than 250 pairs of shoes in a week. If he makes 251 pairs, what is the total amount earned, including the bonus?
- 10 A secretarial assistant gets paid \$12 per page that she types. If she manages to type more than 20 pages in a day, she gets a 10% bonus. If a typist typed 32 pages on Tuesday, how much did she earn?
- 11 There are both fixed and variable costs associated with some products. Consider the cost of importing a radio from China and selling it in Australia. The costs are:
- import of product \$12.50 per unit
 - transportation costs \$400 per 1000 units
 - warehouse rental space \$1 per unit per month
 - advertising costs \$2000 per month (fixed cost).
- If this company imports and sells 500 units per month, what is the total cost per month?
 - At 500 units per month and a selling price of \$25.00, what is the total profit per month?

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11.5 Commission and royalties

- Commission** is a method of payment used mainly for salespeople. The commission paid is usually calculated as a percentage of the value of goods sold.
- A **royalty** is a payment made to a person who owns a copyright. For example, a musician who writes a piece of music is paid a royalty on CD and online sales. An author who writes a book is also paid a royalty based on the number of books sold. Royalties are calculated as a percentage of sales.

WORKED EXAMPLE 8

Mohamad is a songwriter who is paid a royalty of 12% on all sales of his music. Calculate the royalty that Mohamad earns if a song he writes sells CDs to the value of \$150 000.



THINK

- Find the royalty by calculating 12% of \$150 000.
- Write the answer in a sentence.

WRITE

$$\begin{aligned}\text{Royalty} &= 12\% \text{ of } 150\,000 \\ &= 0.12 \times 150\,000 \\ &= 18\,000\end{aligned}$$

Mohamad earns \$18 000 in royalties.

- Sometimes a salesman is paid a small wage, called a retainer, plus a percentage of the value of the goods sold.

WORKED EXAMPLE 9

Gemma, a car salesperson is paid a retainer of \$350 per week, plus a commission of 8% of the profits made by the company on cars that she sells.

- a** How much does Gemma earn in a week when no sales are made?
b How much does she earn in a week when \$5000 profit was generated by her sales?

THINK

- a** If no sales are made, only the retainer is paid.
b **1** Find the commission paid by calculating 8% of \$5000.
2 Find the total amount paid by adding the retainer and the commission.
3 Write the answer in a sentence.

WRITE

- a** Gemma earns \$350.
b $\text{Commission} = 8\% \text{ of } 5000$
 $= 0.08 \times 5000$
 $= \$400$
 $\text{Total earnings} = 350 + 400$
 $= \$750$
 Gemma earns \$750.

- Sometimes the commission is broken into several parts with differing rates.

WORKED EXAMPLE 10

A real estate agency receives 2% commission on the first \$300 000 of a sale and 3% on the remainder. How much commission is received on the sale of a \$380 000 property?

THINK

- 1** Calculate the difference between \$380 000 and \$300 000.
2 Calculate 2% of \$300 000.
3 Calculate 3% of \$80 000.
4 Calculate the total commission by adding the commission earned on \$300 000 and the commission earned on \$80 000.
5 Write the answer in a sentence.

WRITE

- $380\,000 - 300\,000 = 80\,000$
 $2\% \text{ of } 300\,000 = 6000$
 $3\% \text{ of } 80\,000 = 2400$
 $6000 + 2400 = 8400$
 The commission received is \$8400.



Exercise 11.5 Commission and royalties

INDIVIDUAL PATHWAYS

PRACTISE

Questions:
1–5, 7, 11

CONSOLIDATE

Questions:
1–4, 6, 7, 10, 11, 13

MASTER

Questions:
1, 3, 4, 5c, 6d, 7, 8, 9b,
10b, 11–16

REFLECTION

What are the major advantages and disadvantages of each method of getting paid?

FLUENCY

- 1 **WE8** Danyang is a writer who is paid a royalty of 10% on all sales. Calculate the royalty she earns in a year if a book she writes sells copies to the value of \$30 000.
- 2 A home-improvements company pays commission at the rate of 16% on all sales. What would a person earn who had sales to the value of:
 - a \$8000
 - b \$6972.50?
- 3 Linda is a car salesperson who is paid a 1.5% commission on her sales. Calculate the amount of money Linda earns in a week where her sales total \$95 000.
- 4 **WE9** Gordon is paid a retainer of \$200 per week plus a commission of 6% of the profits made by the company on the goods that he sells.
 - a How much does Gordon earn in a week when no sales are made?
 - b How much does Gordon earn in a week during which a \$70 000 profit was generated by his sales?
- 5 Alfonso gets a retainer of \$235 per week plus a commission of $5\frac{1}{2}\%$ on sales. What are his total earnings in a week in which his sales are:
 - a \$1000
 - b \$4500
 - c \$17 384?

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Converting a percentage into a decimal
doc-10856
SkillSHEET
Finding a percentage of a quantity (money)
doc-10857
Spreadsheet
Converting percentages to fractions or decimals
doc-10905
Spreadsheet
Finding a percentage of an amount
doc-10906

UNDERSTANDING

- 6 Bryce is an author. His publisher pays him a fixed allowance of \$500 per month, plus $4\frac{1}{2}\%$ royalty on sales. What would be his income for a month in which his book sales totalled:
 - a \$0
 - b \$2000
 - c \$15 000
 - d \$23 750?



- 7 **WE10** A real estate agency receives 2% commission on the first \$250 000 of a sale and 4% on the rest. How much commission is received on the sale of a \$370 000 property?
- 8 At a second real estate agency, the commission rate is 5% on the first \$180 000 of sale price and 2% on the remainder. Find the commission on the sale of the \$370 000 property.
- 9 Ingrid's real estate agency pays her 1% commission on the first \$500 000 of sale price, then 4% thereafter. How much commission would she receive on the sale of a property worth:
 - a \$480 000
 - b \$510 000
 - c \$735 000?
- 10 Yanu works for a boat broker who pays him 6% of the first \$50 000 of the sale price, then $3\frac{3}{4}\%$ on the rest. Calculate the commission he receives on the following sales.
 - a \$40 000
 - b \$70 000
 - c \$395 000

REASONING

- 11 Veronica earns \$400 per week plus 4% on sales, whereas Francis earns 6% commission only.
 - a How much does each earn on sales of \$8400?
 - b What level of sales would yield each the same income?

- 12** Wolfgang, a car salesman, is paid a weekly retainer of \$550, plus 10% of the dealer's profit on each vehicle. Find his total income for weeks in which the dealer's profits on vehicles he sold were:
- a** \$3500
 - b** \$5980
 - c** \$7036.00
- 13** Using the commission table for house sales below, calculate the commission on each of the following sales.

Sale price	Commission	Plus
Between \$0 and \$80 000	2% of sale price	0
Between \$80 001 and \$140 000	1.5% of amount over \$80 000	\$1600 (2% of \$80 000)
\$140 000 and over	1.1% of amount over \$140 000	\$2500 (2% of \$80 000 + 1.5% of \$60 000)

- a** \$76 000
 - b** \$122 500
 - c** \$145 000
 - d** \$600 000
- 14** Mr Hartney is a used car salesman. He receives a basic monthly salary of \$2400 together with 5% commission on all sales. Although his sales for the month amounted to \$48 300 he also had deductions for insurance (\$12.80), association fees (\$25.70) and income tax (\$1100). Calculate the amount, in dollars, he took home that month.
- 15** A rock musician makes a royalty on all record sales according to the following formula.

Sales from	Sales to	Royalty rate
0	\$100 000	3%
\$100 001	\$500 000	3.5% on amount over \$100 000
\$500 001	1 million	4% on amount over \$500 000
1 million	and above	5% on amount over 1 million

Calculate the royalties for the following years:

- a** 2007 — sales = \$456 000
 - b** 2008 — sales = \$1 234 500
 - c** 2009 — sales = \$986 400
 - d** 2010 — sales = \$2 656 000.
- 16** Four years ago Inka became an employee of TrakRight Tourism where her starting annual salary was \$55 600. After her first year, she received a 2% pay rise. The next year she received a 3% pay rise. Last year she received an $x\%$ pay rise. If her annual salary is now \$61 042, determine the value of x , correct to one decimal place.

