



6

NUMBER AND ALGEBRA

FRACTIONS AND PERCENTAGES

Football players, tennis players and elite athletes often say “I gave it 110%” after a match or event. What do they mean? Giving 100% is giving everything or the whole effort. They mean they have given extra effort or tried even harder than usual. When someone says “I support them 110%”, it is a similar thing. In both situations, the importance of the event or action is being emphasised.



Shutterstock.com/FrankHH

Chapter outline

	Working mathematically				
6.01 Fractions	U	F		R	C
6.02 Adding and subtracting fractions	U	F	PS	R	
6.03 Multiplying and dividing fractions	U	F	PS	R	C
6.04 Percentages, fractions and decimals	U	F		R	C
6.05 Fraction and percentage of a quantity	U	F		R	
6.06 Expressing amounts as fractions and percentages	U	F	PS	R	
6.07 Percentage increase and decrease	U	F	PS	R	C
6.08 Percentages without calculators	U	F	PS	R	
6.09 The unitary method	U	F	PS	R	
6.10 Profit, loss and GST	U	F	PS	R	
6.11 Extension: Simple interest*	U	F	PS		
6.12 Percentage problems	U	F	PS	R	

*Year 9 Extension, Stage 5.1

Wordbank

cost price The price an item costs the retailer

discount The saving made between the original price of an item and the reduced price

improper fraction A fraction such as $\frac{7}{3}$ in which the numerator is larger than or equal to the denominator.

loss The amount lost when selling an item at a lower price

GST Goods and services tax, a 10% tax added to the original price of an item or service

profit The amount made when selling an item at a higher price

selling price The price at which an item is sold by the retailer

unitary method A method for finding the whole amount when a percentage of that amount is known, by first finding the size of 1%

U = Understanding | F = Fluency | PS = Problem solving | R = Reasoning | C = Communication





Using fractions

In this chapter you will:

- order, add, subtract, multiply and divide fractions
- convert between fractions, decimals and percentages
- find a fraction or percentage of a quantity
- express one quantity as a fraction or percentage of another
- increase or decrease a quantity by a percentage
- given a percentage of an amount, use the unitary method to find the whole amount
- solve problems involving percentages, including profit, loss and GST
- **(EXTENSION, STAGE 5.1) solve problems involving simple interest**



Fraction diagrams



Fractions



Classifying fractions

SkillCheck ANSWERS ON P. 560

1 Copy and complete each pair of **equivalent** fractions.

a $\frac{1}{2} = \frac{\quad}{6}$

b $\frac{2}{3} = \frac{\quad}{12}$

c $\frac{4}{5} = \frac{16}{\quad}$

d $\frac{7}{28} = \frac{1}{\quad}$

e $\frac{3}{4} = \frac{\quad}{8}$

f $\frac{15}{20} = \frac{\quad}{4}$

g $\frac{6}{10} = \frac{24}{\quad}$

h $\frac{3}{5} = \frac{9}{\quad}$

2 Write each percentage as a fraction.

a 17%

b 3%

c 51%

d 63%

e 89%

3 Evaluate each difference.

a $100\% - 30\%$

b $100\% - 95\%$

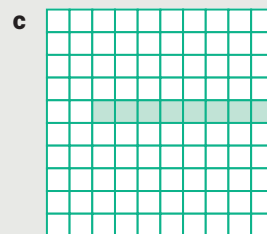
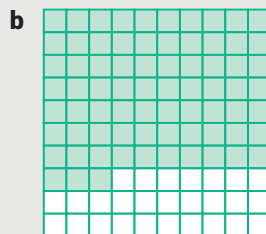
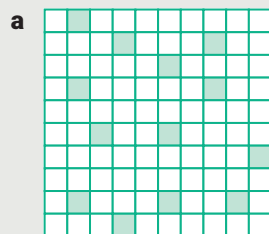
c $100\% - 39\%$

d $100\% - 71\%$

e $100\% - 12\%$

f $100\% - 7\%$

4 Write the percentage that is shaded in each diagram.



5 Write the percentage that is unshaded in each diagram in question 4.

6 On a plane, 10% of the seats are first-class and 25% are business class. The rest are economy class. What percentage of the seating is economy class?

7 Write all of the factors of 100.

8 Evaluate each expression.

a 50% of \$80

b 50% of 12 kg

c 25% of \$20

d 25% of 40 kg

e 10% of \$30

f 10% of 20 kg

Fractions

6.01

Scientific calculators have a fraction key for entering fractions: $\frac{\square}{\square}$ or $\frac{a}{b/c}$

Casio calculators have 2 modes for entering and displaying fractions. MATH mode shows fractions more realistically as it allows you to enter the numerator and denominator into 2 blank spaces on the calculator's screen, while LINE mode shows the fraction in a line (for example, $1 \downarrow 3$) and makes the fraction key act like a vinculum (fraction bar). Press SHIFT MODE to change between MATH and LINE modes. When MATH mode is selected, 'Math' appears on the calculator display. To ensure that mixed numeral answers are not converted to improper fractions, press SHIFT MODE and the down arrow to choose 'ab/c'.

Example 1

Convert $\frac{27}{4}$ into a mixed numeral.

Solution

$$\begin{aligned}\frac{27}{4} &= 27 \div 4 \\ &= 6 \text{ remainder } 3 \\ &= 6\frac{3}{4}\end{aligned}$$

To find the number of 'wholes' in 27 quarters, divide 27 by 4.

Write the remainder in the numerator of a fraction.

Or on a calculator, enter: $27 \frac{\square}{\square} 4 =$ or $27 \frac{a}{b/c} 4 =$.

For Casio MATH mode, press the $\frac{\square}{\square}$ key first and use arrow keys to move the cursor to the 2 blank spaces to enter the values. Then press $=$.

If the display shows $\frac{27}{4}$, press SHIFT $\text{S}\leftrightarrow\text{D}$ or 2nd F $\frac{a}{b/c}$ to convert it to a mixed numeral.

SHIFT $\text{S}\leftrightarrow\text{D}$ or 2nd F $\frac{a}{b/c}$ converts an answer between **mixed numeral** and **improper fraction** forms.

Example 2

Convert $4\frac{2}{5}$ to an improper fraction.

Solution

$$\begin{array}{r} + \\ \times \\ \hline 4\frac{2}{5} = \frac{5 \times 4 + 2}{5} = \frac{22}{5} \end{array}$$

This works because $4\frac{2}{5} = 4 + \frac{2}{5} = \frac{5 \times 4}{5} + \frac{2}{5}$.

Or on a calculator, enter: $4 \frac{\square}{\square} 2 \frac{\square}{\square} 5 =$ SHIFT $\text{S}\leftrightarrow\text{D}$ or $4 \frac{a}{b/c} 2 \frac{a}{b/c} 5 =$ 2nd F $\frac{a}{b/c}$.

For entering mixed numerals in Casio MATH mode, press SHIFT $\frac{\square}{\square}$ and move the cursor to the 3 blank spaces to enter the values of the mixed numeral. Then press $=$.



Improper fractions and mixed numerals



Simplifying fractions



Fractions



Equivalent fractions



Improper fractions and mixed numerals



Simplifying fractions



Fractions wall



Rational numbers



Improper fractions



Mixed numbers to improper fractions



Pop stick calculator



Fraction strips



Example 3

Which fraction is larger, $\frac{4}{10}$ or $\frac{3}{8}$?

Solution

Method 1

Convert both fractions so that they share a common denominator of $10 \times 8 = 80$.

$$\frac{4}{10} = \frac{4 \times 8}{10 \times 8} = \frac{32}{80} \text{ and } \frac{3}{8} = \frac{3 \times 10}{8 \times 10} = \frac{30}{80}$$

Note that we multiply the numerator and denominator of each fraction by the denominator of the **other** fraction.

By comparing numerators, $\frac{32}{80} > \frac{30}{80}$

$\therefore \frac{4}{10}$ is larger.

Method 2

Another suitable denominator is the lowest common denominator (LCD) of both denominators.

The LCD of 10 and 8 is 40.

The LCD is the lowest common multiple (LCM) of both denominators.

Convert both fractions.

$$\frac{4}{10} = \frac{4 \times 4}{10 \times 4} = \frac{16}{40} \text{ and } \frac{3}{8} = \frac{3 \times 5}{8 \times 5} = \frac{15}{40}$$

By comparing numerators, $\frac{16}{40} > \frac{15}{40}$.

$\therefore \frac{4}{10}$ is larger.

Example 4

Simplify each fraction.

a $\frac{10}{15}$

b $\frac{36}{60}$

Solution

a $\frac{10}{15} = \frac{10 \div 5}{15 \div 5} = \frac{2}{3}$

Or on a calculator, enter: 10 \div 15 $=$ or 10 $\text{a}^{\text{b}/\text{c}}$ 15 $=$.

b $\frac{36}{60} = \frac{36 \div 6}{60 \div 6} = \frac{6}{10} = \frac{6 \div 2}{10 \div 2} = \frac{3}{5}$

or $\frac{36}{60} = \frac{36 \div 12}{60 \div 12} = \frac{3}{5}$

We can simplify in one step if we divide by 12, the HCF of 36 and 60.

Or on a calculator, enter: 36 \div 60 $=$ or 36 $\text{a}^{\text{b}/\text{c}}$ 60 $=$.



EXERCISE 6.01 ANSWERS ON P. 560

Fractions UFRC

- 1** Convert each improper fraction into a mixed numeral or whole number. **C**
a $\frac{3}{2}$ **b** $\frac{11}{3}$ **c** $\frac{9}{4}$ **d** $\frac{12}{5}$ **e** $\frac{20}{4}$ **f** $\frac{47}{11}$
- 2** Convert each mixed numeral into an improper fraction. **C**
a $3\frac{1}{2}$ **b** $4\frac{1}{3}$ **c** $5\frac{3}{4}$ **d** $7\frac{2}{3}$
e $7\frac{4}{5}$ **f** $7\frac{2}{9}$ **g** $10\frac{1}{7}$ **h** $9\frac{3}{10}$
- 3** Write an improper fraction that can be converted into a whole number. **R C**
- 4** Which is larger: a proper fraction or a mixed numeral? Explain your answer. **R C**
- 5** For each pair of fractions, find the larger fraction.
a $\frac{1}{2}, \frac{1}{3}$ **b** $\frac{2}{3}, \frac{3}{4}$ **c** $\frac{3}{8}, \frac{1}{3}$
d $2\frac{3}{5}, 2\frac{7}{10}$ **e** $\frac{11}{15}, \frac{3}{5}$ **f** $\frac{5}{12}, \frac{2}{5}$
- 6** Simplify each fraction.
a $\frac{5}{10}$ **b** $\frac{4}{12}$ **c** $\frac{12}{26}$ **d** $\frac{18}{24}$ **e** $\frac{15}{25}$ **f** $\frac{16}{28}$
g $\frac{32}{48}$ **h** $\frac{60}{100}$ **i** $\frac{44}{77}$ **j** $\frac{20}{35}$ **k** $\frac{21}{35}$ **l** $\frac{72}{80}$
- 7** Which one of these fractions is **NOT** equivalent to $\frac{10}{25}$? Select **A, B, C,** or **D.**
A $\frac{1}{5}$ **B** $\frac{2}{5}$ **C** $\frac{20}{50}$ **D** $\frac{40}{100}$
- 8** Convert each improper fraction into a simplified mixed numeral.
a $\frac{9}{6}$ **b** $\frac{18}{6}$ **c** $\frac{45}{10}$ **d** $\frac{36}{20}$

EXAMPLE 1

EXAMPLE 2

6.01

EXAMPLE 3

EXAMPLE 4

Adding and subtracting fractions

6.02

Adding and subtracting fractions

- To **add or subtract fractions**, convert them (if needed) so that they have the same denominator, then simply add or subtract just the numerators
- To **add or subtract mixed numerals**, add or subtract the whole numbers and fractions separately.



