

Chapter

6

Decimals

What you will learn

- 6A Decimals and place value
(Consolidating)
- 6B Rounding decimals
- 6C Addition and subtraction of decimals (Consolidating)
- 6D Multiplying and dividing by powers of 10
- 6E Multiplication of decimals
- 6F Division of decimals
- 6G Decimals and fractions
- 6H Decimals and percentages

Australian curriculum

NUMBER AND ALGEBRA

- 1 Real numbers
 - Multiply and divide fractions and decimals using efficient written strategies and digital technologies (ACMNA154)
 - Round decimals to a specified number of decimal places (ACMNA156)
 - Connect fractions, decimals and percentages and carry out simple conversions (ACMNA157)
 - Find percentages of quantities and express one quantity as a percentage of another, with and without digital technologies. (ACMNA158)
- 2 Money and financial mathematics
 - Investigate and calculate 'best buys', with and without digital technologies (ACMNA174)



Online resources

- Chapter pre-test
- Videos of all worked examples
- Interactive widgets
- Interactive walkthroughs
- Downloadable HOTsheets
- Access to HOTmaths Australian Curriculum courses

Swimming records and decimal places

Swimming times are electronically measured and recorded with the seconds given to 2 decimal places. Accuracy is very important so that the right decision is made for placegetters and records.

Sometimes winners are separated by as little as one-hundredth of a second. Ian Thorpe, who set 13 world records, had his 400 m freestyle record (3:40.06) broken in 2009 by German swimmer Paul Biedermann, who swam only 0.01 of a second faster than Thorpe.

The decimal system allows us to express quantities with great accuracy.

There are many instances in our everyday lives in which accuracy of measurement is highly important. For example, bicycle, car and aeroplane parts must be manufactured to precise measurements; medicine production requires measurement of chemicals in precise quantities; and investment rates, stock market prices and values are measured to many decimal places (8% per year equals 0.153 846% per week).

Can you think of any other quantities that require decimal measurement?

6A Decimals and place value

CONSOLIDATING



Interactive



Widgets



HOTSheets



Walkthroughs

Some quantities change by whole number amounts, such as the number of people in a room, but there are many quantities that increase or decrease continuously, such as your height, weight and age. Often we talk about age as a whole number (e.g. Mike is 12 years old) but, in reality, our age is an ever-increasing (continuous) quantity. For example, if Mike is 12 years, 4 months, 2 weeks, 3 days, 5 hours, 6 minutes and 33 seconds old, then Mike is actually 12.380 621 47 years old!



If a chocolate bar costs \$2, would the price still be a decimal number?

There are many numbers in today's society that are not whole numbers. For example, it is unusual to buy an item in a supermarket that is simply a whole number of dollars. The price of almost all shopping items involves both dollars and cents. A chocolate bar may cost \$1.95, which is an example of a decimal number.

Let's start: Split-second timing

Organise students into pairs and use a digital stopwatch. Many students' watches will have a suitable stopwatch function.

- Try to stop the stopwatch on exactly 10 seconds. Have two attempts each. Were you able to stop it exactly on 10.00 seconds? What was the closest time?
- Try these additional challenges with your partner.

- a** Stop the watch exactly on:
- i $12\frac{1}{2}$ seconds
 - ii 8.37 seconds
 - iii $9\frac{7}{10}$ seconds
 - iv 14.25 seconds
- b** How quickly can you start and stop the stopwatch?
- c** How accurately can you time 1 minute without looking at the stopwatch?

- A **decimal point** is used to separate the whole number from the decimal or fraction part.
- When dealing with decimal numbers, the place value table must be extended to involve tenths, hundredths, thousandths etc.

The number 428.357 means:

Hundreds	Tens	Units	.	Tenths	Hundredths	Thousandths
4	2	8	.	3	5	7
4×100	2×10	8×1	.	$3 \times \frac{1}{10}$	$5 \times \frac{1}{100}$	$7 \times \frac{1}{1000}$
400	20	8	.	$\frac{3}{10}$	$\frac{5}{100}$	$\frac{7}{1000}$

Key ideas



Example 1 Understanding decimal place value

What is the value of the digit 8 in the following numbers?

a 12.85

b 6.1287

SOLUTION

a The value of 8 is $\frac{8}{10}$.

b The value of 8 is $\frac{8}{1000}$.

EXPLANATION

The 8 is in the first column after the decimal point, which is the tenths column.

The 8 is in the third column after the decimal point, which is the thousandths column.



Example 2 Changing to decimals

Express each of the following proper fractions and mixed numerals as decimals.

a $\frac{7}{10}$

b $\frac{5}{100}$

c $3\frac{17}{100}$

SOLUTION

a $\frac{7}{10} = 0.7$

b $\frac{5}{100} = 0.05$

c $3\frac{17}{100} = 3.17$

EXPLANATION

$\frac{7}{10}$ means seven-tenths, so put the 7 in the tenths column.

$\frac{5}{100}$ means five-hundredths, so put the 5 in the hundredths column.

$3\frac{17}{100}$ means 3 units and 17 one-hundredths.
17 hundredths is one-tenth and seven-hundredths.



Example 3 Arranging decimal numbers in order

Arrange the following decimal numbers in ascending order (i.e. smallest to largest).

3.72, 7.23, 2.73, 2.37, 7.32, 3.27

SOLUTION

2.37, 2.73, 3.27, 3.72, 7.23, 7.32

EXPLANATION

The units column has a higher value than the tenths column, and the tenths column has a higher value than the hundredths column.

2.73 is bigger than 2.37 because it has seven-tenths, which is bigger than three-tenths.

Exercise 6A

1–3

3

- 1 For the number 58.237, give the value of the digit:

a 2

b 3

c 7

- 2 A stopwatch is stopped at 36.57 seconds.

a What is the digit displayed in the tenths column?

b What is the digit displayed in the units column?

c What is the digit displayed in the hundredths column?

d Is this number closer to 36 or 37 seconds?

Example 1

- 3 What is the value of the digit 6 in the following numbers?

a 23.612

b 17.46

c 80.016

d 0.693

e 16.4

f 8.568 13

g 2.3641

h 11.926

UNDERSTANDING

4–7($\frac{1}{2}$)4–7($\frac{1}{2}$)4–7($\frac{1}{2}$)

- 4 State whether each of the following is true or false.

a $7.24 < 7.18$

b $21.32 < 20.89$

c $4.61 > 4.57$

d $8.09 > 8.41$

e $25.8 \leq 28.5$

f $2.1118 \leq 2.8001$

g $7.93 \geq 8.42$

h $11.11 \geq 11.109$

i $\frac{3}{10} = \frac{30}{100}$

j $\frac{7}{10} = \frac{70}{100}$

k $\frac{5}{10} \neq 5$

l $\frac{2}{10} \neq \frac{20}{100}$

FLUENCY

Example 2a,b

- 5 Express each of the following proper fractions as a decimal.

a $\frac{3}{10}$

b $\frac{8}{10}$

c $\frac{15}{100}$

d $\frac{23}{100}$

e $\frac{9}{10}$

f $\frac{2}{100}$

g $\frac{121}{1000}$

h $\frac{74}{1000}$

Example 2c

6 Express each of the following mixed numerals as a decimal.

a $6\frac{4}{10}$

b $5\frac{7}{10}$

c $212\frac{3}{10}$

d $1\frac{16}{100}$

e $14\frac{83}{100}$

f $7\frac{51}{100}$

g $5\frac{7}{100}$

h $18\frac{612}{1000}$

7 Write the following number phrases as decimals.

a seven and six-tenths

b twelve and nine-tenths

c thirty-three and four-hundredths

d twenty-six and fifteen-hundredths

e eight and forty-two hundredths

f ninety-nine and twelve-thousandths

8, 9

9, 10

9–11

8 How close are the following decimal numbers to their nearest whole number?

a 6.9

b 7.03

c 18.98

d 16.5

e 17.999

f 4.99

g 0.85

h 99.11

Example 3

9 Arrange these groups of numbers in ascending order (i.e. smallest to largest).

a 3.52, 3.05, 3.25, 3.55

b 30.6, 3.06, 3.6, 30.3

c 17.81, 1.718, 1.871, 11.87

d 26.92, 29.26, 29.62, 22.96, 22.69

10 The batting averages for five retired Australian Cricket test captains are: Adam Gilchrist 47.60, Steve Waugh 51.06, Mark Taylor 43.49, Allan Border 50.56 and Kim Hughes 37.41.

a List the five players in descending order of batting averages (i.e. largest to smallest).

b Ricky Ponting's test batting average is 56.72. Where does this rank him in terms of the retired Australian test captains listed above?



6A

- 11 The depth of a river at 9:00 am on six consecutive days was:
- | | | |
|---------------|---------------|---------------|
| Day 1: 1.53 m | Day 2: 1.58 m | Day 3: 1.49 m |
| Day 4: 1.47 m | Day 5: 1.52 m | Day 6: 1.61 m |
- a** On which day was the river level highest?
- b** On which day was the river level lowest?
- c** On which days was the river level higher than the previous day?



PROBLEM-SOLVING

- 12 a, b and c are digits and $a > b > c$. Write these numbers from smallest to largest. Note that the dot represents the decimal point.
- a** $a.b, b.c, a.c, c.c, c.a, b.a$
- b** $a.bc, b.ca, b.bb, c.ab, c.bc, ba.ca, ab.ab, a.aa, a.ca$

- 13 Write as decimals, if a is a digit.

a $\frac{a}{10}$

b $\frac{a}{100}$

c $\frac{a}{10} + \frac{a}{100}$

d $a + \frac{a}{10} + \frac{a}{1000}$

REASONING

Different decimal combinations

- 14 **a** Write as many different decimal numbers as you can and place them in ascending order using:
- the digits 0, 1 and a decimal point. Each digit can be used only once.
 - the digits 0, 1, 2 and a decimal point. Each digit can be used only once.
 - the digits 0, 1, 2, 3 and a decimal point. Each digit can be used only once.
- b** Calculate the number of different decimal numbers that could be produced using the digits 0, 1, 2, 3, 4 and a decimal point.