11.6 Loadings and bonuses

Loadings

- If a wage or salary earner has to work in difficult or hazardous conditions, then the worker may be granted an extra payment or **loading**.
- Most workers are granted a 'holiday loading'. For a 4-week period each year they are paid an extra 17.5% of their usual wage.



WORKED EXAMPLE 11

Rohan works as an electrician and receives \$38.20 per hour for a 36-hour working week. If Rohan works 'at heights' he receives \$2.50 per hour height loading. Calculate Rohan's wage in a week where he works 15 hours at heights.

THINK

- 1 Calculate Rohan's normal weekly wage.
- 2 Calculate Rohan's loading for the time he worked at heights.
- 3 Calculate Rohan's total wage.

WRITE

$$\begin{aligned}\text{Normal wage} &= 36 \times 38.20 \\ &= \$1375.20\end{aligned}$$

$$\begin{aligned}\text{Loading} &= 15 \times 2.5 \\ &= \$37.50\end{aligned}$$

$$\begin{aligned}\text{Total wage} &= 1375.20 + 37.50 \\ &= \$1412.70\end{aligned}$$

WORKED EXAMPLE 12

Jelena works as a hairdresser and is paid a normal rate of \$19.70 per hour for a 38-hour working week.

- a Calculate Jelena's normal weekly wage.
- b For her 4 weeks annual leave, Jelena is paid a loading of 17.5%. Calculate the amount that Jelena receives in holiday loading.
- c Calculate the total amount that Jelena receives for her 4 weeks annual leave.

THINK

- a Calculate Jelena's normal wage by multiplying the hours worked by the hourly rate.
- b 1 Find 17.5% of Jelena's normal wage.

WRITE

$$\begin{aligned}\text{a Normal wage} &= 38 \times 19.70 \\ &= \$748.60\end{aligned}$$

$$\text{b } 17.5\% \text{ of } \$748.60 = \$131.01$$



- 2 Multiply this amount by 4 to find the holiday loading.
- c Find the total amount received by multiplying Jelena's normal weekly pay by 4 and adding the holiday loading.

$$\begin{aligned}\text{Holiday loading} &= 4 \times 131.01 \\ &= \$524.04\end{aligned}$$

$$\begin{aligned}\text{c Holiday pay} &= 4 \times 748.60 + 524.04 \\ &= \$3518.44\end{aligned}$$

Bonuses

- Many people who are employed in managerial positions receive a bonus if the company achieves certain performance targets. The bonus may be a percentage of their annual salary or a percentage of the company's profits.

WORKED EXAMPLE 13

Brooke is the Chief Executive Officer of a fashion company on a salary of \$240 000 per year. Brooke will receive a bonus of 1% of her salary for every percentage point that she increases the company profit. If the company profit grows from \$3.1 million to \$4.4 million in one year, calculate the amount of Brooke's bonus.

THINK

- 1 Calculate the increase in profit.
- 2 Express the increase in profit as a percentage.
- 3 Calculate this percentage of Brooke's annual salary.
- 4 Write the answer in a sentence.

WRITE

$$\begin{aligned}\text{Increase in profit} &= \$4.4\text{m} - \$3.1\text{m} \\ &= \$1.3\text{m}\end{aligned}$$

$$\begin{aligned}\text{Percentage increase} &= \frac{1.3}{3.1} \times 100\% \\ &= 41.9\%\end{aligned}$$

$$\begin{aligned}\text{Bonus} &= 41.9\% \text{ of } \$240\,000 \\ &= \$100\,560\end{aligned}$$

$$\text{Brooke's bonus is } \$100\,560.$$

assessment

Exercise 11.6 Loadings and bonuses

INDIVIDUAL PATHWAYS

PRACTISE

Questions:
1, 3, 4, 7, 9, 10

CONSOLIDATE

Questions:
1, 2, 4, 5, 8–13

MASTER

Questions:
1, 2, 4, 6–15

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REFLECTION

How are bonuses used to encourage workers?

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Digital doc

SkillsSHEET

Expressing one quantity as a percentage of another

doc-10858

FLUENCY

- 1 **WE11** Rashid works as an electrician and receives \$35.40 per hour for a 35-hour working week. If Rashid works at heights he receives a height loading of \$0.32 per hour. Calculate Rashid's wage in a week where he works 18 hours at heights.

- 2** Patrick is a railway linesman. If he works in wet weather he is paid a loading of 43 cents per hour. If he normally works a 38-hour working week at \$21.02 per hour and 16 hours are spent working in wet weather, find Patrick's pay for the week.

- 3** Saci is an industrial cleaner and is paid at the rate of \$19.82 per hour. If Saci works in a confined space, she is paid a loading of \$0.58 per hour. Calculate Saci's pay for a week in which she works 38 hours where 19 of those hours were in a confined space.



- 4** **WE12** Jordan works as the manager of a supermarket and is paid a normal rate of \$37.60 per hour for a 38-hour working week.

- a** Calculate Jordan's normal weekly wage.
- b** For her 4 weeks annual leave, Jordan is paid a loading of 17.5%. Calculate the amount that Jordan receives in holiday loading.
- c** Calculate the total amount that Jordan receives for her 4 weeks annual leave.

- 5** Charlie earns \$22.80 per hour for a 38-hour week.

- a** Calculate the amount Charlie will earn in a normal working week.
- b** Calculate the total amount Charlie will receive for his 4 weeks annual leave if he receives a 17.5% holiday loading.

- 6** Liam is paid \$15.95 per hour for a 36-hour working week.

- a** Calculate Liam's weekly wage.
- b** Liam takes one week's holiday for which he is given a 17.5% loading. Calculate the holiday loading.

- 7** Karen receives an annual salary of \$63 212.

- a** What is her fortnightly pay?
- b** What is she paid for her annual 4-week holiday, for which she receives an extra 17.5% loading?

UNDERSTANDING

- 8** Brian earns \$956.46 for a standard 38-hour week and a \$27.53 per week allowance for working on scaffolding. Calculate his total pay for a week in which he works on scaffolding and does 4 hours overtime at time-and-a-half.

- 9** **WE13** Eric is a director of a mining company on a salary of \$380 000 per year. Eric is told that at the end of the year he will receive a bonus of 1% of his salary for every percentage point that he increases the company profit. If the company profit grows from \$4.9m to \$6.4m in one year, calculate the amount of Eric's bonus.



REASONING

- 10** Sally is the manager of a small bakery that employs 12 people. As an incentive to her workers she agrees to pay 15% of the business's profits in Christmas bonuses for her employees. The business makes a profit of \$400 000 during the year.
- Find the total amount that Sally pays in bonuses.
 - If the bonus is shared equally what amount does each employee receive as a Christmas bonus?
 - If one employee earns \$42 000 per year, calculate the Christmas bonus as a percentage of annual earnings. Explain your answer.
- 11** Shane, the director of an exercise company, earns a salary of \$275 000 a year. Shane gets paid incentives if he is able to increase the company's profit. He gets:
- 5% if he increases the profit by 0.1–10%.
 - 7.5% if he increases the profit by 10.1–20%.
 - 10% if he increases the profit by more than 20%.
- If the company's profit grows from \$1.2 million to \$1.4 million in a year:
- explain what percentage incentive Shane will get and why
 - calculate his salary for the year.

PROBLEM SOLVING

- 12** Kevin owns a sports store and has 7 staff working for him. He offers each of them a 5.5% end-of-year bonus on any profits over \$100 000. This year the store made a profit of \$275 000.
- Find the amount each employee earned in bonuses.
 - What is the cost to Kevin in total bonuses for the year?
 - If one employee earned \$64 625 including bonuses for the year, what was their base salary p.a.?
- 13** Jimmy is a high-rise window cleaner. He gets paid \$15 per window for the first five levels. For the next 15 levels he gets an extra 15% per window, and above this he gets 20% extra as danger money. How much does Jimmy earn for cleaning:
- a total of 20 windows on levels 3 to 4
 - 10 windows on levels 4 and a total of 27 windows on levels 10 to 13
 - a total of 30 windows on levels 11 to 14 and a total of 30 windows on levels 21 to 25?
- 14** Denise works for a real estate agent. She receives a basic wage of \$250 per week plus commission on sales. The rate of commission is variable. For houses up to \$300 000, the commission is 0.5%. For houses over \$300 000, the commission is an additional 0.25% on the amount over \$300 000. How much pay did she receive in the week she sold a house for:
- \$280 000
 - \$428 000?
- 15** When Jack goes on holidays, he is paid $17\frac{1}{2}\%$ holiday loading in addition to his normal pay. When he went on 2 weeks' leave, his holiday pay was \$1504. What is his normal weekly pay?