Adding and subtracting fractions



Adding and subtracting fractions



Working out fractions

Foundation Standard Complex

9780170453141



Fraction arithmagons



Pop stick calculator



Magic squares



Adding and subtracting fractions

Example 5

Evaluate each expression.

a $\frac{1}{3} + \frac{5}{6}$

b $\frac{5}{7} - \frac{2}{3}$

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

d $4\frac{1}{5} - 1\frac{2}{3}$

Solution

a Common denominator = $3 \times 6 = 18$

$$\frac{1}{3} = \frac{1 \times 6}{3 \times 6} = \frac{6}{18}$$

$$\frac{5}{6} = \frac{5 \times 3}{6 \times 3} = \frac{15}{18}$$

$$\frac{1}{3} + \frac{5}{6} = \frac{6}{18} + \frac{15}{18}$$

$$= \frac{21}{18}$$

$$= \frac{7}{6}$$

$$= 1\frac{1}{6}$$

Note that we multiply the numerator and denominator of each fraction by the denominator of the *other* fraction.

OR Using the lowest common denominator (LCD) of 3 and 6 = 6:

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

$$\frac{5}{6} = \frac{5}{6}$$

$$\frac{1}{3} + \frac{5}{6} = \frac{2}{6} + \frac{5}{6}$$

$$= \frac{7}{6}$$

$$= 1\frac{1}{6}$$

OR on a calculator,

enter: 1 $\frac{\square}{\square}$ 3 \square + 5 $\frac{\square}{\square}$ 6 \square =.

Note: $\frac{\square}{\square}$ or \square/\square .

b Common denominator = $7 \times 3 = 21$:

$$\frac{5}{7} = \frac{5 \times 3}{7 \times 3} = \frac{15}{21}$$

$$\frac{2}{3} = \frac{2 \times 7}{3 \times 7} = \frac{14}{21}$$

$$\frac{5}{7} - \frac{2}{3} = \frac{15}{21} - \frac{14}{21}$$

$$= \frac{1}{21}$$

OR 5 $\frac{\square}{\square}$ 7 \square - 2 $\frac{\square}{\square}$ 3 \square =.

c $3 - \frac{3}{4} = 2 + 1 - \frac{3}{4}$

$$= 2 + \frac{4}{4} - \frac{3}{4}$$

$$= 2\frac{1}{4}$$

OR 3 \square - 3 $\frac{\square}{\square}$ 4 \square =.

d $4\frac{1}{5} - 1\frac{2}{3} = 4 - 1 + \frac{1}{5} - \frac{2}{3}$

$$= 3 + \frac{3}{15} - \frac{10}{15}$$

$$= 3 - \frac{7}{15}$$

$$= 2 + \frac{15}{15} - \frac{7}{15}$$

$$= 2\frac{8}{15}$$

OR 4 $\frac{\square}{\square}$ 1 $\frac{\square}{\square}$ 5 \square - 1 $\frac{\square}{\square}$ 2 $\frac{\square}{\square}$ 3 \square =.

For MATH mode, press **SHIFT** $\frac{\square}{\square}$ first.



EXERCISE 6.02 ANSWERS ON P. 560

Adding and subtracting fractions **U F P S R**

1 Evaluate each expression.

a $\frac{1}{5} + \frac{3}{5}$

b $\frac{3}{4} - \frac{1}{4}$

c $\frac{3}{8} + \frac{2}{8}$

d $\frac{7}{8} + \frac{4}{8}$

2 Evaluate each expression.

a $\frac{2}{5} + \frac{3}{10}$

b $\frac{2}{3} - \frac{3}{7}$

c $\frac{3}{5} + \frac{1}{4}$

d $\frac{1}{2} - \frac{1}{4}$

e $\frac{1}{6} + \frac{3}{8}$

f $\frac{7}{10} - \frac{2}{3}$

g $\frac{4}{9} + \frac{5}{6}$

h $\frac{7}{8} - \frac{5}{12}$

i $\frac{5}{8} + \frac{1}{2}$

j $1 - \frac{6}{7}$

k $4 - \frac{4}{9}$

l $3 - \frac{2}{5}$

3 Joe bought a length of timber to build fences for his garden beds. He used $\frac{1}{5}$ of the wood for the first garden and $\frac{3}{8}$ of the wood for the second garden. What fraction of the wood remains for the third garden? **R**

4 What fraction goes in the blank? $\frac{7}{8} - \underline{\hspace{1cm}} = \frac{1}{4}$. Select the correct answer **A**, **B**, **C**, or **D**.

PS R

A $\frac{6}{4}$

B $\frac{8}{12}$

C $\frac{3}{8}$

D $\frac{5}{8}$

5 Copy and complete each equation with the correct fraction. **PS R**

a $\frac{1}{4} + \underline{\hspace{1cm}} = \frac{2}{3}$

b $\underline{\hspace{1cm}} - \frac{2}{5} = \frac{1}{6}$

6 A bottle is $\frac{3}{4}$ full. $\frac{1}{3}$ of the liquid is then poured out. What fraction of the bottle is filled? **PS R**

7 Danielle used half a sheet of adhesive plastic to cover her books, while Christina used $\frac{2}{5}$ of the same sheet. What fraction of the original sheet remains? Select **A**, **B**, **C**, or **D**.

PS R

A $\frac{3}{5}$

B $\frac{4}{5}$

C $\frac{1}{10}$

D $\frac{9}{10}$

8 Evaluate $2\frac{7}{8} + 1\frac{3}{8}$. Select **A**, **B**, **C**, or **D**.

A $4\frac{1}{4}$

B $3\frac{4}{5}$

C $3\frac{1}{2}$

D $13\frac{1}{4}$

9 Evaluate each expression.

a $1\frac{1}{2} + \frac{2}{5}$

b $2\frac{1}{4} + 1\frac{3}{8}$

c $7\frac{3}{8} + 9\frac{1}{3}$

d $3\frac{4}{5} + 1\frac{2}{9}$

e $6\frac{2}{5} - 4\frac{7}{8}$

f $4\frac{3}{4} - 2\frac{4}{5}$

g $2\frac{1}{3} - 1\frac{1}{2}$

h $4\frac{3}{5} - 2\frac{9}{10}$

EXAMPLE 5

6.02



10 In a magic square, each row, column and diagonal must add to the same total.
Complete each magic square with appropriate fractions. **PS R**

a

4	$1\frac{1}{2}$	
$\frac{1}{2}$		$4\frac{1}{2}$
3		

b

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

6.03 Multiplying and dividing fractions



Multiplying fractions using rectangles



Multiplying and dividing fractions number grids



Fractions and decimals review



Multiplying and dividing fractions



Working out fractions



Multiplying fractions



What's the fraction question?

Multiplying and dividing fractions

- To **multiply fractions**, multiply the numerators and denominators separately, then simplify if possible (sometimes, it is easier to simplify the fractions first).
- To **divide by a fraction**, $\frac{a}{b}$, multiply by its reciprocal $\frac{b}{a}$.
- To **multiply or divide mixed numerals**, convert them to improper fractions first.

Example 6

Evaluate each expression.

a $\frac{3}{5} \times \frac{2}{7}$

b $\frac{2}{3} \times \frac{3}{8}$

c $\frac{4}{5} \div \frac{2}{3}$

d $1\frac{1}{2} \times 2\frac{2}{3}$

Solution

$$\begin{aligned} \mathbf{a} \quad \frac{3}{5} \times \frac{2}{7} &= \frac{3 \times 2}{5 \times 7} \\ &= \frac{6}{35} \end{aligned}$$

$$\begin{aligned} \mathbf{b} \quad \frac{2}{3} \times \frac{3}{8} &= \frac{2 \times 3}{3 \times 8} \\ &= \frac{6}{24} \\ &= \frac{1}{4} \end{aligned}$$

OR on a calculator, enter:

$$3 \left[\frac{\square}{\square} \right] 5 \left[\times \right] 2 \left[\frac{\square}{\square} \right] 7 \left[= \right]$$

Note: $\left[\frac{\square}{\square} \right]$ or $\left[a^{b/c} \right]$

OR by simplifying first before multiplying:

$$\begin{aligned} \frac{2}{3} \times \frac{3}{8} &= \frac{2^1}{3^1} \times \frac{3^1}{8^1} \\ &= \frac{1}{4} \end{aligned}$$

OR on a calculator, enter:

$$2 \left[\frac{\square}{\square} \right] 3 \left[\times \right] 3 \left[\frac{\square}{\square} \right] 8 \left[= \right]$$



$$\begin{aligned} \text{c } \frac{4}{5} \div \frac{2}{3} &= \frac{4}{5} \times \frac{3}{2} \\ &= \frac{12}{10} \\ &= \frac{6}{5} \\ &= 1\frac{1}{5} \end{aligned}$$

$$\begin{aligned} \text{d } 1\frac{1}{2} \times 2\frac{2}{3} &= \frac{3}{2} \times \frac{8}{3} \\ &= \frac{\overset{1}{3} \times \overset{4}{8}}{\underset{1}{2} \times \underset{1}{3}} \\ &= \frac{4}{1} \\ &= 4 \end{aligned}$$

OR by simplifying first before multiplying:

$$\frac{4}{5} \div \frac{2}{3} = \frac{\overset{2}{4}}{5} \times \frac{3}{\underset{1}{2}} = \frac{6}{5} = 1\frac{1}{5}$$

OR on a calculator, enter:

$$4 \left[\frac{\square}{\square} \right] 5 \left[\div \right] 2 \left[\frac{\square}{\square} \right] 3 \left[= \right]$$

OR on a calculator, enter:

$$1 \left[\frac{\square}{\square} \right] 1 \left[\frac{\square}{\square} \right] 2 \left[\times \right] 2 \left[\frac{\square}{\square} \right] 2 \left[\frac{\square}{\square} \right] 3 \left[= \right]$$

For MATH mode, press **SHIFT** $\left[\frac{\square}{\square} \right]$ first.