ENRICHMENT

6B Rounding decimals



Interactive



Widgets



HOTsheets

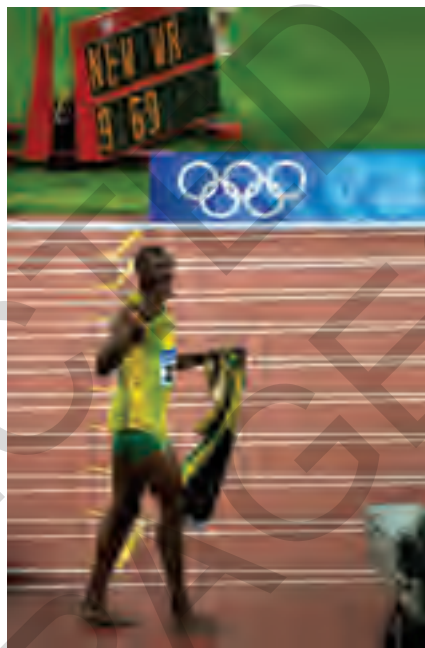


Walkthroughs

Decimal numbers sometimes contain more decimal places than we need. It is important that we are able to round decimal numbers when working with money, measuring quantities, including time and distance, or writing answers to some division calculations.

For example, the distance around the school oval might be 0.39647 km, which rounded to 1 decimal place is 0.4 km or 400 m. The rounded figure, although not precise, is accurate enough for most applications.

Running events are electronically measured and rounded to 2 decimal places. Usain Bolt has repeatedly broken his own world records. In August 2009 he set a new world record of 9.58 seconds over 100 m at the World Championships in Germany, which was 11-hundredths (0.11) of a second faster than his Beijing Olympic Games (August 2008) record of 9.69 seconds.



Usain Bolt's 100-metre sprint world record is measured to 2 decimal places.

Let's start: Rounding brainstorm

- 1 In a group of four, brainstorm occasions when it may be useful to round or estimate decimal numbers. Aim to get more than 10 common applications.
- 2 In pairs one person states a decimal number and the partner needs to state another decimal number that would allow the two numbers to add up to a whole number. Use mental arithmetic only. Start with 1 decimal place and try to build up to 3 or 4 decimal places.

- **Rounding** involves approximating a decimal number to fewer decimal places.
- To round a decimal:
 - Cut the number after the required decimal place; e.g. round to 2 decimal places.
 - To determine whether you should round your answer up or down, consider only the digit *immediately* to the right of the specified place. For rounding purposes this can be referred to as the **critical digit**.

15.63 | 27

'cut' →

2 is the critical digit in this example

Key
ideas

Key
ideas

- If the critical digit is *less than 5* (i.e. 0, 1, 2, 3 or 4), then you *round down*. This means write the original number to the place required, leaving off all other digits. This can be referred to as simply leaving the number as it is.
- If the critical digit is *5 or more* (i.e. 5, 6, 7, 8 or 9), then you *round up*. This means write the original number to the place required, but increase this digit by 1. Leave off all other digits.

**Example 4 Determining the critical digit**

The following decimal numbers need to be rounded to 2 decimal places. Draw a line where the number must be cut and then circle the critical digit.

a 23.5398**b** 1.75137**SOLUTION****a** 23.53 | 9 8**b** 1.75 | 1 3 7**EXPLANATION**

A line is drawn directly after the specified number of decimal places, in this case, 2.

The critical digit is always the number straight after the specified number of decimal places.

**Example 5 Rounding decimals to 1 decimal place**

Round each of the following to 1 decimal place.

a 25.682**b** 13.5458**SOLUTION****a** 25.7**b** 13.5**EXPLANATION**

The critical digit is 8 and therefore the tenths column must be rounded up from a 6 to a 7.

The critical digit is 4 and therefore the tenths column remains the same, in effect rounding the original number down to 13.5.

**Example 6 Rounding decimals to different decimal places**

Round each of the following to the specified number of decimal places.

a Round 18.34728 to 3 decimal places.**b** Round 0.43917 to 2 decimal places.**c** Round 7.59967 to 3 decimal places.

SOLUTION

a 18.347

b 0.44

c 7.600

EXPLANATION

The critical digit is 2, therefore round down.

The critical digit is 9, therefore round up.

The critical digit is 6, therefore round up.

Rounding up has resulted in digits being carried over.

Remember to show the stated number of decimal places; hence, the zeros must be displayed.

Exercise 6B

1–3

3

—

1 For each of the following, select the closer alternative.

a Is 5.79 closer to 5.7 or 5.8?

b Is 2.4 closer to 2 or 3?

c Is 83 closer to 80 or 90?

d Is 6.777 closer to 6.77 or 6.78?

Example 4

2 The following decimals need to be rounded, correct to 2 decimal places. Draw a line where the number must be cut and then circle the critical digit that must be checked as to whether to round up or down.

a 12.6453

b 4.81932

c 157.281

d 4 001 565.38471

e 0.06031

f 203.5791

g 66.6666

h 7.995123

3 To round correctly to a specified number of places, you must know which digit is the critical digit. Remember: The critical digit is always the digit immediately to the right of the specified number of places.

a State the critical digit in each of the following numbers.

i 25.8174 rounded to 1 decimal place.

Critical digit = ____

ii 25.8174 rounded to 2 decimal places.

Critical digit = ____

iii 25.8174 rounded to 3 decimal places.

Critical digit = ____

iv 25.8174 rounded to the nearest whole number.

Critical digit = ____

b State the correct rounded numbers for the numbers in parts **i** to **iv** above.

UNDERSTANDING

 4–8($\frac{1}{2}$)

 4–9($\frac{1}{2}$)

 4–9($\frac{1}{2}$)

Example 5

4 Round each of the following to 1 decimal place.

a 14.82

b 7.38

c 15.62

d 0.87

e 6.85

f 9.94

g 55.55

h 7.98

FLUENCY

6B

FLUENCY

5 Write each of the following correct to 2 decimal places.

- | | | | |
|-----------|-------------|-----------|-----------|
| a 3.7823 | b 11.8627 | c 5.9156 | d 0.93225 |
| e 123.456 | f 300.0549 | g 3.1250 | h 9.849 |
| i 56.2893 | j 7.121 999 | k 29.9913 | l 0.8971 |

Example 6a, b

6 Round each of the following to the specified number of decimal places, given as the number in the brackets.

- | | | | |
|--------------|--------------|--------------|-----------------|
| a 15.913 (1) | b 7.8923 (2) | c 235.62 (0) | d 0.5111 (0) |
| e 231.86 (1) | f 9.3951 (1) | g 9.3951 (2) | h 34.712 89 (3) |

Example 6c

7 Round each of the following to the specified number of decimal places.

- | | | | |
|--------------|---------------|---------------|-----------------|
| a 23.983 (1) | b 14.8992 (2) | c 6.95432 (0) | d 29.999731 (3) |
|--------------|---------------|---------------|-----------------|

8 Round each of the following to the nearest whole number.

- | | | | |
|----------|-----------|----------|-----------|
| a 27.612 | b 9.458 | c 12.299 | d 123.72 |
| e 22.26 | f 117.555 | g 2.6132 | h 10.7532 |

9 Round each of the following amounts to the nearest dollar.

- | | | | |
|------------|-----------|----------|-------------|
| a \$12.85 | b \$30.50 | c \$7.10 | d \$1566.80 |
| e \$120.45 | f \$9.55 | g \$1.39 | h \$36.19 |

10

10, 11

10, 11

10 Some wise shoppers have the habit of rounding all items to the nearest dollar as they place them in their shopping basket. They can then keep a running total and have a close approximation as to how much their final bill will cost. Use this technique to estimate the cost of the following.

- a Jeanette purchases 10 items:
\$3.25, \$0.85, \$4.65, \$8.99, \$12.30, \$7.10, \$2.90, \$1.95, \$4.85, \$3.99
- b Adam purchases 12 items:
\$0.55, \$3.00, \$5.40, \$8.90, \$6.90, \$2.19, \$3.20, \$5.10, \$3.15, \$0.30, \$4.95, \$1.11
- c Jeanette's actual shopping total is \$50.83 and Adam's is \$44.75. How accurate were Jeanette's and Adam's estimations?



PROBLEM-SOLVING

- 11** Electronic timing pads are standard in National Swimming competitions. In a recent National Under 15 100-m freestyle race, Edwina receives a rounded time of 52.83 seconds and Jasmine a time of 53.17 seconds.



- a** If the timing pads can calculate times only to the nearest second, what will be the time difference between the two swimmers?
- b** If the timing pads can calculate times only to the nearest tenth of a second, what will be the time difference between the two swimmers?
- c** What is the time difference between the two swimmers, correct to 2 decimal places?
- d** If the timing pads can measure to 3 decimal places, what would be the quickest time that Edwina could have swum the race in?

12

12

12, 13

- 12** Without using a calculator, evaluate $15.735\ 629 \div 7$, correct to 2 decimal places. What is the least number of decimal places you need to find in the quotient to ensure that you have rounded correctly to 2 decimal places?
- 13** Samara believes 0.449 999 should be rounded up to 0.5, but Cassandra believes it should be rounded down to 0.4. Make an argument to support each of their statements, but then show the flaw in one girl's logic and clearly indicate which girl you think is correct.