11.7 Taxation and net earnings

- In Australia, people who earn more than \$18 200 in a financial year must pay a percentage of their earnings as **income tax**.
- The rates of taxation for Australian residents for 2014–15 are shown in the table below.

Taxable income	Tax on this income
0–\$18 200	Nil
\$18 201–\$37 000	19c for each \$1 over \$18 200
\$37 001–\$80 000	\$3572 plus 32.5c for each \$1 over \$37 000
\$80 001–\$180 000	\$17 547 plus 37c for each \$1 over \$80 000
\$180 001 and over	\$54 547 plus 45c for each \$1 over \$180 000



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The above rates do not include the Medicare levy of 2.0%.

WORKED EXAMPLE 14

Find the amount of tax paid on an annual income of:

- a** \$22 000 **b** \$92 000.

THINK

WRITE

- a**
- \$22 000 is in the \$18 201 to \$37 000 bracket.
 - The tax payable is 19c (0.19) for every dollar over \$18 200.
 - Calculate the amount over \$18 200 by subtracting \$18 200 from \$22 000.
 - Apply the rule '19c for every dollar over \$18 200'.
 - Write the answer in a sentence.
- b**
- \$92 000 is in the \$80 001 to \$180 000 bracket.
 - Calculate the amount over \$80 000 by subtracting \$80 001 from \$92 000.
 - Apply the rule '\$17 547 plus 37c for each \$1 over \$80 000'.
 - Write the answer in a sentence.

- a**
- $$\$22\,000 - \$18\,200 = \$3800$$
- $$\text{Tax payable} = 0.19 \times 3800 = 722$$
- The tax payable on \$22 000 is \$722.
- b**
- $$\$92\,000 - \$80\,000 = \$12\,000$$
- $$\text{Income tax} = 17\,547 + 0.37 \times 12\,000 = 21\,987$$
- The tax payable on \$92 000 is \$21 987.

Medicare levy

- Medicare is the scheme that gives Australian residents access to health care.
- Most taxpayers pay 2.0% of their taxable income to pay for this scheme. This is called the Medicare levy.
- People who have private medical insurance can reclaim some of this money.

Pay As You Go (PAYG) taxation

- When you receive a pay cheque, some of the money has been taken out by the employer to cover your income tax and Medicare levy. This is called 'pay as you go' (PAYG) taxation.
- The initial amount, before tax is taken out, is called your **gross salary** and the amount that you actually receive is called your **net salary**.
- The amount of money to be deducted by the employer each week is published by the Australian Tax Office, as shown in the following table.

PAYG TABLE: Weekly tax withheld (\$)					
Gross wage	With tax-free threshold	Gross wage	With tax-free threshold	Gross wage	With tax-free threshold
450	24	950	165	1450	339
500	38	1000	183	1500	356
550	48	1050	200	1550	374
600	59	1100	217	1600	393
650	69	1150	235	1650	413
700	80	1200	252	1700	432
750	96	1250	270	1750	452
800	113	1300	287	1800	471
850	130	1350	304	1850	491
900	148	1400	321	1900	510

Note: Most Australian citizens qualify for the tax-free threshold. For the purposes of this section, apply the tax-free threshold values.

Deductions

- Often other sums of money, such as union fees and private health insurance, are deducted from gross pay.

Family Tax Benefit

- When a family has young or dependent children, the government may pay an allowance called the 'Family Tax Benefit', which is added to a person's gross salary.



WORKED EXAMPLE 15

Fiona has a gross wage of \$900 per week.

- a Use the PAYG table to find the amount of tax that should be deducted.
- b What percentage of her gross pay is deducted?
- c If Fiona receives \$98 in family allowance but has deductions of \$71 (superannuation) and \$5.50 (union fee), what is her net pay?



THINK

- a From the table, PAYG tax payable on a gross wage of \$900 per week is \$148.
- b Find 148 as a percentage of 900.
- c
 - 1 Fiona receives \$98 in family allowance. Add this to her gross weekly wage to find her total income.
 - 2 Calculate her total deductions.
 - 3 Calculate her net pay by subtracting her total deductions from her total income.

WRITE

- a \$148
- b $\frac{148}{900} \times 100 = 16.44\%$ deducted
- c Total income = $900 + 98$
= \$998

Total deductions = $148 + 71 + 5.50$
= \$224.50

Net pay = $998 - 224.50$
= \$773.50

Exercise 11.7 Taxation and net earnings

assessment

INDIVIDUAL PATHWAYS

PRACTISE

Questions:
1–10

CONSOLIDATE

Questions:
1–11

MASTER

Questions:
1–11

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REFLECTION

What strategies would you use to remember how to calculate income tax?

FLUENCY

- 1 **WE14** Find the amount of tax paid on an annual income of:
 - a \$15 000
 - b \$22 000
 - c \$44 000
 - d \$88 000.
- 2 **WE15** In the PAYG a tax table, look up the amount of tax that must be deducted from the following weekly earnings and find this as a percentage of the gross pay.
 - a \$650
 - b \$1100
 - c \$1550
- 3 For each of the following, calculate the net pay.
 - a Gross pay \$450.00, tax \$24.00 and union fees \$4.75
 - b Gross pay \$550.00, tax \$48.00, private health insurance \$25.85 and superannuation \$53.80
 - c Gross pay \$850.00, tax \$130.00, loan repayment \$160.00 and insurance payment \$45.40

- 4 Calculate the net annual salary of a person who has a gross annual salary of \$57 200 with deductions of \$17 264 for tax, annual union fees of \$262.75, social club payments of \$104.00, and a family allowance of \$4392.20.
- 5 Sergio works as a security guard and receives gross pay of \$950.00 each week. His tax totals \$165 per week. If his other deductions are \$60.10 for superannuation and \$5.05 for union fees, what is his net pay?

UNDERSTANDING

- 6 Lieng works as an interior decorator and earns \$1350 per week.
 - a How much tax should be deducted from her pay each week?
 - b What percentage of her gross pay is her tax?
 - c If Lieng also has deductions of \$105 for superannuation, \$5.20 for union fees, and \$4.00 for a social club, what is her net weekly pay?

REASONING

- 7 Yelena works as a chef and is paid \$22.86 per hour and works a 35-hour week.
 - a Calculate Yelena's gross weekly earnings.
 - b How much tax should be deducted from Yelena's pay?
 - c What percentage of her gross pay is deducted in tax?
 - d If Yelena also has deductions of \$56.20 for superannuation and \$22.50 for her health insurance, and gets \$60.00 taken out to pay off her car loan, what is her net pay?
 - e What percentage of her gross pay is her net pay?
- 8 Debbie earns \$72 000 per year.
 - a Explain why she takes home only \$57 053.
 - b Give reasons why this figure could possibly be different again.



PROBLEM SOLVING

- 9 Jacko works at an IT firm and earns \$1725 a week.
 - a How much does he earn a year, gross?
 - b How much tax will he need to pay per year?
 - c If he has no deductions, how much will he need to pay for the Medicare levy?
- 10 Tamara works as a swimming instructor and earns \$21.50 per hour when working a 38-hour week.
 - a Using the PAYG table, find the amount of tax that should be deducted from Tamara's salary per week, correct to the nearest dollar.
 - b What percentage of her gross salary is deducted? Give your answer to one decimal place.
 - c If Tamara receives \$82 per week in family allowance but pays \$50 per week towards her superannuation, what is her net weekly pay?