6.03

EXERCISE 6.03 ANSWERS ON P. 560

Multiplying and dividing fractions **U F P S R C**

1 Evaluate each product.

a $\frac{1}{2} \times \frac{2}{3}$

b $\frac{2}{3} \times \frac{5}{7}$

c $\left(\frac{1}{8}\right)^2$

d $\frac{9}{10} \times \frac{5}{6}$

e $\frac{3}{5} \times \frac{3}{4}$

f $1\frac{1}{2} \times 3$

g $3\frac{1}{4} \times 3\frac{4}{5}$

h $1\frac{1}{3} \times 2\frac{1}{3}$

2 What is the value of $\frac{7}{10} \div \frac{1}{5}$? Select the correct answer **A**, **B**, **C**, or **D**.

A $\frac{7}{50}$

B $1\frac{1}{5}$

C $1\frac{2}{5}$

D $3\frac{1}{2}$

3 Evaluate each quotient.

a $\frac{1}{7} \div \frac{2}{3}$

b $\frac{2}{5} \div \frac{3}{4}$

c $\frac{5}{9} \div \frac{5}{6}$

d $\frac{9}{10} \div \frac{3}{5}$

e $4 \div \frac{1}{4}$

f $6 \div \frac{2}{3}$

g $\frac{5}{8} \div 5$

h $\frac{2}{5} \div 6$

i $\frac{7}{8} \div \frac{1}{4}$

j $10 \div 3\frac{1}{7}$

k $3\frac{1}{2} \div 1\frac{1}{4}$

l $3\frac{3}{4} \div 1\frac{1}{10}$

4 From a box of chocolates, Lindy takes $\frac{3}{8}$ of the chocolates and shares them equally among her 4 children. What fraction of the box of lollies does each child receive? **PS R**

- 5**
- a** What number's reciprocal is itself?
 - b** What number does not have a reciprocal?
 - c** What is the product of a number and its reciprocal?
 - d** What is the reciprocal of the reciprocal of $\frac{1}{3}$? **R C**

6 Copy and complete each equation. **R**

a $\frac{3}{4} \times \underline{\hspace{1cm}} = \frac{21}{32}$

b $\underline{\hspace{1cm}} \times \frac{1}{5} = \frac{2}{15}$

c $\underline{\hspace{1cm}} \div \frac{2}{3} = \frac{1}{7}$

d $\frac{4}{15} \div \underline{\hspace{1cm}} = \frac{8}{21}$



- 7 a** When a number is divided by a proper fraction, does the number increase or decrease? Give reasons for your answer.
- b** When a number is multiplied by an improper fraction, does the number increase or decrease? Give reasons for your answer. **R C**

6.04 Percentages, fractions and decimals

A **percentage** is a fraction whose denominator is 100.



Multiplying and dividing by 10, 100, 1000



Converting percentages to fractions and decimals



Fractions wall



Decimals wall



Converting percentages to fractions and decimals



Percentages wall



Percentage shapes



Percentages, fractions and decimals



Converting percentages to fractions

Example 7

Convert each percentage into a simplified fraction.

a 55%

b 130%

c $37\frac{1}{2}\%$

Solution

$$\begin{aligned} \mathbf{a} \quad 55\% &= \frac{55}{100} \\ &= \frac{11}{20} \end{aligned}$$

$$\begin{aligned} \mathbf{b} \quad 130\% &= \frac{130}{100} \\ &= \frac{13}{10} \\ &= 1\frac{3}{10} \end{aligned}$$

$$\begin{aligned} \mathbf{c} \quad 37\frac{1}{2}\% &= \frac{37\frac{1}{2}}{100} \\ &= \frac{37\frac{1}{2} \times 2}{100 \times 2} \\ &= \frac{75}{200} \\ &= \frac{3}{8} \end{aligned}$$

Example 8

Convert each percentage into a decimal.

a 8%

b 43.6%

c $18\frac{1}{2}\%$

Solution

$$\begin{aligned} \mathbf{a} \quad 8\% &= \frac{8}{100} \\ &= 8 \div 100 \\ &= 0.08 \end{aligned}$$

$$\begin{aligned} \mathbf{b} \quad 43.6\% &= \frac{43.6}{100} \\ &= 43.6 \div 100 \\ &= 0.436 \end{aligned}$$

$$\begin{aligned} \mathbf{c} \quad 18\frac{1}{2}\% &= \frac{18\frac{1}{2}}{100} \\ &= 18.5 \div 100 \\ &= 0.185 \end{aligned}$$

To convert a percentage into a decimal mentally, move the decimal point 2 places to the left



Converting to a percentage

To convert a fraction or a decimal into a percentage, multiply it by 100%

Example 9

Convert each fraction into a percentage.

a $\frac{1}{8}$

b $\frac{34}{40}$

Solution

a $\frac{1}{8} = \frac{1}{8} \times 100\%$
 $= 12\frac{1}{2}\%$

b $\frac{34}{40} = \frac{34}{40} \times 100\%$
 $= 85\%$

Example 10

Convert each decimal into a percentage.

a 0.147

b 0.6

Solution

a $0.147 = 0.147 \times 100\%$
 $= 14.7\%$

b $0.6 = 0.6 \times 100\%$
 $= 60\%$

To mentally convert a decimal into a percentage, just move the decimal point 2 places to the right

Ordering fractions, decimals and percentages

To order fractions, percentages and decimals, convert each into a percentage first.

Example 11

Arrange in ascending order: 0.667, 66%, $\frac{7}{11}$.

Solution

Convert all numbers into percentages.

$$0.667 \times 100\% = 66.7\%$$

$$66\% = 66\%$$

$$\frac{7}{11} \times 100\% = 63\frac{7}{11}\%$$

Arrange the percentages from smallest to largest: $63\frac{7}{11}\%$, 66% and 66.7%

So, in ascending order, the numbers are $\frac{7}{11}$, 66% and 0.667.



Converting fractions to percentages



Converting fractions and decimals to percentages



Converting decimals to percentages



Percentages to decimals



Converting fractions and decimals to percentages



Percentominoes

6.04

EXERCISE 6.04 ANSWERS ON P. 561

Percentages, fractions and decimals UFRC

EXAMPLE
7

1 Convert each percentage into a simplified fraction. **C**

- | | | | |
|---------------|---------------|--------------|---------------|
| a 60% | b 75% | c 31% | d 8% |
| e 30% | f 85% | g 99% | h 3% |
| i 160% | j 135% | k 25% | l 250% |

EXAMPLE
8

2 Which decimal is equal to $62\frac{1}{2}\%$? Select the correct answer **A, B, C,** or **D.** **C**

- | | | | |
|----------------|---------------|----------------|-----------------|
| A 62.12 | B 62.5 | C 0.625 | D 0.0625 |
|----------------|---------------|----------------|-----------------|

3 Convert each percentage to a decimal. **C**

- | | | | |
|----------------|----------------|----------------|----------------------------|
| a 18% | b 82% | c 2% | d 50% |
| e 120% | f 51.1% | g 79% | h $12\frac{1}{2}\%$ |
| i 16.3% | j 4% | k 18.7% | l $5\frac{1}{4}\%$ |

EXAMPLE
9

4 Convert each fraction into a percentage. **C**

- | | | | |
|---------------------------|--------------------------|--------------------------|--------------------------|
| a $\frac{17}{100}$ | b $\frac{7}{10}$ | c $\frac{13}{50}$ | d $\frac{11}{20}$ |
| e $\frac{5}{8}$ | f $\frac{24}{25}$ | g $\frac{2}{3}$ | h $\frac{5}{4}$ |
| i $1\frac{2}{5}$ | j $\frac{27}{40}$ | k $\frac{1}{16}$ | l $\frac{4}{9}$ |

EXAMPLE
10

5 Convert each decimal into a percentage. **C**

- | | | | |
|---------------|----------------|---------------|----------------|
| a 0.38 | b 0.55 | c 0.96 | d 0.625 |
| e 0.08 | f 0.054 | g 0.6 | h 0.003 |
| i 1.9 | j 0.405 | k 1.26 | l 0.114 |

6 Copy and complete this table. **C**

	Fraction	Decimal	Percentage
a		0.65	
b		0.6	
c			20%
d			84%
e	$\frac{1}{2}$		
f	$\frac{1}{8}$		
g			36%
h	$\frac{5}{8}$		
i		0.73	
j	$\frac{1}{3}$		
k			$66\frac{2}{3}\%$





- 7** For each pair of numbers, determine which is larger. **R**
- a** 75% and 0.73 **b** $\frac{4}{25}$ and 14% **c** $\frac{2}{3}$ and 0.64
- d** 18% and $\frac{1}{7}$ **e** 0.22 and $\frac{1}{4}$ **f** 55% and $\frac{6}{11}$
- g** 0.93 and $\frac{19}{20}$ **h** 60% and $\frac{13}{25}$ **i** $\frac{1}{6}$ and 0.08
- 8** Arrange each set of numbers in ascending order. **R**
- a** $\frac{4}{5}$, 78%, 0.75, $\frac{9}{11}$ **b** 22%, $\frac{1}{4}$, 0.29, $\frac{7}{20}$ **c** 0.62, $\frac{3}{5}$, 57%, 0.605
- 9** Which list of numbers is arranged in descending order? Select **A**, **B**, **C**, or **D**. **R**
- A** $\frac{4}{11}$, $\frac{2}{5}$, 0.41, 43% **B** $\frac{2}{5}$, 0.41, $\frac{4}{11}$, 43%
- C** 43%, 0.41, $\frac{2}{5}$, $\frac{4}{11}$ **D** 0.41, $\frac{4}{11}$, 43%, $\frac{2}{5}$
- 10** Arrange each set of numbers in descending order. **R**
- a** $\frac{9}{20}$, 0.47, $\frac{2}{5}$, 43% **b** 0.08, 86%, $\frac{21}{25}$, 0.88 **c** 0.905, $\frac{19}{20}$, 91%, $\frac{9}{10}$

EXAMPLE
11

6.04

Mental skills 6A: Maths without calculators ANSWERS ON P. 561

Finding 10%, 20% and 5%

To find 10% or $\frac{1}{10}$ of a number, simply divide the number by 10 by moving the decimal point one place to the left.