Rounding with technology

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14, 15



- 14** Most calculators are able to round numbers correct to a specified number of places. Find out how to do this on your calculator and check your answers to Questions **5** and **6**.
- 15** Spreadsheet software packages can also round numbers correct to a specified number of places. Find out the correct syntax for rounding cells in a spreadsheet program, such as Microsoft Excel, and then check your answers to Questions **7** and **8**.

6C

Addition and subtraction of decimals

CONSOLIDATING



Interactive



Widgets



HOTSheets



Walkthroughs

Addition and subtraction of decimals follows the same procedures as those for whole numbers.

To add or subtract whole numbers you must line up the units, tens, hundreds and so on, and then you add or subtract each column. When dealing with the addition or subtraction of decimals the routine is the same.

Consider how similar the following two sums are:

$$\begin{array}{r} 5^1 14 \\ 272 \\ 106 \\ \hline 892 \end{array}$$

$$\begin{array}{r} 5^1 1.4 \\ 27.2 \\ 10.6 \\ \hline 89.2 \end{array}$$

Let's start: What's the total?

Each student thinks of three coins (gold or silver) and writes their total value on a sheet of paper. Each student in the class then estimates the total value of the amounts written down in the classroom. Record each student's estimated total.

- Each student then writes the value of the three coins they thought of on the board (e.g. \$2.70, \$0.80 etc.).
- Students copy down the values into their workbooks and add the decimal numbers to determine the total value of the coins in the classroom.
- Which student has the closest estimation?



Accounting involves the addition and subtraction of decimal numbers.

Key ideas

- When adding or subtracting decimals, the decimal points and each of the decimal places must be aligned under one another.
- The location of the decimal point in the answer is directly in line with the location of each of the decimal points in the question.
- Once the numbers are correctly aligned, proceed as if completing whole number addition or subtraction.
- If the numbers of decimal places in the numbers being added or subtracted are different, it can be helpful to place additional zeros in the 'shorter' number(s) to prevent calculation errors.



Example 7 Adding decimals

Find:

a $8.31 + 5.93$

b $64.8 + 3.012 + 5.94$

SOLUTION

$$\begin{array}{r} \text{a} \quad {}^1 8.31 \\ + 5.93 \\ \hline 14.24 \end{array}$$

$$\begin{array}{r} \text{b} \quad {}^1 6 {}^1 4.800 \\ \quad \quad 3.012 \\ + 5.940 \\ \hline 73.752 \end{array}$$

EXPLANATION

Make sure all decimal points and decimal places are correctly aligned directly under one another.

Align decimal points directly under one another. Fill in missing decimal places with additional zeros.

Carry out addition, following the same procedure as that for addition of whole numbers.



Example 8 Subtracting decimals

Find:

a $5.83 - 3.12$

b $146.35 - 79.5$

SOLUTION

$$\begin{array}{r} \text{a} \quad 5.83 \\ - 3.12 \\ \hline 2.71 \end{array}$$

$$\begin{array}{r} \text{b} \quad \begin{array}{ccccccc} & 13 & 15 & & 1 & & \\ & \diagdown & \diagup & \diagdown & \diagup & & \\ 1 & 4 & 6 & . & 3 & 5 & \\ - & 7 & 9 & . & 5 & 0 & \\ \hline & 6 & 6 & . & 8 & 5 & \end{array} \end{array}$$

EXPLANATION

Make sure all decimal points and decimal places are correctly aligned directly under one another.

Align decimal points directly under one another and fill in missing decimal places with additional zeros.

Carry out subtraction, following the same procedure as that for subtraction of whole numbers.

Exercise 6C

1, 2

2

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UNDERSTANDING

- 1 7.12, 8.5 and 13.032 must be added together. Which of the following is the best way to prepare these numbers ready for addition?

A

$$\begin{array}{r} 7.12 \\ 8.5 \\ + 13.032 \\ \hline \end{array}$$

B

$$\begin{array}{r} 7.12 \\ 8.5 \\ + 13.032 \\ \hline \end{array}$$

C

$$\begin{array}{r} 7.120 \\ 8.500 \\ + 13.032 \\ \hline \end{array}$$

D

$$\begin{array}{r} 7.12 \\ 8.5 \\ + 13.032 \\ \hline \end{array}$$

- 2 Which of the following is the correct way to present and solve the subtraction problem $77.81 - 6.3$?

a

$$\begin{array}{r} 77.81 \\ - 6.3 \\ \hline 84.11 \end{array}$$

b

$$\begin{array}{r} 77.81 \\ - 6.30 \\ \hline 71.51 \end{array}$$

c

$$\begin{array}{r} 77.81 \\ - 6.3 \\ \hline 14.81 \end{array}$$

d

$$\begin{array}{r} 77.81 \\ - 6.3 \\ \hline 77.18 \end{array}$$

3-6($\frac{1}{2}$)3-6($\frac{1}{2}$)3-6($\frac{1}{2}$)

FLUENCY

- 3 Find each of the following.

a

$$\begin{array}{r} 13.25 \\ + 14.72 \\ \hline \end{array}$$

b

$$\begin{array}{r} 7.23 \\ 16.31 \\ + 2.40 \\ \hline \end{array}$$

c

$$\begin{array}{r} 210.0 \\ 22.3 \\ + 15.1 \\ \hline \end{array}$$

d

$$\begin{array}{r} 47.81 \\ 6.98 \\ + 3.52 \\ \hline \end{array}$$

Example 7

- 4 Find each of the following.

a $12.45 + 3.61$

b $5.37 + 13.81 + 2.15$

c $312.5 + 31.25$

d $1.567 + 3.4 + 32.6$

e $5.882 + 3.01 + 12.7$

f $323.71 + 3.4506 + 12.9$

- 5 Find:

a

$$\begin{array}{r} 17.2 \\ - 5.1 \\ \hline \end{array}$$

b

$$\begin{array}{r} 128.63 \\ - 14.50 \\ \hline \end{array}$$

c

$$\begin{array}{r} 23.94 \\ - 17.61 \\ \hline \end{array}$$

d

$$\begin{array}{r} 158.32 \\ - 87.53 \\ \hline \end{array}$$

Example 8

- 6 Find:

a $14.8 - 2.5$

b $234.6 - 103.2$

c $25.9 - 3.67$

d $31.657 - 18.2$

e $412.1 - 368.83$

f $5312.271 - 364.93$

7, 8

7–10

10–12

6C

PROBLEM-SOLVING

- 7 Find the missing numbers in the following sums.

a
$$\begin{array}{r} 3. \square \\ + 4. 6 \\ \hline \square. 3 \end{array}$$

b
$$\begin{array}{r} 8. \square 9 \\ + \square. 7 5 \\ \hline \square 4. 4 \square \end{array}$$

c
$$\begin{array}{r} 1. \square 1 \\ + \square \square. 1 1 \\ \hline 1 1. 1 \square \end{array}$$

d
$$\begin{array}{r} \square. 3 \square 6 \\ 2. \square 4 3 \\ + 1. 8 9 \square \\ \hline \square 1. 3 9 5 \end{array}$$

- 8 How much greater is 262.5 than 76.31?
- 9 Stuart wants to raise \$100 for the Rainbow Club charity. He already has three donations of \$30.20, \$10.50 and \$5.00. How much does Stuart still need to raise?
- 10 Daily rainfalls for 4 days over Easter were 12.5 mm, 3.25 mm, 0.6 mm and 32.76 mm. What was the total rainfall over the 4-day Easter holiday?
- 11 Complete the addition table below.

+	0.01	0.05	0.38	1.42
0.3				1.72
0.75			1.13	
1.20	1.21		1.58	
1.61				3.03

- 12 Michelle earned \$3758.65 working part-time over a 1-year period. However, she was required to pay her parents \$20 per week for board for 52 weeks. Michelle also spent \$425.65 on clothing and \$256.90 on presents for her family and friends during the year. She placed the rest of her money in the bank. How much did Michelle bank for the year?

13

13

13, 14

REASONING

- 13 If $a = 2.8$, $b = 1.31$ and $c = 3.928$, find:

a $a + b + c$

b $a + b - c$

c $c + b - a$

d $c - (b + b)$

- 14 **a** Write down three numbers between 1 and 10, each with 2 decimal places, that would add to 11.16.
- b** Can you find a solution to part **a** that uses each digit from 1 to 9 exactly once each?

Money, money, money ...

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15

ENRICHMENT

- 15 Investigate the following procedures and share your findings with a friend.
- a** Choose an amount of money that is less than \$10.00 (e.g. \$3.25).
- b** Reverse the order of the digits and subtract the smaller number from the larger number (e.g. $\$5.23 - \$3.25 = \$1.98$).
- c** Reverse the order of the digits in your new answer and now add this number to your most recent total (e.g. $\$1.98 + \$8.91 = \$10.89$).
- Did you also get \$10.89? Repeat the procedure using different starting values.
- Try to discover a pattern or a rule. Justify your findings.

6D Multiplying and dividing by powers of 10



Powers of 10 include $10^1, 10^2, 10^3, 10^4, \dots$, which correspond to the numbers 10, 100, 1000, 10 000, ... Note that the number of zeros in the number is the same as the power of 10 for that number. For example, $10^4 = 10\,000$, the number ten thousand has four zeros and it is equal to ten to the power of four.



Let's start: Dynamic leap frog

A set of large number cards, enough for one card per student in the class, is required.

The set of cards should include the following digits, numbers and symbols:

0, 1, 2, 3, 4, 5, 6, 7, 8, 9, ., \times , \div , 1, 10, 100, 1000, 10 000, 100 000, 1 000 000

The decimal place card is vital! Cards should be big enough to be read from the back of the classroom. Any of the digits can be doubled up to increase the total number of cards. Each student receives one card.