11.8 Simple interest

- **Interest** is the fee charged for the use of someone else's money. It is normally a percentage of the amount borrowed.
- Lenders or investors receive interest from banks for lending them money.
- Borrowers pay interest to banks and other financial institutions.
- **Simple interest** or 'flat rate' interest can be calculated using a simple formula:

$$I = PRN$$

where I = the amount of interest to be paid

P = the principal, which is the amount of money borrowed

R = the interest rate, usually given as a percentage

N = the number of times that the interest must be paid.

- The abbreviation p.a. stands for 'per annum', which means 'each year'. For example, an interest rate of 5% p.a. for 4 years means that $R = 5\%$ (or 0.05) and $N = 4$.

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Interactivity
Effects of P , R , I and t
int-0745

WORKED EXAMPLE 16

Zac borrows \$3000 for 2 years at 9% p.a. simple interest.

a How much interest is he charged?

b What total amount must he repay?

THINK

- a 1** Write the simple interest formula, and the known values of the variables.

- 2** Substitute the values into the formula to find I .

- 3** Write the answer in a sentence.

- b 1** Repayment = amount borrowed + interest.

- 2** Write the answer in a sentence.

WRITE

a $I = PRN$, $P = 3000$, $R = 9\% = 0.09$, $N = 2$

$$I = 3000 \times 0.09 \times 2 \\ = \$540$$

Zac is charged \$540 interest.

b $3000 + 540 = 3540$

Zac must repay \$3540 in total.

- Care needs to be taken with examples where the term of the investment is given in months or even in days. In these examples, the period of the investment needs to be expressed in years.
- The simple interest formula can also be used to find the principal, interest rate or the term of the investment by substituting the known values into the formula, and solving the resulting equation.

WORKED EXAMPLE 17

Anthony invested \$1000 at a simple interest rate of 4.6% p. a. For how long must he invest it in order to earn at least \$100 in interest?

THINK

- 1** Write the formula and the known values of the variables.

- 2** Substitute the given values into the formula.

- 3** Solve the equation.

WRITE

$I = PRN$, where $I = 100$, $P = 1000$,
 $R = 4.6\% = 0.046$

$$100 = 1000 \times 0.046 \times N$$

$$100 = 46N$$

$$N = \frac{100}{46} \\ \approx 2.1739$$



- 4 Change the decimal part of the years into months. $0.1739 \times 12 = 2.09$ months
- 5 Write the answer in a sentence using years and months. Anthony must invest for 2 years and 2 months.

- The same method is used when R or P are to be found.

WORKED EXAMPLE 18

The Smiths need to buy a new refrigerator at a cost of \$1679. They will pay a deposit of \$200 and borrow the balance at an interest rate of 19.5% p.a. The loan will be paid off with 24 equal monthly payments.

- a** How much money do the Smiths need to borrow?
b What is the term of the loan?
c How much interest will they pay?
d What will be the total cost of the refrigerator?
e How much is each payment?



THINK

- a** 1 Subtract the deposit from the cost to find the amount still owing.
 2 Write the answer in a sentence.
- b** The term is 24 months as this is the length of time between borrowing and paying back. The interest rate is per year.
- c** 1 Identify the principal (P), interest rate (R) and time period (N), and use the formula.
 2 Write the answer in a sentence.
- d** Add the interest to the initial cost.
- e** 1 Subtract the deposit from the total cost to find the amount to be repaid.
 2 Divide the total payment into 24 equal payments.
 3 Write the answer in a sentence.

WRITE

- a** $1679 - 200 = 1479$
 They must borrow \$1479.
- b** 24 months is 2 years. The term is 2 years.
- c** $P = 1479, R = \frac{19.5}{100} = 0.195, N = 2$
 $I = PRN$
 $= 1479 \times 0.195 \times 2$
 $= 576.81$
 The interest will be \$576.81.
- d** $1679.00 + 576.81 = 2255.81$
 The total cost will be \$2255.81.
- e** $2255.81 - 200 = 2055.81$
 $2055.81 \div 24 = 85.66$
 Each payment will be \$85.66.

- Spreadsheets are often used to make simple interest calculations easier.

Developing a simple interest spreadsheet

- The spreadsheet below calculates the total amount of simple interest for a given number of years.

	A	B	C	D	E	F
1						
2		Principal	1000			
3		Interest rate (per year)	5			
4		Time (years)	6			
5						
6		<i>Year</i>	<i>Principal</i>	<i>Interest</i>	<i>New value</i>	
7		1	1000	50	1050	
8		2	1000	50	1100	
9		3	1000	50	1150	
10		4	1000	50	1200	
11		5	1000	50	1250	
12		6	1000	50	1300	
13						

- Inputs (yellow cells)
 - Cell D2: the amount of principal. Above, the principal is \$1000.
 - Cell D3: the interest rate, as a percentage. Above, the interest rate is 5%.
 - Cell D4: the term. Above, the term is 6 years.
- Outputs (Row 7 and beyond)
 - Column B: shows the years: 1, 2, 3, ... 6
 - Column C: shows the principal each year. Set C7 = \$D\$2 and fill down.
 - Column D: shows the interest calculation. Set D7 = C7*\$D\$3/100 and fill down.
 - Cell E7: Shows the new value after year 1. Set E7 = C7 + D7.
 - Cell E8: Shows the new value after year 2. Set E8 = E7 + D8 and fill down.
- For time periods greater than 6 years, highlight Row 12's cells and fill down.

Exercise 11.8 Simple interest

assess on

INDIVIDUAL PATHWAYS

PRACTISE

Questions:
1, 3–5, 7, 8, 10, 11, 14

CONSOLIDATE

Questions:
1, 2, 6–10, 12, 14–16

MASTER

Questions:
1, 3, 5, 7, 9–18

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REFLECTION

How does interest affect the way we live?

FLUENCY

- WE16** Monique borrows \$5000 for 3 years at 8% per annum simple interest.
 - How much interest is she charged?
 - What total amount must she repay?

- 2 Calculate the simple interest earned on an investment of \$15 000 at 5.2% p.a. over 30 months.
- 3 For each loan in the table, calculate:
- the simple interest
 - the amount repaid.

	Principal (\$)	Interest rate per annum	Time
a	1 000	5%	2 years
b	4 000	16%	3 years
c	8 000	4.5%	48 months
d	2 700	3.9%	2 years 6 months
e	15 678	9.2%	42 months

- 4 Find the *final value* of each of the following investments.
- \$3000 for 2 years at 5% p.a.
 - \$5000 for 3 years at 4.3% p.a.
- 5 Hasim borrows \$14 950 to buy a used car. The bank charges a 9.8% p.a. flat rate of interest over 60 months.
- What total amount must he repay?
 - How much is each equal monthly repayment?
- 6 Carla borrows \$5200 for an overseas trip at 8.9% p.a. simple interest over 30 months. If repayment is made in equal monthly instalments, how much is each instalment?



- 7 **WE17** Michael invested \$2000 at a simple interest rate of 4% p.a. For how long must he invest it in order to earn \$200 in interest?
- 8 If Jodie can invest her money at 8% p.a., how much does she need to invest to earn \$2000 in 2 years?
- 9 If the simple interest charged on a loan of \$9800 over 3 years is \$2352, what percentage rate of interest was charged?

- 10 Find the missing quantity in each row of the table.

	Principal	Rate of interest p.a.	Time	Interest earned
a	\$2 000	6%		\$240.00
b	\$3 760	5.8%		\$545.20
c		7%	3 years	\$126.00
d		4.9%	1 year 9 months	\$385.88
e	\$10 000		$1\frac{1}{2}$ years	\$1200.00
f	\$8 500		42 months	\$1041.25

UNDERSTANDING

- 11 **WE18** Mika is buying a used car priced at \$19 998. He has a deposit of \$3000 and will pay the balance in equal monthly payments over 4 years. The simple interest rate will be 12.9% p.a.
- How much money is he borrowing?
 - How much interest will he pay?
 - What will be the total cost of the car?
 - How many payments will he make?
 - How much is each payment?
- 12 A new sound system costs \$3500, but it can be purchased for no deposit, followed by 48 equal monthly payments, at a simple interest rate of 16.2% p.a.
- What will be the total cost of the sound system?
 - Under a 'no deposit, no payment for 2 years' scheme, 48 payments are still required, but the first payment isn't made for two years. (This will stretch the loan over 6 years.) How much will the system cost using this scheme?
 - What will be the monthly payment under each of the schemes above?