1 Study each example.

- a** $10\% \times 150 = 150 \div 10 = 15$
- b** $10\% \times \$1256.80 = \$1256.80 \div 10 = \$125.68$
- c** $10\% \times 4917 = 4917 \div 10 = 491.7$
- d** $10\% \times \$48.55 = \$48.55 \div 10 = \$4.855$

2 Now find 10% of each amount.

- | | | | |
|------------------|------------------|--------------------|----------------------|
| a 190 | b \$75 | c 875 | d \$202 |
| e \$37.60 | f 400 | g \$9.25 | h 896 |
| i \$2700 | j \$3.80 | k \$1527.60 | l \$72.50 |
| m 3154 | n \$10.70 | o 426 | p \$24 317.60 |



20% is 10% doubled so to find 20% of a number, first find 10% then double it.

3 Study each example.

a $20\% \times 700$

$10\% \times 700 = 70$

$\therefore 20\% \times 700 = 70 \times 2 = 140$

c $20\% \times 325$

$10\% \times 325 = 32.5$

$\therefore 20\% \times 325 = 32.5 \times 2 = 65$

b $20\% \times \$876$

$10\% \times \$876 = \87.60

$\therefore 20\% \times \$876 = \$87.60 \times 2 = \$175.20$

d $20\% \times \$38.50$

$10\% \times \$38.50 = \3.85

$\therefore 20\% \times \$38.50 = \$3.85 \times 2 = \$7.70$

4 Now find 20% of each amount.

a 50

b 620

c \$2450

d \$8.60

e 72

f \$12 700

g 390

h \$5.80

i \$45

j \$84

k \$4600

l 320

5% is half of 10%, so to find 5% of a number, first find 10% then divide it by 2.

5 Study each example.

a $5\% \times 180$

$10\% \times 180 = 18$

$\therefore 5\% \times 180 = 18 \div 2 = 9$

c $5\% \times 120$

$10\% \times 120 = 12$

$\therefore 5\% \times 120 = 12 \div 2 = 6$

b $5\% \times \$76$

$10\% \times \$76 = \7.60

$\therefore 5\% \times \$76 = \$7.60 \div 2 = \$3.80$

d $5\% \times \$142.20$

$10\% \times \$142.20 = \14.22

$\therefore 5\% \times \$142.20 = \$14.22 \div 2 = \$7.11$

6 Now find 5% of each amount.

a 2000

b \$12

c 50

d \$27

e \$36.80

f \$84

g 800

h 130

i \$9.60

j \$138

k \$72

l 840

6.05 Fraction and percentage of a quantity



Fraction and percentage of a quantity



Percentage crossnumber



Percentages

Example 12

Find:

a $\frac{1}{5} \times 45$

b $\frac{7}{8} \times \$32$

c $\frac{1}{3}$ of one year

d $\frac{4}{5}$ of 2 kg (in grams)



Solution

a $\frac{1}{5} \times 45 = 45 \div 5$
 $= 9$

c $\frac{1}{3}$ of 1 year $= \frac{1}{3} \times 12$ months
 $= 4$ months

d $\frac{4}{5}$ of 2 kg $= \frac{4}{5} \times 2000$ g
 $= \left(\frac{1}{5} \times 2000\right) \times 4$
 $= 400 \text{ g} \times 4$
 $= 1600 \text{ g}$

b $\frac{7}{8} \times \$32 = \left(\frac{1}{8} \times \$32\right) \times 7$
 $= \$4 \times 7$
 $= \$28$

Convert 1 year to 12 months.

Convert 2 kg to 2000 g.



Fractions of words



Percentages of an amount



Percentages of an amount

6.05

Percentage of a quantity

To find a **percentage of a quantity**, calculate:

$$\frac{\text{percentage}}{100} \times \text{quantity} \quad \text{or} \quad \text{percentage} \div 100 \times \text{quantity}$$

Example 13

Find:

- a** 8% of \$400
- b** 12.5% of 1 hour (in minutes)
- c** 20% of 3 m (in centimetres).

Solution

a 8% of \$400 $= \frac{8}{100} \times \$400$
 $= \$32$

or $8 \div 100 \times \$400$ or $0.08 \times \$400$

b 12.5% of 1 h $= 12.5\% \times 60$ min
 $= \frac{12.5}{100} \times 60$ min
 $= 7.5$ min

Convert 1 h to 60 min

or $12.5 \div 100 \times 60$ or 0.125×60

c 20% of 3 m $= 20\% \times 300$ cm
 $= \frac{20}{100} \times 300$ cm
 $= 60$ cm

Convert 3 m to 300 cm

or $20 \div 100 \times 300$ or 0.2×300



Fraction and percentage of a quantity

**EXERCISE 6.05** ANSWERS ON P. 561**Fraction and percentage of a quantity UFR**EXAMPLE
12**1** Find:

a $\frac{3}{5} \times 40$

b $\frac{1}{4} \times 28$

c $\frac{1}{6} \times 24$

d $\frac{2}{3} \times 15$

e $\frac{7}{10} \times 60$

f $\frac{5}{8} \times 16$

g $\frac{3}{4}$ of 1 km (in metres)

h $\frac{1}{3}$ of 1 day (in hours)

i $\frac{2}{5}$ of 1 L (in mL)

j $\frac{1}{8}$ of 1 t (in kg)

k $\frac{5}{6}$ of 1 year (in months)

l $\frac{7}{12}$ of 1 hour (in minutes)

2 What is 35% of \$75? Select the correct answer **A, B, C,** or **D.****A** \$40**B** \$110**C** \$26.25**D** \$48.75EXAMPLE
13**3** Find:**a** 11% of \$500**b** 2% of 250 kg**c** 13% of 150 L**d** 21% of 600 cm**e** 15% of \$450**f** 5% of 5700 g**g** 42% of 1128 m**h** 112% of 256 km**i** 19.4% of 785 mL**j** 7.1% of \$220**k** 23.6% of \$380**l** 11.3% of 403 kg**m** 110% of 95**n** 150% of 302**o** 130% of \$2010**p** 105% of 120 m**q** 170% of 350 g**r** 115% of \$400**4** Taffy the cat had a mass of 2.7 kg when she was found. If her mass increased by $\frac{1}{4}$, how much did she gain?

Shutterstock.com/Galushko Sergey

5 A **discount** is a saving made between the original price of an item and the cheaper price.**a** How much do you *save* if you get a 25% discount on a \$420 games system?**b** What would be the discount price of the games system?**6** An Airbus can seat 351 passengers. If the plane flew with $\frac{2}{3}$ of the seats occupied, how many passengers were on the flight?

Foundation Standard Complex





- 7** Calculate each amount (convert to a smaller unit first).
- a** 12% of 8 m **b** 35% of 1 tonne **c** $\frac{1}{5}$ of 12 hours
- d** $2\frac{1}{2}\%$ of 3 litres **e** $\frac{3}{4}$ of 15 kg **f** $7\frac{1}{2}\%$ of 12 km
- g** 35% of 10 days **h** $\frac{1}{8}$ of 4 hours **i** 67.5% of 40 g
- 8** 12% of the 525 swimmers at the swimming carnival wore black caps. How many swimmers wore black caps?
- 9** Haroula earns \$17.20 an hour in her part-time job. If she is given a 5% pay increase, by how much does her hourly rate increase?
- 10** If 42% of the 650 road deaths occurred on country roads, how many road deaths happened in the country?
- 11** In a city of 3 million people, 1% of the population are doctors. How many doctors are there? Select **A**, **B**, **C** or **D**.
- A** 3 **B** 3000 **C** 300 **D** 30 000
- 12** $\frac{1}{20}$ of the cars produced in a factory were found to have steering defects. If 340 cars were produced, how many had steering defects?
- 13** How many children are there in a crowd of 40 530 if $\frac{3}{5}$ are children?
- 14** If 70% of the seats at a rock concert must be sold to make a profit, how many must be sold in a 2000-seat theatre?
- 15** Copy and complete each equation. **R**
- a** $20\% \times \underline{\hspace{2cm}} = \18 **b** $15\% \times \underline{\hspace{2cm}} = \75

6.05

Technology

Discounts

In this activity, you will calculate the discount and sale price of items in a department store given their original price.

- 1** Enter the following data into a spreadsheet. Make the headings in row 1 **bold**.

	A	B	C	D	E
1	Item	Original Price	% Discount	Discount	Sale Price
2	Backpack	\$69.95	10%	=B2*C2	
3	Headphones	\$38.00	5%		
4	Beach towel	\$20	30%		
5	Book	\$29.95	15%		
6	Swimwear	\$60	20%		
7	Media player	\$145	10%		

Foundation Standard Complex

9780170453141

Chapter 6 | Fractions and percentages

247





- 2 Cell D2 shows the formula for calculating the discount on the backpack. Right-click on D2 and **Fill Down** to copy the formula down to cell D7. This will calculate the discount that applies to each item.
- 3 In cell E2, enter the formula **=B2-D2** to calculate the sale price of the backpack. Use **Fill Down** to calculate the sale prices of the remaining items.

6.06 Expressing amounts as fractions and percentages



Calculating percentages



Money and percentages review



Calculating percentages



Percentages



Online discounts



Coffee shop sales

Expressing amounts as fractions and percentages

To write an amount as a fraction of a whole amount:

- write the amount in the numerator of the fraction
- write the whole amount (total) in the denominator

$$\text{Fraction} = \frac{\text{amount}}{\text{whole amount}}$$

To write an amount as a percentage of a whole amount:

- write the amount in the numerator of a fraction
- write the whole amount (total) in the denominator
- multiply by 100%

$$\text{Percentage} = \frac{\text{amount}}{\text{whole amount}} \times 100\%$$

Example 14

There were 250 people at the school fete, and 160 of them were children.

- a What fraction of the people at the fete were children?
- b What percentage of the people at the fete were children?

Solution

$$\begin{aligned} \text{a Fraction} &= \frac{\text{Number of children}}{\text{Total number of people}} \\ &= \frac{160}{250} \\ &= \frac{16}{25} \end{aligned}$$

$$\begin{aligned} \text{b Percentage} &= \frac{160}{250} \times 100\% \\ &= 64\% \end{aligned}$$

Example 15

Express 36 minutes as:

- a a fraction of an hour
- b a percentage of an hour

Solution

Quantities need to be expressed in the same units, so change 1 hour to 60 minutes.

$$\text{a Fraction} = \frac{36}{60} = \frac{3}{5}$$

$$\begin{aligned} \text{b Percentage} &= \frac{36}{60} \times 100\% \\ &= 60\% \end{aligned}$$



EXERCISE 6.06 ANSWERS ON P. 561**Expressing amounts as fractions and percentages** U F P S R

1 Convert each test mark into a simplified fraction.

a 50 out of 100

b 38 out of 50

c 87 out of 100

d 8 out of 12

e 5 out of 20

f 45 out of 120

2 Convert each test mark in question **1** into a percentage.

3 A hockey team scored 8 goals. If one player scored 5 of them, what is this as a percentage of the team score?



Shutterstock.com/Alexander Kalina

4 In a class of 25 students, 6 ride bikes, 10 walk to school and the rest catch the bus.

a What fraction walk to school?

b What percentage catch the bus?