- Four students with one of the 0 to 9 digit cards stand up at the front and make a 4-digit number.
- The student with the decimal place card then positions themselves somewhere within this number or on either end.
- Now a student with the \times or \div operation comes up the front.
- Finally, a student with a power of 10 card comes up and performs the actual calculation by gently moving the decimal place!
- Repeat a number of times with students swapping cards on several occasions.



Key ideas

- Every number contains a decimal point but it is usually not shown in integers.
For example: 345 is 345.0 and 2500 is 2500.0
- Extra zeros can be added in the column to the right of the decimal point without changing the value of the decimal.
For example: $12.5 = 12.50 = 12.500 = 12.5000$ etc.
- When multiplying by powers of 10:
 - Move the decimal point to the *right* the same number of places as there are zeros in the multiplier.
For example, if multiplying by 1000, move the decimal point 3 places to the right.
 $5.7839 \times 1000 = 5783.9$

Note: The decimal point actually stays still and all the digits move three places to the left, but this is harder to visualise.

■ When dividing by powers of 10:

- Move the decimal point to the *left* the same number of places as there are zeros in the multiplier.

For example, if dividing by 100, move the decimal point 2 places to the left.

$$2975.6 \div 100 = 29.756$$

Note: The decimal point actually stays still and all the digits move two places to the right, but this is harder to visualise.



Example 9 Multiplying by powers of 10

Evaluate:

a 36.532×100

b $4.31 \times 10\,000$

SOLUTION

a $36.532 \times 100 = 3653.2$

b $4.31 \times 10\,000 = 43\,100$

EXPLANATION

100 has two zeros, therefore decimal point appears to move 2 places to the right. 36.532

Decimal point appears to move 4 places to the right and additional zeros are inserted as necessary. 4.3100



Example 10 Dividing by powers of 10

Evaluate:

a $268.15 \div 10$

b $7.82 \div 1000$

SOLUTION

a $268.15 \div 10 = 26.815$

b $7.82 \div 1000 = 0.00782$

EXPLANATION

10 has one zero, therefore decimal point is moved 1 place to the left. 268.15

Decimal point is moved 3 places to the left and additional zeros are inserted as necessary.

$.00782$



Example 11 Working with 'the missing' decimal point

Evaluate:

a $567 \times 10\,000$

b $23 \div 1000$

SOLUTION

a $567 \times 10\,000 = 5\,670\,000$

b $23 \div 1000 = 0.023$

EXPLANATION

If no decimal point is shown in the question, it must be at the very end of the number. Four additional zeros must be inserted to move the invisible decimal point 4 places to the right.

$567\overline{0000}.$

Decimal point is moved 3 places to the left.

$0.\overline{023}$



Example 12 Evaluating using order of operations

Calculate this expression, using the order of operations:

$$426 \div 100 + 10(0.43 \times 10 - 1.6)$$

SOLUTION

$$\begin{aligned} 426 \div 100 + 10(0.43 \times 10 - 1.6) \\ = 4.26 + 10(4.3 - 1.6) \\ = 4.26 + 10 \times 2.7 \\ = 4.26 + 27 \\ = 31.26 \end{aligned}$$

EXPLANATION

First, we must calculate the brackets. The division by 100 can also be done in the first step.

$10(4.3 - 2.6)$ means $10 \times (4.3 - 2.6)$.

Exercise 6D

1-3

3

—

- 1** Fill in the correct number of zeros in the multiplier to make the following product statements correct. The first one has been done for you.

a $56.321 \times 1 \boxed{00} = 5632.1$

b $27.9234 \times 1 \boxed{} = 27\,923.4$

c $0.035\,72 \times 1 \boxed{} = 3.572$

d $3200 \times 1 \boxed{} = 320\,000\,000$

6D

UNDERSTANDING

- 2** Fill in the correct number of zeros in the divisor to make the following division statements correct. The first one has been done for you.
- a** $2345.1 \div 1 \boxed{000} = 2.3451$ **b** $7238.4 \div 1 \boxed{} = 72.384$
c $0.003\ 67 \div 1 \boxed{} = 0.000\ 367$ **d** $890 \div 1 \boxed{} = 0.0089$
- 3 a** How many places and in what direction does the decimal point in the number appear to move if the following operations occur?
- i** $\times 100$ **ii** $\div 10$ **iii** $\times 1\ 000\ 000$ **iv** $\div 1$
v $\div 1000$ **vi** $\times 1000$ **vii** $\times 10$ **viii** $\div 10\ 000\ 000$
- b** If all of the operations above had taken place on a number, one after the other, what would be the final position of the decimal place relative to its starting position?

Example 9

4 Calculate:

- a** 4.87×10 **b** 35.283×10 **c** 422.27×10
d 14.304×100 **e** $5.699\ 23 \times 1000$ **f** $1.259\ 63 \times 100$
g 12.7×1000 **h** 154.23×1000 **i** $0.34 \times 10\ 000$
j 213.2×10 **k** $867.1 \times 100\ 000$ **l** $0.005\ 16 \times 100\ 000\ 000$

Example 10

5 Calculate:

- a** $42.7 \div 10$ **b** $353.1 \div 10$ **c** $24.422 \div 10$
d $5689.3 \div 100$ **e** $12\ 135.18 \div 1000$ **f** $93\ 261.1 \div 10\ 000$
g $2.9 \div 100$ **h** $13.62 \div 10\ 000$ **i** $0.54 \div 1000$
j $36.7 \div 100$ **k** $0.02 \div 10\ 000$ **l** $1000.04 \div 100\ 000$

6 Calculate:

- a** 22.913×100 **b** $0.031\ 67 \times 1000$ **c** $4.9 \div 10$
d $22.2 \div 100$ **e** $6348.9 \times 10\ 000$ **f** $1.0032 \div 1000$

Example 11

7 Calculate:

- a** 156×100 **b** 43×1000 **c** $2251 \div 10$
d $16 \div 1000$ **e** 2134×100 **f** $2134 \div 100$
g $7 \div 1000$ **h** $99 \times 100\ 000$ **i** $34 \div 10\ 000$

FLUENCY


Example 12

8 Calculate the following, using the order of operations.

- a** $1.56 \times 100 + 24 \div 10$ **b** $16 \div 100 + 32 \div 10$
c $3 + 10(24 \div 100 + 8)$ **d** $10(6.734 \times 100 + 32)$
e $35.4 + 4.2 \times 10 - 63.4 \div 10$ **f** $4.7 - 24 \div 10 + 0.52 \times 10$
g $14 \div 100 + 1897 \div 1000$ **h** $78.1 - 10(64 \div 100 + 5)$

PROBLEM-SOLVING

6D

- 9 A service station charges \$1.37 per litre of petrol. How much will it cost Tanisha to fill her car with 100 litres of petrol?
- 10 A large bee farm produces 1200 litres of honey per day.
- a If there are 1000 millilitres in 1 litre, how many millilitres of honey can the farm's bees produce in one day?
 - b The farm's honey is sold in 100 millilitre jars. How many jars of honey can the farm's bees fill in one day?
- 11 Wendy is on a mobile phone plan that charges her 3 cents per text message. On average, Wendy sends 10 text messages per day. What will it cost Wendy for 100 days of sending text messages at this rate? Give your answer in cents and then convert your answer to dollars.
- 
- 12 Darren wishes to purchase 10 000 shares at \$2.12 per share. Given that there is also an additional \$200 brokerage fee, how much will it cost Darren to purchase the shares?

13

13, 14

14, 15

- 13 The weight of a matchstick is 0.000 15 kg. Find the weight of 10 000 boxes of matches, with each box containing 100 matches. The weight of one empty match box is 0.0075 kg.
- 14 Complete the table below, listing at least one possible combination of operations that would produce the stated answer from the given starting number.

Starting number	Answer	Possible two-step operations
12.357	1235.7	$\times 1000, \div 10$
34.0045	0.0340045	
0.003 601	360.1	
<i>bac.dfg</i>	<i>ba.cdfg</i>	$\div 100, \times 10$
<i>d.swkk</i>	<i>dswkk</i>	
<i>fvy</i>	<i>f.wy</i>	

- 15 The number 12 345.6789 undergoes a series of multiplication and division operations by different powers of 10. The first four operations are: $\div 1000$, $\times 100$, $\times 10\,000$ and $\div 10$. What is the fifth and final operation if the final number is 1.234 567 89?

Standard form

16

6D

ENRICHMENT

- 16** Extremely large numbers and extremely small numbers are often written in a more practical way, known as standard form or scientific notation.

For example, the distance from the Earth to the Sun is 150 000 000 kilometres! The distance of 150 million kilometres can be written in standard form as 1.5×10^8 kilometres.

On a calculator, 150 000 000 can be represented as 1.5E8.

1.5×10^8 and 1.5E8 represent the same large number and indicate that the decimal place needs to be moved 8 places to the right.

$$1.5\text{E}8 = 1.5 \times 10^8 = 1.5 \times 100\,000\,000 \\ = 1\,500\,000\,000.$$

- a** Represent these numbers in standard form.

i 50 000 000 000 000 **ii** 42 000 000 **iii** 12 300 000 000 000 000

- b** Use a calculator to evaluate the following.

i $40\,000\,000\,000 \times 500\,000\,000$ **ii** $9\,000\,000 \times 120\,000\,000\,000\,000$

- c** The distance from the Earth to the Sun is stated above as 150 million kilometres. The more precise figure is 149 597 892 kilometres. Research how astronomers can calculate the distance so accurately. Hint: It is linked to the speed of light.