REASONING

- 13 A \$269 000 business is purchased on \$89 000 deposit with the balance payable over 5 years at 8.95% p.a. flat rate.
- How much money is borrowed to purchase this business?
 - How much interest is charged?
 - What total amount must be repaid?
 - Find the size of each of the equal monthly repayments, and explain two ways how these payments could be reduced.
- 14 If a bank offers interest on its savings account of 4.2% p.a. and the investment is invested for 9 months, explain why 4.2 is not substituted into the simple interest formula as the interest rate.

PROBLEM SOLVING

- 15 A Year 9 girl is paid \$79.50 in interest for an original investment of \$500 for 3 years. What is the annual interest rate?

- 16** A loan is an investment in reverse; you *borrow* money from a bank and are *charged* interest. The value of a loan becomes its total cost.

A worker wishes to borrow \$10 000 from a bank, which charges 11.5% interest per year. If the loan is over 2 years:

- a** calculate the total interest paid **b** calculate the total cost of the loan.
- 17** For the following question assume that the interest charged on a home loan is simple interest.
- a** Tex and Molly purchase their first home and arrange for a home loan of \$375 000. Their home loan interest rate rises 0.25% per annum within the first 6 months of the loan. Determine the monthly increase, in dollars, of their repayments.
- b** Brad and Angel's interest on their home loan is also increased by 0.25% per annum. Their monthly repayments increase by \$60. Determine the amount of their loan, in dollars.
- 18 a** Theresa invests \$4500 at 5.72% per annum that attracts simple interest for 6 months. Show that at the end of 6 months she should expect to have \$4628.70.
- b** Barry has \$6273 in his bank account at a simple interest rate of 4.86% per annum. After 39 days he calculates that he will have \$6305.57 in his account. Did Barry calculate his interest correctly? Justify your answer by showing your calculations.
- c** Juanita receives \$10 984 for the sale of her car. She invests $x\%$ of \$10 984 in an account at 6.68% per annum simple interest for $1\frac{1}{2}$ years. She spends the remainder of the money from the sale of her car. At the end of the investment she has exactly enough money to purchase a car for \$11 002. Find the value of x , correct to 2 decimal places.

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Digital doc
WorkSHEET 11.2
doc-6246

11.9 Compound interest

- Consider \$1000 invested for 3 years at 10% p.a. simple interest.
- Each year the value of the investment increases by \$100, reaching a total value of \$1300.
- The simple interest process can be summarised in the following table.

	Principal	Interest	Total value
Year 1	\$1000	\$100	\$1100
Year 2	\$1000	\$100	\$1200
Year 3	\$1000	\$100	\$1300

Total interest = \$300

- Under the system called **compound interest**, the interest is added to the principal at the end of each year; in other words, it is *compounded* annually.
- The compound interest process can be summarised in this table.

	Principal	Interest	Total value
Year 1	\$1000	\$100	\$1100
Year 2	\$1100	\$110	\$1210
Year 3	\$1210	\$121	\$1331

Total interest = \$331

- The principal grows each year and so does the interest.
- Over many years, the difference between simple interest and compound interest can become enormous.

WORKED EXAMPLE 19

Complete the table to find the interest paid when \$5000 is invested at 11% p.a. compounded annually for 3 years.

	Principal	Interest	Total value
Year 1	\$5000		
Year 2			
Year 3			

Total interest =

THINK

- 1 Interest for year 1 = 11% of \$5000

Find the principal for year 2 by adding the interest to the year 1 principal.

- 2 Interest for year 2 = 11% of \$5550

Find the total value at the end of year 2. This is the principal for year 3.

- 3 Interest for year 3 = 11% of \$6160.50

- 4 Calculate the interest earned over 3 years by subtracting the year 1 principal from the final amount.

WRITE

$$11\% = \frac{11}{100} = 0.11$$

$$I = 0.11 \times 5000 = 550$$

$$5000 + 550 = 5550$$

$$0.11 \times 5550 = 610.50$$

$$5550 + 610.50 = 6160.50$$

$$0.11 \times 6160.50 = 677.66$$

$$6160.50 + 677.66 = 6838.16$$

$$6838.16 - 5000 = 1838.16$$

	Principal	Interest	Total value
Year 1	\$5000	\$550	\$5550
Year 2	\$5550	\$610.50	\$6160.50
Year 3	\$6160.50	\$677.66	\$6838.16

Total interest = \$1838.16

- There is a quicker way of finding the total value of the investment. Look again at Worked example 19. The investment grows by 11% each year, so its value at the end of the year is $111\% \left(\frac{111}{100} = 1.11 \right)$ of its value at the start of the year.

$$\begin{aligned} 111\% \text{ of } 5000 \\ &= 1.11 \times 5000 \\ &= 5550 \end{aligned}$$

- This process is repeated each year for 3 years.

$$5000 \xrightarrow{\times 1.11} 5550 \xrightarrow{\times 1.11} 6160.50 \xrightarrow{\times 1.11} 6838.16$$

- After 3 years the value of the investment is \$6838.16.

WORKED EXAMPLE 20

Complete the table to find the value, after 4 years, of an investment of \$2000 compounded annually at 8% p.a.

Year	Start of year	End of year
Year 1	\$2000	
Year 2		
Year 3		
Year 4		

THINK

- 1 Interest is compounded at 8%, so at the end of the first year the value is 108% of the initial value.
- 2 For the value at the end of year 2, calculate 108% of the amount accumulated in year 1, so find 108% of 2160.
- 3 For the value at the end of year 3, calculate 108% of the amount accumulated in year 2, so find 108% of 2332.80.
- 4 For the value at the end of year 4, calculate 108% of the amount accumulated in year 3, so find 108% of 2519.424.
- 5 Complete the table.

WRITE

$$108\% = \frac{108}{100} = 1.08$$

$$1.08 \times 2000 = 2160$$

$$1.08 \times 2160 = 2332.80$$

$$1.08 \times 2332.80 = 2519.424$$

$$1.08 \times 2519.424 = 2720.98$$

Year	Start of year	End of year
Year 1	\$2000	\$2160
Year 2	\$2160	\$2332.80
Year 3	\$2332.80	\$2519.42
Year 4	\$2519.42	\$2720.98

- The repeated multiplication above can be developed into a formula for compound interest.
- In Worked example 20 the principal (\$2000) was multiplied by 108% four times (because there were 4 years). The final amount, A , was given by

$$\begin{aligned}
 A &= 2000 \times 108\% \times 108\% \times 108\% \times 108\% \\
 &= 2000(108\%)^4 \\
 &= 2000(1 + 8\%)^4
 \end{aligned}$$

In general, $A = P(1 + R)^n$

where A = the final value of the investment

P = the principal

R = the interest rate

n = the number of investment periods.

WORKED EXAMPLE 21

a Find the final value of \$40 000 invested at 7.5% p.a. compounding annually for 8 years.

b How much interest is earned by the investment?

THINK

a 1 Write the compound interest formula.

2 Write the values of P , R (converting the percentage to a decimal) and n .

3 Substitute the values into the formula and calculate.

4 Write the answer in a sentence.

b Subtract the initial principal from the final value of the investment to find the interest earned.

WRITE

$$\mathbf{a} \quad A = P(1 + R)^n$$

$$P = 40\,000, R = 0.075, n = 8$$

$$A = 40\,000(1.075)^8 \\ = 71\,339.11$$

The value of the investment is \$71 339.11.

$$\mathbf{b} \quad 71\,339.11 - 40\,000 = 31\,339.11$$

The interest earned was \$31 339.11.

Exercise 11.9 Compound interest

assessment

INDIVIDUAL PATHWAYS

PRACTISE

Questions:
1–3, 7, 9, 11

CONSOLIDATE

Questions:
1–3, 5–7, 9–12

MASTER

Questions:
1–4, 7–14

Individual pathway interactivity int-4527 eBookplus

REFLECTION

Is compound interest 'fairer' than simple interest?