5 Wakeel answered 21 questions correctly out of 24 in his driving test. If the pass mark is 95%, did he pass? **PS R**

6 The World Cup cricket final attracted 86 000 people to the game, but 94 500 tickets were sold before the match.

a What fraction of the sold tickets were used?

b What percentage (correct to the nearest whole number) of the sold tickets were not used?

7 Tania earns \$1340 a week. She pays \$428.80 in tax and saves \$180 a week.

a What percentage of Tania's earnings is paid in tax?

b What fraction of her earnings does Tania save?

c What percentage (correct to one decimal place) of her earnings does Tania save?

8 Louise sells a house for \$458 000. If the real estate agent is paid a commission of \$22 900, what percentage of the sale price does the agent receive?

EXAMPLE
14

6.06

Foundation Standard Complex

9780170453141

Chapter 6 | Fractions and percentages

249



EXAMPLE
15

- 9** The Great Gals are having a sale on microwave ovens. The sale price of each oven is listed below, along with the discount. **PS R**



- a** Calculate the original price of each microwave oven.
b Calculate, to one decimal place, the percentage discount on each oven.
c Which oven has the greatest percentage discount?

- 10** Jamal bought a pair of roller skates for \$180 and sold them at a profit of \$45. What is the profit as a percentage? Select the correct answer **A, B, C, or D.** **PS**

A 25% **B** 4% **C** 45% **D** 20%

- 11** Express each measurement as a simplified fraction.

a 5 min of 1 h **b** 250 mL of 1 L **c** 700 m of 1 km **d** 230 kg of 1 t
e 75c of \$6 **f** 40 min of 4 h **g** 300 g of 2 kg **h** \$3.80 of \$14
i 12 h of 4 days **j** 75 mm of 20 cm **k** 800 m of 1.5 km **l** 400 mL of 3.5 L

- 12** Express each measurement in question **11** as a percentage.

- 13** What is 40 minutes as a percentage of 2 hours? Select **A, B, C, or D.**

A 20% **B** 5% **C** $33\frac{1}{3}\%$ **D** 0.33%

- 14** A football team is scoring well in its matches if its points percentage is over 100, according to the formula:

$$\text{Points percentage} = \frac{\text{Points for}}{\text{Points against}} \times 100$$

where 'points for' are the total number of points the team has scored and 'points against' are the total number of points the other teams have scored when playing against that team.

- a** Calculate, correct to one decimal place, the points percentage for each team listed in the table. **PS R**

Team	Points for	Points against	Team	Points for	Points against
Broncos	391	313	Raiders	405	466
Bulldogs	410	366	Roosters	296	479
Cowboys	383	452	Sea Eagles	434	235
Dragons	321	395	Sharks	328	279
Eels	407	352	Storm	478	207
Knights	332	382	Tigers	498	642
Panthers	357	469	Titans	319	399
Rabbitohs	275	283	Warriors	688	454

- b** What are the top 4 teams based on these results?

Foundation Standard Complex



Did you know?



Where are the percentages?

Percentages are all around us.

- Financial institutions advertise interest rates they pay on investments and charge on loans as percentages
- Companies report profits or losses as percentages. They also report dividends paid as percentages
- When the value of a product increases or the cost to the consumer of different items increases, it is reported as a percentage.
- Many statistics about the population are given as percentages.

An understanding of percentages is vital to understanding the world we live in.

Find 5 other situations where percentages are used.

6.06

Investigation



Success rates in netball and basketball



Alamy Stock Photo/Action Plus Sports Images

Percentages are a good way of comparing sporting performances. Commentators often give statistics in the form of percentages so that we can compare the success of teams or players.

- 1 In netball, goal shooters rarely have the same number of shooting chances. To work out their success rates, we must use percentages to compare the number of shooting chances with the number of successful shots.

The following statistics were recorded in a match between Australia and New Zealand.

	Australia		New Zealand	
	Shooting chances	Goals	Shooting chances	Goals
1st quarter	15	11	9	9
2nd quarter	25	17	14	13
3rd quarter	18	14	23	20
4th quarter	27	20	18	17



- a** Calculate as a percentage correct to one decimal place:
- i** each team's success rate for each quarter
 - ii** the total success rate for each team.
- b** Comment on the relationship between the success rates and the final scores. What can you say about each team?

- 2** At any stage during the season in the National Basketball League (NBL), the teams will have played different numbers of games. The highest position on the ladder is awarded to the team with the highest **wins percentage**, which is calculated as follows:

$$\text{Wins percentage} = \frac{\text{Number of games won}}{\text{Number of games played}} \times 100\%$$

At one stage of a season the teams had won and lost the number of games shown below.

Team	Won	Lost
Adelaide 36ers	6	6
Cairns Taipans	8	7
Brisbane Bullets	7	4
Melbourne United	6	9
New Zealand Breakers	9	4
Perth Wildcats	3	11
Sydney Kings	11	3
SE Melbourne Phoenix	8	4
Illawarra Hawks	2	12



Alamy Stock Photo/ZUMA Press

Calculate the wins percentage for each team and construct the 'NBL Ladder' showing the teams in the correct order.



Percentage increase and decrease

6.07

- Percentage increase means to increase (make bigger) a quantity by a percentage
- Percentage decrease means to decrease (make smaller) a quantity by a percentage

Example 16

Increase \$200 by 7%.

Solution

Method 1

$$\begin{aligned}7\% \text{ of } \$200 &= \frac{7}{100} \times \$200 \\ &= \$14 \\ \$200 + \$14 &= \$214\end{aligned}$$

$$\text{or } 7 \div 100 \times \$200 \text{ or } 0.07 \times \$200$$

Method 2

$$\begin{aligned}(100\% + 7\%) \text{ of } \$200 &= 107\% \text{ of } \$200 \\ &= \frac{107}{100} \times \$200 \\ &= \$214\end{aligned}$$

$$\begin{aligned}\text{Increasing by } 7\% \text{ is the same as calculating } &107\% \\ \text{or } 107 \div 100 \times \$200 \text{ or } 1.07 \times \$200\end{aligned}$$

Example 17

Decrease \$150 by 12%.

Solution

Method 1

$$\begin{aligned}12\% \text{ of } \$150 &= \frac{12}{100} \times \$150 \\ &= \$18 \\ \$150 - \$18 &= \$132\end{aligned}$$

$$\text{or } 12 \div 100 \times \$150 \text{ or } 0.12 \times \$150$$

Method 2

$$\begin{aligned}(100\% - 12\%) \text{ of } \$150 &= 88\% \text{ of } \$150 \\ &= \frac{88}{100} \times \$150 \\ &= \$132\end{aligned}$$

$$\begin{aligned}\text{Decreasing by } 12\% \text{ is the same as calculating } &88\% \\ \text{or } 88 \div 100 \times \$150 \text{ or } 0.88 \times \$150\end{aligned}$$

Example 18

The price of a watch increases by 15%. If its original price was \$35, find its new price.

Solution

Method 1

$$\begin{aligned}15\% \text{ of } \$35 &= \$5.25 \\ \$35 + \$5.25 &= \$40.25\end{aligned}$$

Method 2

$$\begin{aligned}(100\% + 15\%) \text{ of } \$35 &= 115\% \text{ of } \$35 \\ &= \$40.25\end{aligned}$$



Percentage increase and decrease



Discounts and special offers



Discounts



Discounts



Percentage increase and decrease

6.07



Example 19

Find the price of a computer game system, originally priced at \$420, after a 9% discount.



Shutterstock.com/Saikorn

Solution

Method 1

$$9\% \text{ of } \$420 = \$37.80$$

$$\$420 - \$37.80 = \$382.20$$

Method 2

$$(100\% - 9\%) \text{ of } \$420 = 91\% \text{ of } \$420$$

$$= \$382.20$$

EXERCISE 6.07 ANSWERS ON P. 562

Percentage increase and decrease **U F P S R C**

EXAMPLE 16

1 Increase:

- | | | |
|-----------------------|-----------------------|-----------------------|
| a \$150 by 5% | b 400 by 20% | c 60 km by 22% |
| d \$2500 by 6% | e 95 kg by 60% | f 10 L by 33% |

EXAMPLE 17

2 Decrease:

- | | | |
|-----------------------|------------------------|-----------------------|
| a \$440 by 60% | b 120 by 15% | c 110 kg by 8% |
| d \$325 by 25% | e 2000 L by 38% | f \$1570 by 3% |

EXAMPLE 18

3 Wooden chairs cost \$172 to make. Calculate the selling price if the chairs are marked up by 35% when sold. **PS**

4 Julie buys a bike for \$2700 and sells it a year later, making a 15% profit.

- How much profit did Julie make?
- What was the selling price of the bike?

5 Geeva's weekly pay of \$980 increased by 4.5%. What is his new pay?

6 Yumi's height of 168 cm increased by 2%. What is her new height?

7 A department store has a mark-up of 200% on clothing. If the store buys a vest for \$12, what will be its selling price after the mark-up? Select the correct answer **A**, **B**, **C**, or **D**.

- | | | | |
|---------------|------------------|---------------|---------------|
| A \$32 | B \$14.40 | C \$24 | D \$36 |
|---------------|------------------|---------------|---------------|

EXAMPLE 19

8 A car dealer offers a 15% discount on all new car purchases. What would you pay for a car marked at \$21 990?

9 Calculate the sale price of a pair of sports shoes marked at \$165 after a discount of 12%.





- 10** After speed cameras were installed, the road toll of 840 deaths decreased by 5%. What is the new road toll?



iStock.com/Michele Jackson

- 11** Aaron bought a house for \$464 000 and sold it 10 years later, making a 150% profit. Calculate the selling price of the house.
- 12** What is the new price of a pair of jeans worth \$75 if they are discounted by 25%? Select **A**, **B**, **C**, or **D**.
- A** \$50 **B** \$56.25 **C** \$18.75 **D** \$55
- 13** A netball sells for \$45, but you receive a 11% discount if you buy 2. What is the discounted price of 2 netballs? **PS**
- 14** The owner of a store buys a tablet device for \$470. She adds a mark-up of \$70 but, at sale time, offers a 30% discount. **PS**
- a** Find the selling price after the mark-up.
b Find the discounted price at sale time.
c How much loss did the store owner make on the tablet device?
d Calculate the percentage loss correct to one decimal place.
- 15** Find the number which, if increased by 18%, gives 767. **R**
- 16** Winter coats priced at \$830 were reduced by 15% at the end-of-season sale. On the last weekend of the sale, they were reduced by a further 40% off the discounted price. What was the final price of a coat? **PS R**
- 17** Find the number which, if decreased by 40%, gives 306. **R**
- 18** A portable air conditioner with an original price of \$680 has 10% GST added to it. It is then sold at an end-of-year sale for '10% off'. Is the sale price of the air conditioner more than, less than, or equal to its original price? Justify your answer by calculation. **PS R C**

6.07

Foundation Standard Complex

9780170453141

Chapter 6 | Fractions and percentages

255



6.08 Percentages without calculators



If we know the equivalent fractions for common percentages, then we can find percentages mentally.