- d** Carry out further research on very large numbers. Create a list of 10 very large numbers (e.g. distance from Earth to Pluto, the number of grains in 1 kg of sand, the number of stars in the galaxy, the number of memory bytes in a terabyte. . .). Rank your 10 large numbers in ascending order.

- e** How are very small numbers, such as 0.0000000000035, represented in standard form?

- f** Represent the following numbers in standard form.

i 0.000001 **ii** 0.0000000009 **iii** 0.0000000000007653



6E Multiplication of decimals



Interactive



Widgets



HOTsheets



Walkthroughs

There are countless real-life applications that involve the multiplication of decimal numbers. For example, finding the area of a block of land that is 34.5 m long and 5.2 m wide, or pricing a 4.5-hour job at a rate of \$21.75 per hour. In general, the procedure for multiplying decimal numbers is the same as multiplying whole numbers. There is, however, one extra final step, which involves placing the decimal point in the correct position in the answer.



Finding the area of a block of land usually involves multiplying decimals.

Let's start: Multiplication musings

Consider the following questions within your group.

- What happens when you multiply by a number that is less than 1?
- Consider the product of 15×0.75 . Will the answer be more or less than 15? Why?
- Estimate an answer to 15×0.75 .
- What is the total number of decimal places in the numbers 15 and 0.75?
- Calculate 15×0.75 . How many decimal places are there in the answer?

- When multiplying decimals, start by ignoring any decimal points and perform the multiplication as you would normally. On arriving at your answer, now place the decimal point in the correct position.
- The correct position of the decimal point in the answer is found by following the rule that the total number of decimal places in the question must equal the number of decimal places in the answer.

For example: 5.34×1.2 ← 3 decimal places in the question

$$\begin{array}{r} 534 \\ \times 12 \\ \hline 1068 \\ 5340 \\ \hline 6408 \end{array}$$

decimal points ignored here

$$5.34 \times 1.2 = 6.408 \quad \text{3 decimal places in the answer}$$

- It is always worthwhile estimating your answer. This allows you to check that your decimal point is in the correct place and that your answer makes sense.
- When multiplying by multiples of 10, initially ignore the zeros in the multiplier and any decimal points and perform routine multiplication. On arriving at your answer, position your decimal point, remembering to move your decimal point according to the rules of multiplying by powers of 10.

Key ideas



Example 13 Multiplying decimals

Calculate:

a 12.31×7

b 3.63×6.9

SOLUTION

$$\begin{array}{r} 1231 \\ \times 7 \\ \hline 8617 \end{array}$$

$$12.31 \times 7 = 86.17$$

$$\begin{array}{r} 363 \\ \times 69 \\ \hline 3267 \\ 21780 \\ \hline 25047 \end{array}$$

$$3.63 \times 6.9 = 25.047$$

EXPLANATION

Perform multiplication, ignoring decimal point.

There are 2 decimal places in the question, so there will be 2 decimal places in the answer.

Estimation is less than 100 ($\approx 12 \times 7 = 84$).

Ignore both decimal points.

Perform routine multiplication.

Total of 3 decimal places in the question, so there must be 3 decimal places in the answer.

Estimation is less than 28 ($\approx 4 \times 7 = 28$).



Example 14 Multiplying decimals by multiples of 10

Calculate:

a $2.65 \times 40\,000$

b 0.032×600

SOLUTION

a $2.65 \times 40\,000 = 106\,000$

$$\begin{array}{r} 265 \\ \times 4 \\ \hline 1060 \end{array}$$

$$\therefore 10.60 \times 10\,000 = 106\,000.$$

b $0.032 \times 600 = 19.2$

$$\begin{array}{r} 32 \\ \times 6 \\ \hline 192 \end{array}$$

$$\therefore 0.192 \times 100 = 19.2$$

EXPLANATION

Ignore the decimal point and zeros.

Multiply 265×4 .

Position the decimal place in your answer.

There are 2 decimal places in the question, so must have 2 decimal places in the answer.

Move the decimal point 4 places to the right.

Ignore the decimal point and zeros.

Multiply 32×6 .

Position decimal place in the answer.

Shift decimal place 2 places to the right because there are two zeros in the question.

Exercise 6E

1–5

5

—

UNDERSTANDING

- Work out the total number of decimal places in each of the following product statements.

a 4×6.3	b 3.52×76	c 42×5.123
d 8.71×11.2	e 5.283×6.02	f 2.7×10.3
g 4.87×3241.21	h 0.003×3	i 0.00103×0.0045
- Insert the decimal point into each of the following answers so that the multiplication is true.

a $6.4 \times 3 = 192$	b $6.4 \times 0.3 = 192$	c $0.64 \times 0.3 = 192$
-------------------------------	---------------------------------	----------------------------------
- Why is it worthwhile to estimate an answer to a multiplication question involving decimals?
- What is the difference between a decimal point and a decimal place?
 - How many decimal points and how many decimal places are in the number 423.1567?
- Copy and complete the rule for multiplying decimal numbers (see the **Key ideas** in this section).
The total number of decimal places _____ must equal the number of _____ in the answer.

6–8($\frac{1}{2}$)6–8($\frac{1}{2}$)6–8($\frac{1}{2}$)

FLUENCY

Example 13

- Calculate:

a 5.21×4	b 3.8×7	c 22.93×8
d 14×7.2	e 3×72.82	f 1.293×12
g 3.4×6.8	h 5.4×2.3	i 0.34×16
j 43.21×7.2	k 0.023×0.042	l 18.61×0.071

Example 14

- Calculate:

a 2.52×40	b 6.9×70	c 31.75×800
d 1.4×7000	e 3000×4.8	f $7.291 \times 50\ 000$
g 0.0034×200	h $0.0053 \times 70\ 000$	i 3.004×30
- Calculate and then round your answer to the nearest dollar.

a $5 \times \$6.30$	b $3 \times \$7.55$	c $4 \times \$18.70$
d $\$1.45 \times 12$	e $\$30.25 \times 4.8$	f $7.2 \times \$5200$
g $34.2 \times \$2.60$	h $0.063 \times \$70.00$	i $0.085 \times \$212.50$

9, 10

10–12

11–13

PROBLEM-SOLVING

- Anita requires 4.21 m of material for each dress she is making. She is planning to make a total of seven dresses. How much material does she need?
- The net weight of a can of spaghetti is 0.445 kg. Find the net weight of eight cans of spaghetti.
- Jimbo ran 5.35 km each day for the month of March. How many kilometres did he run for the month?

- 12** Bernard is making a cubby house for his children. He needs 32 lengths of timber, each 2.1 m long.
- a** What is the total length of timber needed to build the cubby house?
 - b** What is the cost of the timber if the price is \$2.95 per metre?
- 13** A lawyer charges \$125.00 per hour to assist her client. How much does the lawyer charge the client if she works on the job for 12.25 hours?

14

14, 15

15, 17

- 14** According to its manufacturer, a particular car can travel 14.2 km on 1 litre of petrol.
- a** How far could the car travel on 52 litres of petrol?
 - b** The car has 23.4 litres of fuel in the tank and must complete a journey of 310 km. Will it make the journey without refuelling?
 - c** If the car does make the journey, how much petrol is left in the tank at the end of the trip? If the car doesn't make the journey, how many extra litres of fuel is needed?
- 15** Write down two numbers, each with 2 decimal places, that when multiplied by 1.83 will give an answer between 0.4 and 0.5.
- 16** Write down one number with 4 decimal places that when multiplied by 345.62 will give an answer between 1 and 2.
- 17 a** If $68 \times 57 = 3876$, what is the answer to 6.8×5.7 ? Why?
- b** If $23 \times 32 = 736$, what is the answer to 2.3×32 ? Why?
- c** If $250 \times 300 = 75\,000$, what is the answer to 2.5×0.3 ? Why?
- d** What is 7×6 ? What is the answer to 0.7×0.6 ? Why?

Creating a simple cash register

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18

- 18** Using a spreadsheet program, such as Excel, design a user-friendly cash register interface. You must be able to enter up to 10 different items into your spreadsheet. You will need a quantity column and a cost per item column.

Using appropriate formulas, the total cost of the bill should be displayed, and there should then be room to enter the amount of money paid and, if necessary, what change should be given.

When your spreadsheet is set up, enter the following items.

4 chocolate bars @ \$1.85 each

toothpaste @ \$4.95

3 loaves of bread @ \$3.19 each

2 kg sausages @ \$5.99 per kg

newspaper @ \$1.40

tomato sauce @ \$3.20

2 × 2 litres of milk @ \$3.70 each

washing powder @ \$8.95

2 packets of Tim Tams @ \$3.55 each

5 × 1.25 litres of soft drink @ \$0.99 each

Money paid = \$80.00

If your program is working correctly, the amount of change given should be \$13.10.

6F Division of decimals



Similar to multiplication of decimal numbers, there are countless real-life applications that involve the division of decimal numbers. However, unlike multiplying decimal numbers, where we basically ignore the decimal points until the very end of the question, with division we try to manipulate the question in such a way as to prevent dividing by a decimal number.

Terminology reminders

Example: $24 \div 4 = 6$

or

$$\frac{24}{4} = 6$$

or

$$4 \overline{) 24} \quad 6$$

24 is known as the **dividend** (the amount you have, or the number being divided), 4 is known as the **divisor** (the number doing the dividing) and 6 is known as the **quotient** (or the answer).

Let's start: Division decisions

Consider the following questions within your group.

- What happens when you divide by a number that is less than 1?
- Consider the answer of $10 \div 0.2$. Will the answer be more or less than 10? Why?
- Estimate an answer to $10 \div 0.2$.
- Calculate the answer of $100 \div 2$. How does this compare to the answer of $10 \div 0.2$?
- Can you think of an easier way to calculate $21.464 \div 0.02$?