FLUENCY

1 WE19 Complete the tables to find the interest paid when:

a \$1000 is invested at 12% p.a. compounded annually for 3 years

	Principal	Interest	Total value
Year 1	\$1000		
Year 2			
Year 3			

Total interest =



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Digital doc
Spreadsheet
Simple and compound
interest
doc-10907

- b** \$100 000 is invested at 9% p.a. compounded annually for 4 years.

	Principal	Interest	Total value
Year 1	\$100 000		
Year 2			
Year 3			
Year 4			

Total interest =

- 2 WE20** Complete the tables to find the final value of each investment.

- a** \$5000 invested at 12% p.a. compounded annually for 3 years

	Start of year	End of year
Year 1	\$5000	
Year 2		
Year 3		

- b** \$200 000 invested at 7% p.a. compounded annually for 3 years

	Start of year	End of year
Year 1	\$200 000	
Year 2		
Year 3		

- c** \$100 000 invested at 8.5% p.a. compounded annually for 5 years

	Start of year	End of year
Year 1	\$100 000	
Year 2		
Year 3		
Year 4		
Year 5		

- d** \$12 000 invested at 15% p.a. compounded annually for 4 years

	Start of year	End of year
Year 1	\$12 000	
Year 2		
Year 3		
Year 4		

- 3 WE21** For each of the following investments, use the compound interest formula to find:
- i** the total value **ii** the amount of interest paid.
- a** \$8000 is invested for 8 years at 15% p.a. interest compounding annually.
- b** \$50 000 is invested for 4 years at 6% p.a. interest compounding annually.
- c** \$72 000 is invested for 3 years at 7.8% p.a. interest compounding annually.
- d** \$150 000 is invested for 7 years at 6.3% p.a. interest compounding annually.
- e** \$3500 is invested for 20 years at 15% p.a. interest compounding annually.
- f** \$21 000 is invested for 10 years at 9.2% p.a. interest compounding annually.
- 4** Peter invests \$5000 for 3 years at 6% p.a. simple interest, and Maria invests the same amount for 3 years at 5.8% p.a. compounding annually.
- a** Calculate the value of Peter's investment on maturity.
 - b** Calculate the value of Maria's investment on maturity.
 - c** Explain why Maria's investment is worth more, although she received a lower interest rate.
- 5** Gianni invests \$8000 at 15% p.a. compounded annually, and Dylan invests \$8 000 at 15% p.a. flat rate. How much more than Dylan's investment will Gianni's investment be worth after:
- a** 1 year **b** 2 years
 - c** 5 years **d** 10 years?
- 6** When her granddaughter was born, Barbara invested \$100 at the rate of 7% p.a. compounding annually. She plans to give it to her granddaughter on her eighteenth birthday. What will the amount be?
- 



UNDERSTANDING

- 7** Mai's investment account has compounded at a steady 9% for the last 10 years. If it is now worth \$68 000, how much was it worth:
- a** last year **b** ten years ago?
- 8** Chris and Jenny each invested \$10 000. Chris invested at 6.5% p.a. compounding annually, and Jenny took a flat rate of interest. After 5 years, their investments had equal value.
- a** Find the value of Chris's investment after 5 years.
b Find Jenny's interest rate.
c Find the value of each investment after 6 years.

REASONING

- 9** Two investment options are available to invest \$3000.
- A Invest for 5 years at 5% p.a. compounding monthly.
 - B Invest for 5 years at 5% p.a. compounding weekly.
- Explain which option you would you choose and why.
- 10** There are 3 factors that affect the value of a compound interest investment: the principal, the interest rate and the length of the investment.
- a** Let the interest rate be 10% p.a. and the length of the investment be 2 years. Calculate the value of an investment of:
 - i \$1000
 - ii \$2000
 - iii \$4000.

- b** Comment on the effect of increasing the principal on the value of the investment.
- c** Let the principal be \$1000 and the interest rate be 10% p.a. Calculate the value of an investment of:
 - i** 2 years **ii** 4 years **iii** 8 years.
- d** Comment on the effect of increasing the length of the investment on the value of the investment.
- e** Let the principal be \$1000 and the length of the investment be 5 years. Calculate the value of an investment of:
 - i** 6% interest p.a. **ii** 8% interest p.a. **iii** 10% interest p.a.
- f** Comment on the effect of increasing the interest rate on the value of the investment.

PROBLEM SOLVING

- 11** Calculate the value of each of the following investments if the principal is \$1000.
 - a** Interest rate = 8% p.a., compounding period = 1 year, time = 2 years
 - b** Interest rate = 8% p.a., compounding period = 6 months, time = 2 years
 - c** Interest rate = 8% p.a., compounding period = 3 months, time = 2 years
- 12** A bank offers a term deposit for 3 years at an interest rate of 8% p.a. with a compounding period of 6 months. What would be the end value of a \$5000 investment under these conditions?
- 13** A building society offers term deposits at 9%, compounded annually. A credit union offers term deposits at 10% but with simple interest only.
 - a** After 2 years, which has the larger value?
 - b** After 3 years, which has the larger value?
 - c** How many years before the compound interest offer has the greater value?
- 14** One aspect of compound interest is of great importance to investors: how long does it take to double my money? Consider a principal of \$100 and an annual interest rate of 10% (annual compounding).
 - a** How long does it take for this investment to be worth \$200?
 - b** How long would it take for the investment to be worth \$400 (a second doubling)?



CHALLENGE 11.2

Which would be better, and by what percentage — a wage rise of 20% or two successive wage rises of 10%?

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11.10 Review



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The Maths Quest Review is available in a customisable format for students to demonstrate their knowledge of this topic.

The Review contains:

- **Fluency** questions — allowing students to demonstrate the skills they have developed to efficiently answer questions using the most appropriate methods
- **Problem Solving** questions — allowing students to demonstrate their ability to make smart choices, to model and investigate problems, and to communicate solutions effectively.

A summary of the key points covered and a concept map summary of this topic are available as digital documents.

Review questions

Download the Review questions document from the links found in your eBookPLUS.

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Interactivities

Word search:
int-2699



Crossword:
int-2700



Sudoku
int-3210



Language

It is important to learn and be able to use correct mathematical language in order to communicate effectively. Create a summary of the topic using the key terms below. You can present your summary in writing or using a concept map, a poster or technology.

$(1 + R)$

bonus

commission

compound interest

gross

initial

investment

loading

net

overtime

p.a.

percentage rate

piecework

principal

retainer

royalty

salary

simple interest

time period

time sheet

wage

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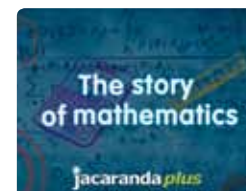
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The story of mathematics

is an exclusive Jacaranda video series that explores the history of mathematics and how it helped shape the world we live in today.

The high life (eles-1698) takes a glance into the world of high finance, where millions of dollars are made and lost on a daily basis. The mathematics behind stock trading is examined, as are the potential rewards and pitfalls.



RICH TASK

Australian currency

Australia's coins have distinctive features and our notes are unique in colour and texture. Since decimal currency was introduced in Australia in 1966, our notes and coins have undergone many changes. Only our five-, ten- and twenty-cent coins are still minted as they were back then. The one- and two-cent coins are no longer in circulation, the fifty-cent coin is a different shape, the one- and two-dollar notes have been replaced by coins, and our notes have changed from paper to a special type of plastic.



Coins have two sides: an obverse side and a reverse side. The obverse side of all Australian coins depicts our reigning monarch, Queen Elizabeth II, and the year in which the coin was minted. The reverse side depicts a typical Australian feature and sometimes a special commemorative event.

Note: Answer the following questions on a separate sheet of paper.

1 What is depicted on the reverse side of each Australian coin?

The table below includes information on Australia's current coins in circulation. Use the table to answer questions 2 to 4.