Fraction	$\frac{1}{4}$	$\frac{1}{2}$	$\frac{3}{4}$	$\frac{1}{3}$	$\frac{2}{3}$	$\frac{1}{5}$	$\frac{2}{5}$	$\frac{3}{5}$	$\frac{1}{10}$	$\frac{1}{8}$
Percentage	25%	50%	75%	$33\frac{1}{3}\%$	$66\frac{2}{3}\%$	20%	40%	60%	10%	$12\frac{1}{2}\%$

Example 20

Calculate each percentage mentally.

a $33\frac{1}{3}\%$ of \$1800

b $12\frac{1}{2}\%$ of 72 kg

Solution

a $33\frac{1}{3}\%$ of \$1800 = $\frac{1}{3}$ of \$1800
= \$600

b $12\frac{1}{2}\%$ of 72 kg = $\frac{1}{8}$ of 72 kg
= 9 kg

Example 21

a Increase \$470 by 10%.

b Decrease \$75 by 20%.

Solution

a 10% of \$470 = $\frac{1}{10} \times \$470$
= \$47
\$470 + \$47 = \$517

b 20% of \$75 = $\frac{1}{5} \times \$75$ (or $10\% \times \$75 \times 2$)
= \$15
\$75 - \$15 = \$60

Note: More examples and exercises on increasing and decreasing an amount by a percentage mentally can be found in Mental skills 6B: Percentage increase and decrease on p.258.



Shutterstock.com/Lin Xiu Xiu

EXERCISE 6.08 ANSWERS ON P. 562**Percentages without calculators** **U F P S R**

Complete this exercise without using a calculator.

1 Find 25% of each amount.

- a** 32 kg **b** 180 mm **c** 24 L **d** \$1000

2 Find 40% of \$60. Select the correct answer **A, B, C,** or **D.**

- A** \$6 **B** \$12 **C** \$24 **D** \$48

3 Find each amount.

- a** 50% of 36 m **b** 75% of 12 g **c** $12\frac{1}{2}\%$ of 24 h
d 20% of 5 L **e** $66\frac{2}{3}\%$ of \$30 **f** 60% of 20 km
g 25% of 20 mL **h** $33\frac{1}{3}\%$ of 18 days **i** 75% of 100 kg

4 Find 10% of:

- a** 60 tonnes **b** 40 hours **c** 300 sheep **d** \$90

5 Find each amount.

- a** 10% of 70 **b** 50% of \$80 **c** 40% of 120 minutes
d 30% of \$210 **e** 60% of 250 cm **f** 20% of 400 mL

6 What is 5% of 80 days? Select **A, B, C,** or **D.**

- A** 8 days **B** 4 days **C** 40 days **D** 80 days

7 Find $12\frac{1}{2}\%$ of each amount.

- a** \$72 **b** 40 kg **c** 160 kL

8 Increase:

- a** \$80 by 25% **b** 140 by 10% **c** \$150 by $33\frac{1}{3}\%$
d 28 by 50% **e** \$240 by $12\frac{1}{2}\%$ **f** 45 by 20%

9 Decrease:

- a** \$310 by 10% **b** 120 by 20% **c** \$80 by $12\frac{1}{2}\%$
d 60 by 5% **e** \$900 by $66\frac{2}{3}\%$ **f** 2000 by 75%

10 A class of 28 students sat for a History test out of 40. After 25 minutes, Leonie had already answered 60% of the test correctly. **PS R**

- a** How many marks has Leonie already scored?
b If Leonie's goal is to obtain 85% or more in the test, how many more marks will she need?

EXAMPLE
20

6.08

EXAMPLE
21

Mental skills 6B: Maths without calculators ANSWERS ON P. 562

Percentage increase and decrease

The fraction equivalents of commonly-used percentages can help us when we need to increase or decrease a number by a percentage.

Percentage	10%	$12\frac{1}{2}\%$	20%	25%	$33\frac{1}{3}\%$	50%	$66\frac{2}{3}\%$	75%
Fraction	$\frac{1}{10}$	$\frac{1}{8}$	$\frac{1}{5}$	$\frac{1}{4}$	$\frac{1}{3}$	$\frac{1}{2}$	$\frac{2}{3}$	$\frac{3}{4}$

1 Consider each example.

a Increase 80 by 20%

$$\begin{aligned} 20\% \text{ of } 80 &= \frac{1}{5} \times 80 & \text{or} & \quad 10\% \text{ of } 80 = 8 \\ &= 80 \div 5 & & \quad 20\% \text{ of } 80 = 8 \times 2 \\ &= 16 & & \quad = 16 \\ 80 + 16 &= 96 \end{aligned}$$

b Increase \$36 by $66\frac{2}{3}\%$

$$\begin{aligned} 66\frac{2}{3}\% \text{ of } 36 &= \frac{2}{3} \times 36 \\ &= \$36 \div 3 \times 2 \\ &= \$12 \times 2 \\ &= \$24 \\ \$36 + \$24 &= \$60 \end{aligned}$$

2 Now increase:

- a** \$280 by 10% **b** 45 by $33\frac{1}{3}\%$ **c** 25 by 20% **d** \$400 by $12\frac{1}{2}\%$
e 64 by 50% **f** \$72 by 25% **g** \$55 by 10% **h** 90 by $66\frac{2}{3}\%$
i 120 by 75% **j** \$80 by 5% **k** \$250 by 20% **l** 70 by 40%

3 Consider each example.

a Decrease 225 by $33\frac{1}{3}\%$

$$\begin{aligned} 33\frac{1}{3}\% \text{ of } 225 &= \frac{1}{3} \times 225 \\ &= 225 \div 3 \\ &= 75 \\ 225 - 75 &= 150 \end{aligned}$$

b Decrease \$70 by 15%

$$\begin{aligned} 10\% \text{ of } \$70 &= \frac{1}{10} \times \$70 = \$7 \\ \therefore 5\% \text{ of } \$70 &= \frac{1}{2} \times \$7 = \$3.50 \\ \therefore 15\% \text{ of } \$70 &= (10\% \times \$70) + (5\% \times \$70) \\ &= \$7 + \$3.50 \\ &= \$10.50 \\ \$70 - \$10.50 &= \$59.50 \end{aligned}$$

4 Now decrease:

- a** \$480 by 25% **b** 60 by $33\frac{1}{3}\%$ **c** 110 by 20% **d** \$25 by 10%
e 900 by 50% **f** \$72 by $12\frac{1}{2}\%$ **g** \$320 by 75% **h** 150 by $66\frac{2}{3}\%$
i \$63 by 20% **j** \$100 by $12\frac{1}{2}\%$ **k** 250 by 10% **l** \$150 by 30%

The unitary method

6.09

If we know the percentage of an amount, but not the actual amount, we can use the **unitary method** to find the whole amount. The word **unit** means ‘one’, and with the unitary method we find 1% first.

Example 22

If 15% of an amount is \$75, what is the amount?

Solution

$$15\% \text{ of amount} = \$75$$

$$\begin{aligned} 1\% \text{ of amount} &= \$75 \div 15 \\ &= \$5 \end{aligned}$$

Find 1% first by dividing by 15.

$$\begin{aligned} 100\% \text{ of amount} &= \$5 \times 100 \\ &= \$500 \end{aligned}$$

Then find the whole amount by multiplying by 100.

The amount is \$500.

Check: $15\% \times \$500 = \75



The unitary method



The unitary method



Working with percentages

6.09

The unitary method

To find an amount given a **percentage** of the amount:

- first find 1% of the amount by dividing by the known percentage
- then multiply by 100 to find the whole amount (100%).

Example 23

Farmer Kate lost 30% of her sheep in a flood. If she had 560 sheep left, how many sheep did she have before the flood?

Solution

Because 30% of the total were lost,
 $100\% - 30\% = 70\%$ of the total were left.

So: 70% of the total = 560 sheep

$$\begin{aligned} 1\% \text{ of the total} &= 560 \div 70 \\ &= 8 \text{ sheep} \end{aligned}$$

$$\begin{aligned} 100\% \text{ of the total} &= 8 \times 100 \\ &= 800 \text{ sheep} \end{aligned}$$

Kate had 800 sheep before the flood.

Check: $70\% \times 800 = 560$



EXERCISE 6.09 ANSWERS ON P. 562

The unitary method U F P S R

EXAMPLE 22

- 1** What is the whole amount if:
- | | | |
|----------------------------------|-----------------------------------|-------------------------------------|
| a 10% of it is \$70? | b 25% of it is \$140? | c 17% of it is \$782? |
| d 8.5% of it is \$161.50? | e 16% of it is 64 cm? | f 20% of it is 56 kg? |
| g 42% of it is 1.26 m? | h 30% of it is 45 minutes? | i 70% of it is \$280? |
| j 110% of it is \$396? | k 45% of it is 180 kg? | l 120% of it is 132 minutes? |

2 The deposit of 15% on a kitchen stove is \$180. What is the price of the stove? **PS R**

3 There were 51 870 men in the crowd at the football match. If this was 65% of the crowd, what was the total attendance? **PS R**

4 Last year Joanna paid \$23 009.28 in income tax. If this represents 28% of her income, calculate her income. **PS R**

EXAMPLE 23

5 Jude sold his car for \$12 200, making a loss of 20% on the original price. What was the original price? **PS R**

6 Pip makes 18% profit on cakes she decorates. If she sells a cake for \$330.40, what was the original cost of the cake? Select the closest answer

- A, B, C** or **D.** **PS R**
- | | |
|----------------|----------------|
| A \$184 | B \$238 |
| C \$271 | D \$280 |



iStock.com/Larisa Sadoimtseva

7 Binnsville's population increased by 5%, or 1200 people. What was the old population? **PS R**

8 The interest earned on an investment is \$168. If the interest rate is 5.6%, how much was invested? **PS R**

9 Venus buys a dress that has been discounted by 25%. If the sale price is \$225, what was the original price of the dress? **PS R**

10 Matthew buys a tent for \$348 at a discount of 20%. What was the original price of the tent? **PS R**



Profit, loss and GST

6.10

Profit and loss

Retailers (store owners) buy goods and sell them to people.

- **Cost price** is how much they buy the item for
- **Selling price** is how much they sell them for
- If they sell the item for more than what they paid for it, they make a **profit**
- If they sell the item for less than what they paid for it, they make a **loss**

The **percentage profit** or **percentage loss** is usually calculated as a percentage of the cost price.