■ Division of decimal numbers by whole numbers

- Complete as you would normally with any other division question.
- The decimal point in the quotient (answer) goes directly above the decimal point in the dividend.

For example: $60.524 \div 4$

$$\begin{array}{r} 15.131 \\ 4 \overline{) 60.524} \end{array}$$

■ Division of decimal numbers by other decimals

- Change the divisor into a whole number.
- Whatever change is made to the divisor must also be made to the dividend.

For example: $24.562 \div 0.02$

$$24.562 \div 0.02 = 2456.2 \div 2$$

- When dividing by multiples of 10, initially ignore the zeros in the divisor and perform routine division. On arriving at your answer, you must then re-position your decimal point according to the rules of dividing by powers of 10. For each zero in the question that you ignored initially, the decimal point must move 1 place to the left.



Calculate:

b $0.0234 \div 4$

EXPLANATION

Carry out division, remembering that the decimal point in the answer is placed directly above the decimal point in the dividend.

b 0.005 85

Remember to place zeros in the answer every time the divisor ‘doesn’t go’.

Again, align the decimal place in the answer directly above the decimal place in the question.

An additional zero is required at the end of the dividend to terminate the decimal answer.



Calculate:

b $0.03152 \div 0.002$

EXPLANATION

Need to divide by a whole number.

$$62.316 \div 0.03$$

Move each decimal point 2 places to the right.
Carry out the division question $6231.6 \div 3$.

Multiply divisor and dividend by 1000.

$$0.03152 \div 0.002$$

Move each decimal point 3 places to the right.
Carry out the division question $31.52 \div 2$.



Example 17 Dividing decimals by multiples of 10

Calculate $67.04 \div 8000$.

SOLUTION

$$\begin{array}{r} 08.38 \\ 8 \overline{) 67.04} \end{array}$$

$$8.38 \div 1000 = 0.00838$$

$$67.04 \div 8000 = 0.00838$$

EXPLANATION

Ignore the three zeros in the 8000.

Divide 67.04 by 8.

Now divide by 1000, resulting in moving the decimal point 3 places to the left.



Example 18 Evaluating using order of operations

Calculate using the order of operations:

$$3.8 - 1.6 \times 0.45 + 5 \div 0.4$$

SOLUTION

$$\begin{aligned} 3.8 - 1.6 \times 0.45 + 5 \div 0.4 \\ = 3.8 - 0.72 + 12.5 \\ = 3.08 + 12.5 \\ = 15.58 \end{aligned}$$

EXPLANATION

First carry out \times and \div , working from left to right.
Then carry out $+$ and $-$, working from left to right.

Exercise 6F

1-4

4

—

UNDERSTANDING

- For the question $36.52 \div 0.4 = 91.3$, which of the following options uses the correct terminology?
A 36.52 is the divisor, 0.4 is the dividend and 91.3 is the quotient.
B 36.52 is the dividend, 0.4 is the divisor and 91.3 is the quotient.
C 36.52 is the quotient, 0.4 is the dividend and 91.3 is the divisor.
D 36.52 is the divisor, 0.4 is the quotient and 91.3 is the dividend.

- Explain where you place the decimal point in the quotient (i.e. answer), when dividing a decimal by a whole number.

- Calculate:

a $1200 \div 20$

b $120 \div 2$

c $12 \div 0.2$

d $1.2 \div 0.02$

- e** Explain why these questions all give the same answer.

- For each of the following pairs of numbers, move the decimal points the same number of places so that the second number becomes a whole number.

a 3.2456, 0.3

b 120.432, 0.12

c 0.003 45, 0.0001

d 1234.12, 0.004

Example 15

5 Calculate:

a $8.4 \div 2$

d $2.822 \div 4$

g $38.786 \div 11$

j $234.21 \div 2$

b $30.5 \div 5$

e $4.713 \div 3$

h $1491.6 \div 12$

k $3.417 \div 5$

c $64.02 \div 3$

f $2.156 \div 7$

i $0.0144 \div 6$

l $0.010\ 25 \div 4$

Example 16

6 Calculate:

a $6.14 \div 0.2$

d $5.1 \div 0.6$

g $0.0032 \div 0.04$

j $4.003 \div 0.005$

b $23.25 \div 0.3$

e $0.3996 \div 0.009$

h $0.040\ 34 \div 0.8$

k $0.948 \div 1.2$

c $2.144 \div 0.08$

f $45.171 \div 0.07$

i $10.78 \div 0.011$

l $432.2 \div 0.0002$

- 7 Design three decimal division questions for your partner. Make sure you calculate the answer to each question. Swap questions with your partner. Go to work solving your partner's questions. Pass your answers back for your partner to correct. Discuss any mistakes made by either person.

Example 17

8 Calculate:

a $236.14 \div 200$

d $0.846 \div 200$

b $413.35 \div 50$

e $482.435 \div 5000$

c $3.712\ 44 \div 300$

f $0.0313 \div 40$

- 9 Calculate the following, rounding your answers to 2 decimal places.

a $35.5\text{ kg} \div 3$

d $287\text{ g} \div 1.2$

b $\$213.25 \div 7$

e $482.523\text{ L} \div 0.5$

c $182.6\text{ m} \div 0.6\text{ m}$

f $\$235.50 \div 9$

Example 18

10 Calculate the following, using the order of operations.

a $3.68 \div 2 + 5.7 \div 0.3$

c $17.83 - 1.2(8.1 - 2.35)$

e $(56.7 - 2.4) \div (0.85 \div 2 + 0.375)$

b $6(3.7 \times 2.8 + 5.2)$

d $9.81 \div 0.9 + 75.9 \div 10$

f $34.5 \times 2.3 + 15.8 \div (0.96 - 0.76)$

11 Find the missing digits in these division questions.

a
$$\begin{array}{r} 0. \square \square \\ 3 \overline{) 2. 6 7} \end{array}$$

c
$$\begin{array}{r} 2. \square 5 \\ \square \overline{) 10.7 \square} \end{array}$$

b
$$\begin{array}{r} 0. 6 4 \\ 3 \overline{) 1. \square 2} \end{array}$$

d
$$\begin{array}{r} 2. 1 4 \square \\ \square \overline{) 15. \square 2 9} \end{array}$$

- 12 Charlie paid \$12.72 to fill his ride-on lawnmower with 8 L of fuel. What was the price per litre of the fuel that he purchased?
- 13 Dibden is a picture framer and has recently purchased 214.6 m of timber. The average-sized picture frame requires 90 cm (0.9 m) of timber. How many average picture frames could Dibden make with his new timber?

6F

- 14 A water bottle can hold 600 mL of water. How many water bottles can be filled from a large drink container that can hold 16 L?
- 15 Six friends go out for dinner. At the end of the evening, the restaurant's bill is \$398.10.
- As the bill is split equally among the six friends, how much does each person pay?
 - Given that they are happy with the food and the service, they decide to round the amount they each pay to \$70. What is the waiter's tip?

PROBLEM-SOLVING

- | | 16 | 16, 17 | 17, 18 |
|--|----|--------|--------|
| 16 Clara purchases 1.2 kg of apples for \$3.90. Her friend Sophia buys 900 g of bananas for \$2.79 at the same shop. Find the cost per kilogram of each fruit. Which type of fruit is the best value in terms of price per kilogram? | | | |

- 17 A police radar gun measures a car to be 231.5 m away. At 0.6 seconds later, the radar gun measures the same car to be 216.8 m away.

- Determine the speed of the car in metres per second (m/s).
- Multiply your answer to part a by 3.6 to convert your answer to km/h.
- The car is travelling along an 80 km/h stretch of road. Is the car speeding?



- 18 Given that $24.53 \times 1.97 = 48.3241$, write down the value of each of the following questions, without using a calculator.

- | | | |
|------------------------|---------------------------|------------------------|
| a $48.3241 \div 1.97$ | b $48.3241 \div 2.453$ | c $4832.41 \div 1.97$ |
| d $483.241 \div 245.3$ | e $0.483\ 241 \div 0.197$ | f $483\ 241 \div 2453$ |

REASONING

What number am I?

- | | — | — | 19 |
|--|---|---|----|
| 19 I am thinking of a number. Given the following clues for each, find the number. | | | |
- When I add 4.5 and then multiply by 6, the answer is 30.
 - When I divide it by 3 and then add 2.9, the answer is 3.
 - When I multiply it by 100 and then add 9, the answer is 10.
 - When I multiply it by 5 and then add a half, the answer is 6.
 - When I subtract 0.8, then divide by 0.2 and then divide by 0.1, the answer is 200.
 - Make up three of your own number puzzles to share with the class.

ENRICHMENT



Progress quiz

- 6A** **1** What is the place value of the digit 6 in the following numbers?
a 3.5678 **b** 126.872
- 6A** **2** Express each of the following fractions as a decimal.
a $\frac{9}{10}$ **b** $\frac{19}{1000}$ **c** $3\frac{1}{4}$
- 6A** **3** Arrange the following decimal numbers in ascending order.
3.4, 4.3, 0.43, 0.34, 0.043
- 6B** **4** Round each of the following to the specified number of decimal places.
a 16.8765 to 2 decimal places **b** 2.34999 to 3 decimal places
c 0.66 to 1 decimal place
- 6C** **5** Find:
a $0.9 + 4.5$ **b** $12.56 + 3.671 + 0.8$
c $12.89 - 9.37$ **d** $8.06 - 2.28$
- 6D** **6** Evaluate:
a 3.45×1000 **b** $65.345 \div 100$
- 6E/F** **7** Calculate:
a 45×2000 **b** 23.8×5 **c** 4.78×0.4 **d** $4.56 \times 30\,000$
e $56.4 \div 4$ **f** $0.065 \div 5$ **g** $3.864 \div 0.02$ **h** $88.4 \div 400$
i $9 \div 0.001$ **j** $3.4 - 3.2 \times 0.4 + 1.2 \div 3$
- 6C/E** **8** Insert the decimal point in the answer so that each mathematical sentence is true.
a $12 - 3.989 = 8011$ **b** $1.234 \times 0.08 \times 2000 = 19744$
- 6C-F** **9** It costs \$59.85 for 15 kilograms of dog shampoo. Find:
a the change from paying with one \$50 note and one \$20 note
b the cost of the shampoo per kilogram
c the number of kilograms that can be purchased with a \$100 note

6G Decimals and fractions



Decimals and fractions are both commonly used to represent numbers that are not simply whole numbers. It is important that we know how to convert a decimal number to a fraction, and how to convert a fraction to a decimal number.