Coin	Diameter (mm)	Mass (g)	Composition
Five-cent	19.41	2.83	75% copper, 25% nickel
Ten-cent	23.60	5.65	75% copper, 25% nickel
Twenty-cent	28.52	11.30	75% copper, 25% nickel
Fifty-cent	31.51	15.55	75% copper, 25% nickel
One-dollar	25.00	9.00	92% copper, 6% aluminium, 2% nickel
Two-dollar	20.50	6.60	92% copper, 6% aluminium, 2% nickel

2 What are the metal compositions of each of the coins?

3 Which is the heaviest coin and which is the lightest? List the coins in order from lightest to heaviest.

4 Which has the smaller diameter — the five-cent coin or the two-dollar coin? Indicate the difference in size.

The table below displays information on Australia's current notes in circulation. The column on the far right compares the average life of the previously used paper notes with that of the current plastic notes. Use the table to answer questions 5 to 9.

Note	Date of issue	Size (mm)	Average life of notes (months)	
			Plastic	Paper
Five-dollar	07/07/1992 24/04/1995 01/01/2001	130 × 65	40	6
Ten-dollar	01/11/1993	137 × 65	40	8
Twenty-dollar	31/10/1994	144 × 65	50	10
Fifty-dollar	04/10/1995	151 × 65	About 100	24
One-hundred-dollar	15/05/1996	158 × 65	About 450	104

5 What denomination notes are available in our Australian currency?

6 On what date was Australia's first plastic note issued and what was the denomination of the note?

7 Suggest a reason for the three issue dates for the five-dollar note.

8 Why do you think each note is of a different size?

9 The table clearly shows that the plastic notes last about five times as long as the paper notes we once used. Why do you think the fifty-dollar and one-hundred-dollar notes last longer than the five- and ten-dollar notes?

CODE PUZZLE

What are the smallest and largest muscles in the human body?

Calculate the simple interest earned on the following investments to the nearest dollar. The amount and the letter beside each give the puzzle's answer code.



Smallest:

\$44	\$83	\$200	\$3974	\$140	\$15	\$1163	\$87	\$44	\$1163	\$68	
\$83	\$529	\$140	\$5	\$1163	\$15	\$15	\$288	\$140	\$140	\$200	\$133

\$2000 at 5% p.a. for 2 years A	\$8000 at 3.4% p.a. for 5 years B	\$8000 at 1.6% p.a. for 5 years C	\$500 at 1.5% p.a. for 2 years D	\$1200 at 3.9% p.a. for 3 years E
\$4000 at 6.3% p.a. for 2 years G	\$3700 at 4.4% p.a. for 3.25 years H	\$12 500 at 6.2% p.a. for 1.5 years I	\$7000 at 3.7% p.a. for 4 months K	\$900 at 6.4% p.a. for 5 years L
\$450 at 2.9% p.a. for 5 months M	\$790 at 3.6% p.a. for 2.4 years N	\$4500 at 4.5% p.a. for 3 months O	\$13 500 at 9.2% p.a. for 3.2 years P	\$2500 at 8% p.a. for 8 months R
\$800 at 5.5% p.a. for 1 year S	\$7500 at 1.1% p.a. for 12 months T	\$550 at 4.5% p.a. for 3.5 years U	\$5000 at 2.6% p.a. for 5 months X	

Largest:

		\$504	\$288	\$87	\$83	\$140	\$87	\$44	\$5	\$200	\$54	\$1163	\$5	\$87	\$44	
\$83	\$529	\$140	\$1360	\$87	\$83	\$83	\$51	\$640	\$86	\$5	\$87	\$44	\$640	\$288	\$140	

Activities

11.1 Overview

Video

- The story of mathematics: The High Life (eles-1698)

11.2 Salaries and wages

Digital docs

- SkillSHEET (doc-10849): Converting units of time
- SkillSHEET (doc-10850): Multiplying and dividing a quantity (money) by a whole number
- SkillSHEET (doc-10851): Multiplying and dividing a quantity (money) by a fraction
- SkillSHEET (doc-10852): Increasing a quantity by a percentage
- SkillSHEET (doc-10853): Adding periods of time

Interactivity

- IP interactivity 11.2 (int-4520): Salaries and wages

11.3 Special rates

Digital doc

- SkillSHEET (doc-10854): Multiplying a quantity (money) by a decimal

Interactivity

- IP interactivity 11.3 (int-4521): Special rates

11.4 Piecework

Digital doc

- WorkSHEET 11.1 (doc-10855): Financial mathematics

Interactivity

- IP interactivity 11.4 (int-4522): Piecework

11.5 Commission and royalties

Digital docs

- SkillSHEET (doc-10856): Converting a percentage into a decimal
- SkillSHEET (doc-10857): Finding a percentage of a quantity (money)
- Spreadsheet (doc-10905): Converting percentages to fractions or decimals
- Spreadsheet (doc-10906): Finding a percentage of an amount

Interactivity

- IP interactivity 11.5 (int-4523): Commission and royalties

11.6 Loadings and bonuses

Digital doc

- SkillSHEET (doc-10858): Expressing one quantity as a percentage of another

Interactivity

- IP interactivity 11.6 (int-4524): Loadings and bonuses

11.7 Taxation and net earnings

eLesson

- Small business (eles-0117)

Interactivity

- IP interactivity 11.7 (int-4525): Taxation and net earnings

11.8 Simple interest

Interactivities

- Effects of P , R , I and t (int-0745)
- IP interactivity 11.8 (int-4526): Simple interest

Digital doc

- WorkSHEET 11.2 (doc-6246): Simple interest

11.9 Compound interest

Digital doc

- Spreadsheet (doc-10907): Simple and compound interest

Interactivity

- IP interactivity 11.9 (int-4527): Compound interest

11.10 Review

Interactivities

- Word search (int-2699)
- Crossword (int-2700)
- Sudoku (int-3210)

Digital docs

- Topic summary (doc-10788)
- Concept map (doc-10801)

To access eBookPLUS activities, log on to



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Answers

TOPIC 11 Financial mathematics

Exercise 11.2 Salaries and wages

- 1 a \$1105.42 b \$2210.85 c \$4790.17
 2 a \$1198.08 b \$2396.15 c \$5191.67
 3 a \$19 136 b \$46 410 c \$68 684.20
 4 a \$25 870 b \$42 183.96 c \$100 498.06
 5 a \$3890 per month b \$3200.68 per fortnight
 6 a \$19.75/h b \$12.17/h c \$25.73/h d \$39.06/h
 7 a \$459.04 b \$670.70
 8 \$210.72
 9 \$261.49
 10 Rob earns more.
 11 \$30.77/h
 12 Job A
 13 38 hours
 14 a \$1605.77 b \$2788.81 c \$1100 d \$8770
 15 B
 16 Minh
 17 \$40 per hour
 18 \$1735.95, \$1833.75
 19 a \$29.81 b \$25.64 c \$72 080.58

Challenge 11.1

12 weeks

Exercise 11.3 Special rates

- 1 a \$23.94 b \$47.80 c \$43.50
 2 a \$906.10 b \$794.33 c \$833.56
 3 a \$25.16 b \$113.22 c \$1069.30
 4 a \$170.40 b \$340.80 c \$426.00
 5 \$1156.96
 6 a \$30.20 b \$45.30
 c \$60.40 d \$135.90
 7 a \$32.93 b \$197.55
 8 a \$11.70 b \$15.60 c \$19.50
 9 8, 8, 8, 6

10

Pay slip for Susan White	Week ending 17 August
Normal hours	38
Normal pay rate	\$25.60
Overtime hours	0
Overtime pay rate	\$38.40
Total pay	\$972.80

11 8, 8, 8, 4

12

Pay slip for Jason Rudd	Week ending 21 December
Normal hours	24
Normal pay rate	\$10.90
Overtime hours	4
Overtime pay rate	\$16.35
Total pay	\$327.00

13 8, 8, 8, 8, 8

14

Pay slip for Brett Simpson	Week ending 17 August
Normal hours	24
Normal pay rate	\$16.80
Time-and-a half hours	8
Time-and-a half pay rate	\$25.20
Double time hours	8
Double time pay rate	\$33.60
Total pay	\$873.60