Example 24

The Book Bin buys books for \$18 each and sells them for \$22.50. For each book, calculate:

a the profit

b the percentage profit.

Solution

a Cost price = \$18

Selling price = \$22.50

$$\begin{aligned}\text{Profit} &= \$22.50 - \$18 \\ &= \$4.50\end{aligned}$$

selling price – cost price

b Percentage profit = $\frac{\$4.50}{\$18} \times 100\%$
 $= 25\%$

$$\frac{\text{profit}}{\text{cost price}} \times 100\%$$

Example 25

Renae buys a car for \$17 500 and sells it 2 years later for \$15 000. Find the percentage loss, correct to one decimal place.

Solution

Cost price = \$17 500

Selling price = \$15 000

$$\begin{aligned}\text{Loss} &= \$17\,500 - \$15\,000 \\ &= \$2500\end{aligned}$$

cost price – selling price

Percentage loss = $\frac{\$2500}{\$17\,500} \times 100\%$
 $= 14.2857\dots\%$
 $\approx 14.3\%$

$$\frac{\text{loss}}{\text{cost price}} \times 100\%$$



Profit and loss



Profit and loss



Business maths



Profit and loss

6.10



Example 26

Cooper buys a mountain bike for \$850 and sells it a year later at 13% profit. Find the selling price.

Solution

$$\begin{aligned} \text{Profit} &= 13\% \times \$850 \\ &= \$110.50 \end{aligned}$$

$$\begin{aligned} \text{Selling price} &= \$850 + \$110.50 \\ &= \$960.50 \end{aligned}$$

$$\begin{aligned} \text{OR Selling price} &= (100\% + 13\%) \times \$850 \\ &= 113\% \times \$850 \\ &= \$960.50 \end{aligned}$$

Increasing \$850 by 13%

GST

Goods and Services Tax (GST) is a tax paid to the government on most goods (items) and services that we purchase. In Australia, GST is charged at 10% of the original price and is generally included in the marked price of the good or service.



GST

Example 27

The selling price of a TV is \$722 + 10% GST. Calculate:

- a the GST payable
- b the selling price

Solution

$$\begin{aligned} \text{a GST} &= 10\% \text{ of } \$722 \\ &= \$72.20 \end{aligned}$$

$$\begin{aligned} \text{b Selling price} &= \$722 + \$72.20 \\ &= \$794.20 \end{aligned}$$

$$\begin{aligned} \text{OR Selling price} &= 110\% \times \$722 \\ &= \$794.20 \end{aligned}$$



GST

Example 28

The selling price of a lounge suite is \$2695 with GST included. How much of this price is the GST?

Solution

$$\text{Selling price} + \text{GST} = 100\% + 10\% = 110\%$$

$$110\% \text{ of the selling price} = \$2695$$

$$\begin{aligned} 10\% \text{ GST} &= \$2695 \div 11 \\ &= \$245 \end{aligned}$$



EXERCISE 6.10 ANSWERS ON P. 562**Profit, loss and GST U F P S R**

1 In each situation, state:

- i** the cost price
 - ii** whether a profit or loss was made.
- a** A car was bought for \$18 700 and sold for \$15 000.
b A house was bought for \$543 000 and sold for \$674 000.
c A video camera was sold for \$350 when it originally cost \$799.
d An antique desk sold for \$8000 when it was purchased for \$6800.

2 For each situation, find:

- i** the profit
 - ii** the percentage profit, correct to one decimal place where necessary.
- a** cost price \$85 selling price \$102
b cost price \$415 selling price \$600
c cost price \$2.75 selling price \$4.20

3 For each situation, find:

- i** the loss
 - ii** the percentage loss, correct to one decimal place where necessary.
- a** cost price \$19 selling price \$14
b cost price \$2700 selling price \$1450
c cost price \$79 selling price \$58

4 Anthony bought a computer for \$519 and sold it 3 years later for \$220. Calculate his percentage loss, correct to 1 decimal place. Select the closest answer **A**, **B**, **C** or **D**.

- A** 26.2% **B** 42.4% **C** 57.6% **D** 172.8%

5 A 3D printer costing \$1250 is sold for \$1400. Find:

- a** the profit **b** the percentage profit.

6 A car costing \$17 000 is sold for \$15 200. Find:

- a** the loss **b** the percentage loss, correct to one decimal place

7 Calculate the selling price for each situation.

- a** cost price \$200 profit 17% **b** cost price \$42 profit 70%
c cost price \$720 loss 35% **d** cost price \$1400 loss 9.5%
e cost price \$2.50 profit 150% **f** cost price \$27 loss 40%

8 A block of land is purchased by Erin and Mark for \$133 000. Six years later, they sell it for \$164 000. Calculate their percentage profit, correct to 2 decimal places. **PS**

6.10EXAMPLE
24EXAMPLE
25EXAMPLE
26



EXAMPLE
27

9 Rose buys a bed for \$2700. She later sells it for \$1500. Calculate her percentage loss, correct to one decimal place. **PS**

10 For each item, calculate the GST payable and the final price.

- | | |
|--|---|
| a a car priced at \$20 900 | b a home entertainment unit priced at \$1810 |
| c an ice cream priced at \$3.00 | d a theatre ticket priced at \$145 |
| e plumber's fees of \$180 | f a desk lamp priced at \$27 |

EXAMPLE
28

11 Given that the final price of each item has GST included, calculate the GST and the original price, correct to the nearest cent. **PS R**

- | | |
|-----------------------------------|--|
| a accountant's fees: \$792 | b piano lessons: \$198 per term |
| c refrigerator: \$924 | d box of chocolates: \$18.70 |
| e travel guide: \$34.65 | f diary: \$16.70 |

12 A manufacturer sells TVs to stores for \$899 each. *Electric City* store adds on 60% profit for its selling price. It then must add on 10% GST. **PS R**

- a** Calculate the store's selling price of one TV before GST is added. Round your answer to the nearest \$10.
- b** Calculate the final selling price of each television after GST is added.
- c** In the January sales all goods are sold at 40% off the marked price. Calculate the discounted price of a TV.
- d** Find how much of this discounted price will be paid in GST by dividing by 11.
- e** After paying GST to the government, does the store make a profit or a loss on each TV? How much profit or loss?
- f** Calculate the percentage profit or loss. Round your answer to one decimal place.

Investigation



Uses of percentages

- 1 Prepare a one-page percentage collage for class display. Look through newspapers, magazines and brochures for examples to cut out. Find photographs or draw situations where percentages are used.
- 2 Select 2 examples of situations where percentages are used. Write a set of 10 questions for each example, using the rules about percentages you have learnt. Calculate the answers.
- 3 Swap the questions you wrote in question 2 with others in the class. Each person should answer at least 3 sets of questions. Ask the student who prepared the questions to mark your answers. If there are any disagreements, check with your teacher.



Extension: Simple interest

6.11

Banks, credit unions and other financial institutions reward you by paying you interest on your savings or investments. However, they also charge you interest if you borrow money from them.

- The original amount of money invested or borrowed is called the **principal**.
- **Interest** is calculated as a percentage of the principal.
- This percentage is called the **interest rate**, usually written as a rate **per annum** ('per year'), abbreviated 'p.a.'
- **Simple interest** (or **flat rate interest**) is interest calculated simply on the original principal.

YEAR 9
STAGE 5.1



Simple interest

6.11

Example 29

Find the simple interest paid on \$7500 borrowed at 8% p.a. for:

a 1 year

b 3 years

Solution

a Interest = 8% of \$7500
= \$600

b Interest = 8% of \$7500 \times 3
= \$1800

The simple interest formula

$I = Prn$, where:

I is the simple interest

P is the principal

r is the interest rate per year, expressed as a decimal

n is the number of years

Applying this to the above example,

$$P = \$7500, r = 8\% = 0.08, n = 3 \text{ years}$$

$$\begin{aligned} I &= Prn \\ &= \$7500 \times 0.08 \times 3 \\ &= \$1800 \end{aligned}$$

Example 30

Find the simple interest earned on \$8620 invested at 2.4% p.a. for 7 months.

Solution

$$\begin{aligned} P &= \$8620, r = 2.4\% = 0.024, \\ n &= 7 \text{ months} = \frac{7}{12} \text{ years} \end{aligned}$$

Divide by 12 to convert 7 months into years

$$\begin{aligned} I &= Prn \\ &= \$8620 \times 0.024 \times \frac{7}{12} \\ &= \$120.68 \end{aligned}$$



Simple interest

Extension: Simple interest **U F P S**

Round answers to the nearest cent if needed.

- 1** Which of the following is the simple interest earned on \$600 at 5% p.a. for 4 years?

Select the correct answer **A, B, C,** or **D.**

A \$20 **B** \$30 **C** \$80 **D** \$120

- 2** Find the simple interest paid on a loan of:

a \$2400 at 5% p.a. for 1 year **b** \$2400 at 5% p.a. for 6 years
c \$820 at 8% p.a. for 4 years **d** \$75 at 4% p.a. for 2 years
e \$16 250 at 3.5% p.a. for 3 years **f** \$6570 at 11.5% p.a. for 5 years
g \$532 at 9.25% p.a. for 8 years **h** \$4200 at 7% p.a. for 2 years
i \$985 at 4.3% p.a. for 1 year **j** \$14 990 at 5.4% p.a. for 3 years

- 3** Find the interest earned if you invest:

a \$5000 at 9% p.a. for 3 years **b** \$7500 at 6% p.a. for 5 years
c \$20 000 at 8% p.a. for 7 years **d** \$45 000 at 12% p.a. for 20 years
e \$875 at 5.8% p.a. for 2 years **f** \$9000 at 6.95% p.a. for 10 years
g \$11 452 at 7.25% p.a. for 6 years **h** \$4500 at 4% p.a. for 3 years
i \$737 at 5% p.a. for 1 year **j** \$2340 at 8% p.a. for 2 years

- 4** Find the simple interest earned on:

a \$1080 at 5% p.a. for 6 months **b** \$700 at 6.5% p.a. for 3 months
c \$2500 at 9% p.a. for 1 month **d** \$40 000 at 3.4% p.a. for 9 months
e \$475 at 2% p.a. for 5 months **f** \$8250 at 4.1% p.a. for 8 months
g \$15 400 at 7% p.a. for 11 months **h** \$4700 at 2.8% p.a. for 17 months
i \$350 at 3% p.a. for 14 months **j** \$12 900 at 4.7% p.a. for 27 months

- 5** Xander borrowed \$7000 from New Century Bank for 3 years at 3.5% p.a. interest. **PS**

a How much interest was he charged?
b How much, including interest, did Xander have to repay the bank?

- 6** Goran borrowed \$30 000 from Nelson Finance to set up a catering business. He is charged 7% p.a. simple interest over 5 years. **PS**

a How much interest will Goran have to pay?
b Calculate the total amount he must repay.
c Goran agrees to repay the loan in monthly payments over 5 years. How much must he repay each month?