In the photo opposite, we can see that

$\frac{1}{4}$ or 0.25 of the cake has been cut and

$\frac{3}{4}$ or 0.75 of the cake remains.



Let's start: Match my call

- In pairs, nominate one student to be 'Fraction kid' and the other to be 'Decimal expert'. 'Fraction kid' starts naming some common fractions and 'Decimal expert' tries to give the equivalent decimal value. Start with easy questions and build up to harder ones.
- After 10 turns, swap around. This time 'Decimal expert' will name some decimal numbers and 'Fraction kid' will attempt to call out the equivalent fraction.
- Discuss the following question in pairs:
Which is easier, converting fractions to decimals or decimals to fractions?

■ Converting decimals to fractions

- Using your knowledge of place value, express the decimal places as a fraction whose denominator is a power of 10. Remember to simplify the fraction whenever possible.

$$\text{e.g. } 0.25 = \frac{25}{100} = \frac{1}{4}$$

■ Converting fractions to decimals

- When the denominator is a power of 10, we can simply change the fraction to a decimal through knowledge of place value.
- When the denominator is *not* a power of 10, try to find an equivalent fraction whose denominator has a power of 10 and then convert to a decimal.
- A method that will always work for converting fractions to decimals is to divide the numerator by the denominator.

$$\text{e.g. } \frac{37}{100} = 0.37$$

$$\text{e.g. } \frac{2}{5} = \frac{4}{10} = 0.4$$

$$\text{e.g. } \frac{5}{8} = \frac{0.625}{5.000} = 0.625$$

■ Recurring decimals are decimals with a repeated pattern.

- A dot, dots or a bar above a number or numbers indicates a repeated pattern.

$$\text{e.g. } \frac{1}{3} = 0.333\ 33\ 33\ \dots = 0.\dot{3} \quad \frac{13}{11} = 1.181\ 818\ \dots = 1.1\dot{8} \quad \text{or} \quad 1.\overline{18}$$

$$\frac{12}{7} = 1.714\ 285\ 714\ 285\ \dots = 1.\dot{7}14\ 28\dot{5} \quad \text{or} \quad 1.\overline{714\ 285}$$



Example 19 Converting decimals to fractions

Convert the following decimals to fractions in their simplest form.

a 0.239

b 10.35

SOLUTION

a $\frac{239}{1000}$

b $10\frac{35}{100} = 10\frac{7}{20}$

EXPLANATION

0.239 = 239 thousandths

0.35 = 35 hundredths, which can be simplified further by dividing the numerator and denominator by the highest common factor of 5.



Example 20 Converting fractions to decimals

Convert the following fractions to decimals.

a $\frac{17}{100}$

b $5\frac{3}{5}$

c $\frac{7}{12}$

SOLUTION

a $\frac{17}{100} = 0.17$

b $5\frac{3}{5} = 5\frac{6}{10} = 5.6$

c $\frac{7}{12} = 0.583\ 33\ \dots$ or $0.58\bar{3}$

EXPLANATION

17 hundredths

$\frac{6}{10}$ is an equivalent fraction of $\frac{3}{5}$, whose denominator is a power of 10.

$$\begin{array}{r} 0.58333\dots \\ 12 \overline{) 7.10444} \\ \underline{7.00000} \end{array}$$

Exercise 6G

1, 2

2

—

UNDERSTANDING

- 1 Complete each of these statements, which convert common fractions to decimals.

a $\frac{1}{2} = \frac{\square}{10} = 0.5$

b $\frac{1}{4} = \frac{25}{\square} = 0.25$

c $\frac{3}{4} = \frac{\square}{100} = 0.\square 5$

d $\frac{2}{\square} = \frac{4}{10} = 0.\square$

- 2 Complete each of these statements, which convert decimals to fractions, in simplest form.

a $0.2 = \frac{\square}{10} = \frac{1}{5}$

b $0.15 = \frac{\square}{100} = \frac{3}{\square}$

c $0.8 = \frac{8}{\square} = \frac{\square}{5}$

d $0.64 = \frac{64}{100} = \frac{\square}{25}$

3–7($\frac{1}{2}$)3–8($\frac{1}{2}$)3–8($\frac{1}{2}$)

FLUENCY

Example 19a

- 3 State whether each of the following is true or false. Use the examples in the **Key ideas** to help.

a $0.333 \dots = 0.3$

b $0.1111 \dots = 0.\dot{1}$

c $3.2222 \dots = 3.\dot{2}$

d $1.7272 \dots = 1.7\dot{2}$

e $3.161616 \dots = 3.\dot{1}\dot{6}$

f $4.216216 \dots = 4.2\dot{1}\dot{6}$

Example 19b

- 4 Convert the following decimals to fractions in their simplest form.

a 0.5

b 6.4

c 10.15

d 18.12

e 3.25

f 0.05

g 9.075

h 5.192

Example 20a

- 5 Convert each of these fractions to decimals.

a $\frac{7}{10}$

b $\frac{9}{10}$

c $\frac{31}{100}$

d $\frac{79}{100}$

e $\frac{121}{100}$

f $3\frac{29}{100}$

g $\frac{123}{1000}$

h $\frac{3}{100}$

Example 20b

- 6 Convert the following fractions to decimals, by first changing the fraction to an equivalent fraction whose denominator is a power of 10.

a $\frac{4}{5}$

b $\frac{1}{2}$

c $\frac{7}{20}$

d $\frac{23}{50}$

e $\frac{19}{20}$

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

g $\frac{5}{2}$

h $\frac{3}{8}$

Example 20c

- 7 Convert the following fractions to decimals, by dividing the numerator by the denominator.

a $\frac{1}{2}$

b $\frac{3}{6}$

c $\frac{3}{4}$

d $\frac{2}{5}$

e $\frac{1}{3}$

f $\frac{3}{8}$

g $\frac{5}{12}$

h $\frac{3}{7}$

- 8 Copy and complete the following fraction/decimal tables. The quarters table (part c) has already been done for you. It's well worth trying to memorise these fractions and their equivalent decimal values.

a halves

Fraction	$\frac{0}{2}$	$\frac{1}{2}$	$\frac{2}{2}$
Decimal			

b thirds

Fraction	$\frac{0}{3}$	$\frac{1}{3}$	$\frac{2}{3}$	$\frac{3}{3}$
Decimal				

c quarters

Fraction	$\frac{0}{4}$	$\frac{1}{4}$	$\frac{2}{4}$	$\frac{3}{4}$	$\frac{4}{4}$
Decimal	0	0.25	0.5	0.75	1

d fifths

Fraction	$\frac{0}{5}$	$\frac{1}{5}$	$\frac{2}{5}$	$\frac{3}{5}$	$\frac{4}{5}$	$\frac{5}{5}$
Decimal						

9–10

9–10

10–11

- 9 Arrange the following from smallest to largest.

a $\frac{1}{2}$, 0.75, $\frac{5}{8}$, 0.4, 0.99, $\frac{1}{4}$

b $\frac{3}{7}$, 0.13, $\frac{1}{9}$, 0.58, 0.84, $\frac{4}{5}$

- 10 Tan and Lillian are trying to work out who is the better chess player. They have both been playing chess games against their computers. Tan has played 37 games and beaten the computer 11 times. Lillian has played only 21 games and has beaten the computer 6 times.

- a Using a calculator and converting the appropriate fractions to decimals, determine who is the better chess player.
- b Lillian has time to play another four games of chess against her computer. To be classified as a better player than Tan, how many of these four games must she win?



- 11 To estimate the thickness of one sheet of A4 paper, Christopher measures a ream of paper, which consists of 500 sheets of A4 paper. He determines that the pile is 55 mm thick. How thick is one sheet of A4 paper? Express your answer as a decimal number and also as a fraction.



6G

12

12–13

13–15

REASONING

12 a Copy and complete the following fraction/decimal table.

Fraction	$\frac{1}{2}$	$\frac{1}{3}$	$\frac{1}{4}$	$\frac{1}{5}$	$\frac{1}{6}$	$\frac{1}{7}$	$\frac{1}{8}$	$\frac{1}{9}$	$\frac{1}{10}$
Decimal									

- b Comment on the trend in the decimal values as the *denominator* increases.
c Try to explain why this makes sense.

13 a Copy and complete the following decimal/fraction table.

Decimal	0.1	0.2	0.25	0.4	0.5	0.6	0.75	0.8	0.9
Fraction									

- b Comment on the trend in the fractions as the *decimal value* increases.
c Try to explain why this makes sense.

14 Write three different fractions with different denominators that are between the decimal value of 2.4 and 2.5.

15 When $\frac{4}{7}$ is expressed in decimal form, find the digit in the 23rd decimal place. Give a reason for your answer.