- 15 a \$754.40 b \$1042.80 c \$1347.42
 16 a \$232.02 b \$1211.66
 17 B
 18 No. Glen should have been paid \$1034.
 19 \$1155
 20

	Hours worked	Regular pay	Overtime pay	Total pay
a	32	464	0	464
b	38.5	522	54.38	576.38
c	40.5	522	101.50	623.50
d	47.2	522	295.80	817.80

- 21 a Stewart \$930.75, Helen \$1108.80
 b i 85 hours
 ii No, because she would have worked 92.5 hours, which is 22.5 hours over the required 70 hours per fortnight.
 c \$894.94

Exercise 11.4 Piecework

- 1 \$97.50
 2 \$89.50
 3 \$175.50
 4 \$318.75
 5 a \$144.00 b 28 c \$21.60
 6 a \$144 b \$218 c \$465
 7 a \$107.50 b 24 c \$7.17
 8 a \$52 b \$9.45
 9 a \$1398.25 b \$1568.12
 10 \$422.40
 11 a \$8950 b \$3550

Exercise 11.5 Commission and royalties

- 1 \$3000
 2 a \$1280 b \$1115.60
 3 \$1425
 4 a \$200 b \$4400
 5 a \$290 b \$482.50 c \$1191.12
 6 a \$500 b \$590 c \$1175 d \$1568.75
 7 \$9800
 8 \$12 800
 9 a \$4800 b \$5400 c \$14 400
 10 a \$2400 b \$3750 c \$15 937.50
 11 a Veronica earns \$736; Francis earns \$504.
 b \$20 000
 12 a \$900 b \$1148 c \$1253.60
 13 a \$1520 b \$2237.50
 c \$2555 d \$7560
 14 \$3676.50
 15 a \$15 460 b \$48 725
 c \$36 456 d \$119 800
 16 4.5%

Exercise 11.6 Loadings and bonuses

- 1 \$1244.76
 2 \$805.64
 3 \$764.18
 4 a \$1428.80 b \$1000.16 c \$6715.36
 5 a \$866.40 b \$4072.08
 6 a \$574.20 b \$100.49
 7 a \$2431.23 b \$5713.39

- 8 \$1135.01
 9 \$116 326.53
 10 a \$60 000 b \$5000 c 11.90%
 11 a Shane receives a 7.5% incentive as the company's profit has grown by 16.7% (which is between 10.1% and 20%).
 b \$295 625
 12 a \$9625 b \$67 375 c \$55 000
 13 a \$300 b \$615.75 c \$1057.50
 14 a \$1650 b \$2070
 15 \$640

Exercise 11.7 Taxation and net earnings

- 1 a 0 b \$722 c \$5847 d \$20 507
 2 a \$69, 10.62% b \$217, 19.73% c \$374, 24.13%
 3 a \$421.25 b \$422.35 c \$514.60
 4 \$43 961.45
 5 \$719.85
 6 a \$297 b 22% c \$938.80
 7 a \$800.10 b \$113 c 14.12%
 d \$548.40 e 68.54%
 8 a Debbie is taxed \$14 947 on the \$72 000 she earns.
 b There may be other deductions on Debbie's net pay, such as superannuation, union fees, private health insurance and the Medicare levy.
 9 a \$89 700 b \$21 136 c \$1794
 10 a \$113 b 13.8% c \$736

Exercise 11.8 Simple interest

- 1 a \$1200 b \$6200
 2 \$1950
 3 a i \$100 ii \$1100
 b i \$1920 ii \$5920
 c i \$1440 ii \$9440
 d i \$263.25 ii \$2963.25
 e i \$5048.32 ii \$20 726.32
 4 a \$3300 b \$5645
 5 a \$22 275.50 b \$371.26
 6 \$211.90
 7 2.5 years
 8 \$12 500
 9 8%
 10 a 2 years b 2.5 years c \$600
 d \$4500.06 e 8% f 3.5%
 11 a \$16 998 b \$8770.97 c \$28 768.97
 d 48 e \$536.85
 12 a \$5768 b \$6902
 c \$120.17, \$143.79
 13 a \$180 000 b \$80 550
 c \$260 550 d \$4342.50
 14 The interest rate in the simple interest formula needs to be converted from a percentage into a decimal: $4.2\% = 0.042$.
 15 5.3%
 16 a \$2300 b \$12 300
 17 a \$78.13 b \$288 000
 18 a Answers will vary. b Yes
 c 91.04

Exercise 11.9 Compound interest

1 a

	Principal	Interest	Total value
Year 1	\$1000	\$120	\$1120
Year 2	\$1120	\$134.40	\$1254.40
Year 3	\$1254.40	\$150.53	\$1404.93

Total interest = \$404.93

b

	Principal	Interest	Total value
Year 1	\$100 000	\$9000	\$109 000
Year 2	\$109 000	\$9810	\$118 810
Year 3	\$118 810	\$10 692.90	\$129 502.90
Year 4	\$129 502.90	\$11 655.26	\$141 158.16

Total interest = \$41 158.16

2 a

	Start of year	End of year
Year 1	\$5000	\$5600
Year 2	\$5600	\$6272
Year 3	\$6272	\$7024.64

b

	Start of year	End of year
Year 1	\$200 000	\$214 000
Year 2	\$214 000	\$228 980
Year 3	\$228 980	\$245 008.60

c

	Start of year	End of year
Year 1	\$100 000	\$108 500
Year 2	\$108 500	\$117 722.50
Year 3	\$117 722.50	\$127 728.91
Year 4	\$127 728.91	\$138 585.87
Year 5	\$138 585.87	\$150 365.67

d

	Start of year	End of year
Year 1	\$12 000	\$13 800
Year 2	\$13 800	\$15 870
Year 3	\$15 870	\$18 250.50
Year 4	\$18 250.50	\$20 988.08

- 3 a i \$24 472.18 ii \$16 472.18
 b i \$63 123.85 ii \$13 123.85
 c i \$90 196.31 ii \$18 196.31
 d i \$230 050.99 ii \$80 050.99
 e i \$57 282.88 ii \$53 782.88
 f i \$50 634.40 ii \$29 634.40
 4 a \$5900 b \$5921.44
 c Each year, Maria's principal increases.
 5 a 0 b \$180
 c \$2090.86 d \$12 364.46
 6 \$337.99
 7 a \$62 385.32 b \$28 723.93
 8 a \$13 700.87 b 7.4%
 c Chris, \$14 591.42; Jenny, \$14 440
 9 Option B would be the best choice, as the shorter the time between the compounding periods, the greater the interest paid.
 10 a i \$1210 ii \$2420 iii \$4840
 b Increasing the principal will increase the value of the investment because it will have a higher value of interest.
 c i \$1210 ii \$1464.10 iii \$2143.59
 d Increasing the length of the investment will increase the value of the investment because it will have a higher value of interest.
 e i \$1338.23 ii \$1469.33 iii \$1610.51
 f Increasing the interest rate will increase the value of the investment because it will have a higher value of interest.

- 11 a** \$1166.40 **b** \$1169.86 **c** \$1171.66
12 \$6326.60
13 a Simple interest **b** Simple interest **c** 4 years
14 a 7.27 years **b** 14.55 years

Challenge 11.2

Two successive wage rises of 10%

Investigation — Rich task

- 1** Five-cent coin: echidna
 Ten-cent coin: lyrebird
 Twenty-cent coin: platypus
 Fifty-cent coin: coat of arms
 One-dollar coin: five kangaroos
 Two-dollar coin: Aboriginal elder Gwoya Jungarai

- 2** Refer to the table.
3 Five-cent, ten-cent, two-dollar, one-dollar, twenty-cent, fifty-cent coin
4 The five-cent coin has a smaller diameter; 1.09 mm.
5 \$5, \$10, \$20, \$50, \$100
6 7 July 1992; \$5
7 Answers will vary.
8 The different sizes allow blind people to tell the difference between each note.
9 The fifty-dollar and one-hundred-dollar notes are used less frequently.

Code puzzle

Stapedius in the middle ear; gluteus maximus, the buttock muscle