- 7** When Jesinta borrowed \$18 000 from a credit union, she was charged 9% p.a. simple interest. **PS**

a How much interest would she pay in one year?
b Her total interest bill was \$6480. For how long did Jesinta borrow the money?

EXAMPLE
29EXAMPLE
30

Percentage problems

6.12

EXERCISE 6.12 ANSWERS ON P. 562

Percentage problems U F P S R



Percentage problems

6.12

- 1 In a box of 180 oranges, 15% are not ripe. How many oranges are not ripe?
- 2 A test result is 65 out of 80. What percentage is this?
- 3 Southside High's hockey team wins 12 games out of 15. What percentage is this?
- 4 A shirt costing \$55 is reduced by 25%. What is the new selling price?
- 5 In some mixed paint, 25% of the mixture is blue, 15% is yellow and the remainder is white. What percentage is white?
- 6 Westvale High's basketball team scored 1065 points in a season. Claire shot 22% of the total points. How many points did Claire score?
- 7 At Upper Darling High, 60% of students are girls. How many boys are there in this school of 870 students? **PS R**
- 8 What percentage of 9 carat gold is pure gold, if pure gold is 24 carat? **PS R**
- 9 When a floor was being tiled, 830 green tiles were used out of a total of 2075 tiles. What percentage of the floor is made of green tiles? **PS R**
- 10 In a Year 1 class of 24 students, there were 3 absent students. Find the percentage of students absent from the class. **PS R**
- 11 A real estate agent earns $2\frac{1}{2}\%$ commission on a sale of \$345 000. How much does the agent earn?
- 12 A worker's pay rate of \$27.30/hour is increased to \$30.40/hour. Find the increase as a percentage of the original pay rate, correct to one decimal place. **PS R**
- 13 Find how much rent is paid if it is 30% of a weekly income of \$875. **PS R**
- 14 Anton receives a 7% pay rise. If his old salary was \$67 000 per year, what is his new salary? Select the correct answer **A, B, C,** or **D.** **PS R**
A \$67 007 **B** \$67 469 **C** \$71 690 **D** \$113 900
- 15 Maxine is a car salesperson. She is paid a retainer of \$620 per week to cover her living expenses, plus 5% of all sales she makes. Maxine's sales in the first week of December total \$74 999. Calculate her pay for that week. **PS R**
- 16 Robert writes novels with a recommended retail price of \$34.95. He is paid 10% royalty on the first 4000 copies sold and 12.5% royalty on the remaining sales. Calculate the royalties Robert will receive if his latest novel sells 11 000 copies. **PS R**

Foundation Standard Complex

9780170453141

Chapter 6 | Fractions and percentages

267

Technology

Weekly budget

In this activity, we will use a spreadsheet to calculate a weekly budget for Abdul, a full-time student with a part-time job in a café.

- 1 Enter Abdul's weekly expenses into a spreadsheet. Highlight cells B2 to B8, right-click on **Format Cells** and **Currency** with **two decimal places**.

	A	B	C
1	Expenses	Weekly Budget	% of total
2	Rent	157.40	
3	Food	80.00	
4	Fares	34.50	
5	Entertainment	37.00	
6	Mobile phone	11.75	
7	Savings	25.00	
8	Total Expenses		

- 2 In cell B8, write a formula to calculate the sum of Abdul's weekly expenses.
- 3 In cell C2, write a formula to calculate the percentage of total expenses spent on rent. Right-click on **Format Cells** and **Number** with **one decimal place**.
- 4 Select cell C2 and **Fill Down** to cell C8 to copy the formula and calculate the percentage of total expenses belonging to each item.
- 5 Highlight cells A1 to B7. Click **Insert, Pie Chart** to create a pie chart (sector graph) and give your pie chart an appropriate title.
- 6 Point your mouse (do **not** click) in each sector of the pie chart to read off the percentage breakdown (in brackets) of Abdul's expenses.



iStock.com/shironosov

Power plus ANSWERS ON P. 562



- 1 A retailer pays \$55 for a chair, then marks it up 60% for the selling price, then adds 10% of this price for GST. Calculate the final selling price.
- 2 Some items increase in value over time, such as jewellery, antiques and real estate. This is called **appreciation**. A gold chain costs \$1500 and appreciates by 8.5% per year. Find:
 - a the value of the chain after one year
 - b the value of the chain after 2 years.
- 3 The Blewes family buys a home for \$480 000, and it appreciates at 4% per year. Calculate the home's value:
 - a after one year
 - b after 2 years
 - c after 5 years
- 4
 - a A number is increased by 25%, then the result is decreased by 25%. Is the final answer more than or less than the original number?
 - b If a number is increased by 25%, then by what percentage must the result be decreased so that the answer is equal to the original number?
- 5 Most items lose value over time. This is called **depreciation**. A Ferrari car costs \$420 000 and depreciates at 15% per year. Calculate how much the Ferrari is worth (correct to the nearest \$100) after:
 - a 1 year
 - b 2 years
 - c 5 years.
- 6
 - a A number is decreased by $33\frac{1}{3}\%$, then the result is increased by $33\frac{1}{3}\%$. Is the final answer more than or less than the original number?
 - b If a number is decreased by $33\frac{1}{3}\%$, then by what percentage must the result be increased so that the answer is equal to the original number?

6.12

CHAPTER 6 REVIEW



Fractions and decimals



Personal business calculations

Language of maths

commission	cost price	decimal	decrease
denominator	discount	fraction	goods and services tax (GST)
improper fraction	increase	loss	lowest common multiple (LCM)
mark-up	mixed numeral	numerator	percentage
profit	proper fraction	quantity	reciprocal
reduction	selling price	simplify	unitary method

- Which words in the list above refer to something getting:
 - bigger?
 - smaller?
- What is the product of a number and its reciprocal?
- Name one good and one service that would have a **GST**.
- The 'cent' in percentage means 100. Find other 'cent' words that are related to 100.
- What do we mean when we say that someone gives '110%' effort or support to something?
- Copy and complete: "A **loss** is made by a retailer if the **cost price** is _____ than the **selling price**."

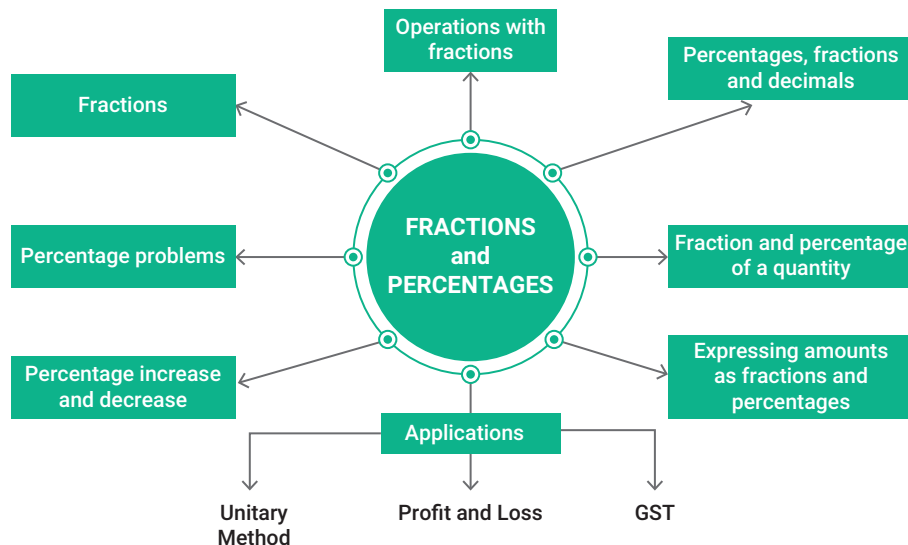


Mind map: Fractions and percentages

Topic summary

- List any rules you remember from your work on fractions and percentages.
- Name at least 3 careers where percentages would be used.
- Is there anything you still do not understand about fractions or percentages? See your teacher.
- Give examples of where you may use fractions or percentages in the future.

Print (or copy) and complete this mind map of the topic, adding detail to its branches and using pictures, symbols and colour where needed. Ask your teacher to check your work.



TEST YOURSELF 6

ANSWERS ON P. 563

1 Simplify each fraction.

a $\frac{6}{8}$

b $\frac{28}{48}$

c $\frac{35}{45}$

2 Convert each improper fraction into a mixed numeral.

a $\frac{15}{4}$

b $\frac{22}{5}$

c $\frac{26}{6}$

3 Convert each mixed numeral into an improper fraction.

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

b $3\frac{2}{3}$

c $6\frac{4}{5}$

4 Arrange these fractions in descending order: $\frac{5}{6}$, $\frac{7}{12}$, $\frac{1}{2}$, $\frac{3}{4}$

5 Evaluate each expression.

a $\frac{1}{3} + \frac{2}{5}$

b $\frac{4}{7} - \frac{1}{2}$

c $\frac{3}{4} + \frac{2}{3}$

d $2\frac{1}{5} + 4\frac{1}{2}$

e $7 - \frac{5}{6}$

f $5\frac{3}{8} - 2\frac{1}{2}$

6 Santi buys 16 m of timber to fix her back deck. She uses $\frac{5}{8}$ of it to fix the deck. What fraction of the timber is left?

7 Evaluate each expression.

a $\frac{7}{8} \times \frac{4}{9}$

b $\frac{4}{5} \times \frac{2}{3}$

c $\frac{6}{7} \times \frac{5}{8}$

d $2\frac{1}{4} \times \frac{3}{10}$

e $\frac{1}{6} \div \frac{5}{12}$

f $5\frac{3}{8} \div 1\frac{1}{2}$

8 In Carrozza Park's population of 27 500, $\frac{3}{5}$ of the people are adults. How many people in Carrozza Park are adults?

9 Convert each percentage into a simplified fraction.

a 74%

b 29%

c 65%

d 157%

10 Convert each percentage into a decimal.

a 12%

b 16.2%

c 2%

d 5.4%

11 Convert each fraction into a percentage.

a $\frac{7}{8}$

b $\frac{12}{50}$

c $\frac{2}{9}$

d $\frac{33}{40}$

12 Convert each decimal into a percentage.

a 0.56

b 0.613

c 0.7

d 0.048

13 Arrange these numbers in ascending order: $\frac{3}{4}$, 0.725, 77%, 0.7

14 Evaluate each expression.

a 15% of 40

b $\frac{1}{4}$ of 64

c 27.5% of \$880

d $\frac{2}{3}$ of 1 year (in months)

e 120% of 90 L

f 35% of 6 m (in cm)

Foundation Standard Complex

9780170453141

Chapter 6 | Fractions and percentages

271

6.01

6.01

6.01

6.01

6.02

6.02

6.03

6.03

6.04

6.04

6.04

6.04

6.04

6.05