Design a decimal game for the class

—

—

16

ENRICHMENT

16 Using the skill of converting decimals to fractions and vice versa, design an appropriate game that students in your class could play. Ideas may include variations of Bingo, Memory, Dominoes etc. Try creating a challenging set of question cards.



6H Decimals and percentages



Interactive



Widgets



HOTSheets



Walkthroughs

Percentages are commonly used in today's society. **Per cent** is derived from the Latin words *per centum*, meaning 'out of 100'.

Percentages give an idea of proportion.

For example, if a newspaper states that 2000 people want a council swimming pool constructed, then we know how many want a pool but we don't know

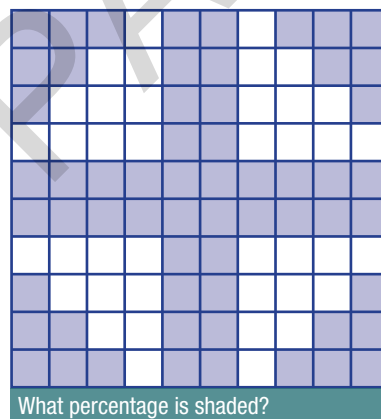
what proportion of the community that is. However, if there are 2500 people in this community, the newspaper can state that 80% want a swimming pool. This informs us that a majority of the community (i.e. 80 out of every 100 people) want a swimming pool constructed.



We see percentages used around us in many different situations.

Let's start: Creative shading

- Draw a square of side length 10 cm and shade exactly 20% or 0.2 of this figure.
- Draw a square of side length 5 cm and shade exactly 60% or 0.6 of this figure.
- Draw another square of side length 10 cm and creatively shade an exact percentage of the figure. Ask your partner to work out the percentage you shaded.



What percentage is shaded?

- The symbol, %, means **per cent**. It comes from the Latin words *per centum*, which translates to 'out of 100'.

For example: 23% means 23 out of 100 $\frac{23}{100} = 0.23$

- To convert a percentage to a decimal, divide by 100. This is done by moving the decimal point 2 places to the left.

For example: $42\% = 42 \div 100 = 0.42$

- To convert a decimal to a percentage, multiply by 100. This is done by moving the decimal point 2 places to the right.

For example: $0.654 = 0.654 \times 100\% = 65.4\%$

Note: As in Section 6D, it is not actually the decimal point that moves; rather, it is the digits that move around the stationary decimal point.

Key
ideas



Example 21 Converting percentages to decimals

Express the following percentages as decimals.

a 30%

b 240%

c 12.5%

d 0.4%

SOLUTION

a $30\% = 0.3$

b $240\% = 2.4$

c $12.5\% = 0.125$

d $0.4\% = 0.004$

EXPLANATION

$30 \div 100$

$240 \div 100 = 2.4$

Decimal point moves 2 places to the left.

Decimal point moves 2 places to the left.



Example 22 Converting decimals to percentages

Express the following decimals as percentages.

a 0.045

b 7.2

SOLUTION

a $0.045 \times 100\% = 4.5\%$

b $7.2 \times 100\% = 720\%$

EXPLANATION

Decimal point moves 2 places to the right.

$7.2 \times 100\% = 720\%$

Exercise 6H

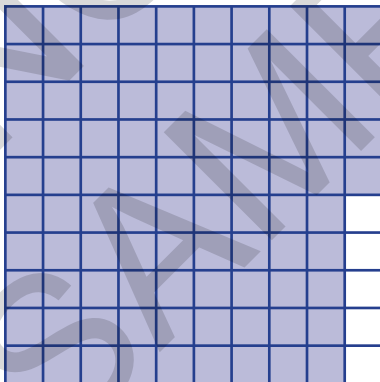
1–6

5, 6

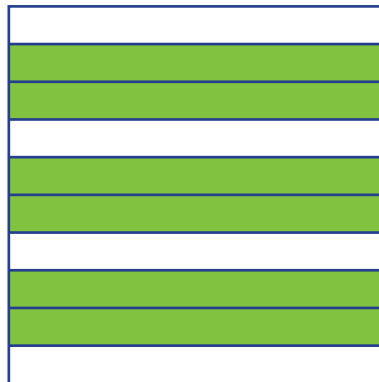
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1 What percentage of each square has been shaded?

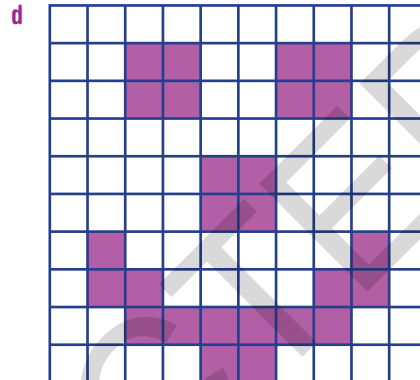
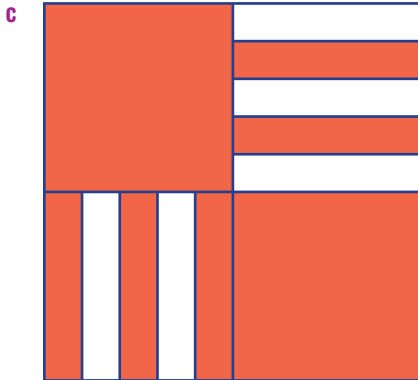
a



b



UNDERSTANDING



- 2** 72.5% is equivalent to which of the following decimals?
A 72.5 **B** 7.25 **C** 0.725 **D** 725.0
- 3** 1452% is equivalent to which of the following decimals?
A 0.1452 **B** 14.52 **C** 145 200 **D** 145.20
- 4** 0.39 is equivalent to which of the following percentages?
A 39% **B** 3.9% **C** 0.39% **D** 0.0039%
- 5** Prue answered half the questions correctly for a test marked out of 100.
a What score did Prue get on the test?
b What percentage did Prue get on the test?
c Find the score you would expect Prue to get if the test was out of:
i 10 **ii** 200
iii 40 **iv** 2
d Find the percentage you would expect Prue to get if the test was out of:
a 10 **b** 200
c 40 **d** 2
- 6** Fill in the empty boxes.
a $58\% = 58 \text{ out of } \square = 58 \div \square = \frac{58}{\square} = 0.\square 58$
b $35\% = \square \text{ out of } 100 = 35 \div \square = \frac{\square}{100} = \square.35$
c $126\% = 126 \div \square = 126 \div \square = \frac{126}{\square} = 1.\square \square$

6H

Example 21a, b

7 Express the following percentages as decimals.

- | | | | |
|--------|--------|--------|--------|
| a 32% | b 27% | c 68% | d 54% |
| e 6% | f 9% | g 100% | h 1% |
| i 218% | j 142% | k 75% | l 199% |

Example 21c, d

8 Express the following percentages as decimals.

- | | | | |
|-----------|----------|----------|---------|
| a 22.5% | b 17.5% | c 33.33% | d 8.25% |
| e 112.35% | f 188.8% | g 150% | h 520% |
| i 0.79% | j 0.025% | k 1.04% | l 0.95% |

Example 22

9 Express the following decimals as percentages.

- | | | | |
|---------|----------|--------|---------|
| a 0.8 | b 0.3 | c 0.45 | d 0.71 |
| e 0.416 | f 0.375 | g 2.5 | h 2.314 |
| i 0.025 | j 0.0014 | k 12.7 | l 1.004 |

FLUENCY

10, 11

11, 12

12, 13

10 Place the following values in order from highest to lowest.

- a 86%, 0.5%, 0.6, 0.125, 22%, 75%, 2%, 0.78
b 124%, 2.45, 1.99%, 0.02%, 1.8, 55%, 7.2, 50

11 At a hockey match, 65% of the crowd supports the home team. What percentage of the crowd supports the visiting team?

12 Last Saturday, Phil spent the 24 hours of the day in the following way: 0.42 of the time was spent sleeping, 0.22 was spent playing sport and 0.11 was spent eating. The only other activity Phil did for the day was watch TV.

- a What percentage of the day did Phil spend watching TV?
b What percentage of the day did Phil spend either sitting down or lying down?

13 Sugarloaf Reservoir has a capacity of 96 gigalitres. However, as a result of the drought it is only 25% full. How many gigalitres of water are in the reservoir?

PROBLEM-SOLVING



14

14, 15

15, 16

6H

REASONING

14 a, b, c and d are digits. Write the following decimal numbers as percentages.

a $0.abcd$ b $a.ac$ c $ab.dc$ d $0.0dd$ e $c.dba$ f $0.cccddd$

15 a, b, c and d are digits. Write the following percentages as decimal numbers.

a $a.b\%$ b $bcd\%$ c $ac\%$ d $0.da\%$ e $abbb\%$ f $dd.d\%$

16 Trudy says that it is impossible to have more than 100%. She supports her statement by saying that if you get every question correct in a test, then you get 100% and you cannot get any more.

a Do you agree with Trudy's statement?

b Provide four examples of when it makes sense that you cannot get more than 100%.

c Provide four examples of when it is perfectly logical to have more than 100%.

AFL ladder

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17, 18

ENRICHMENT

17 The Australian Rules football ladder has the following column headings.



Pos	Team	P	W	L	D	F	A	%	Pos
1	Brisbane Lions	22	13	8	1	2017	1690	108.72	54
2	Carlton	22	13	9	0	2070	2055	110.48	52
3	Essendon	22	10	11	1	2080	2127	97.79	42
4	Hawthorn	22	8	13	1	1962	2121	92.55	36
5	Port Adelaide	22	6	15	1	1990	2244	88.88	36

a Using a calculator, can you determine how the percentage column is calculated?

b What do you think the 'F' and the 'A' column stand for?

c In their next match, Essendon scores 123 points for their team and has 76 points scored against them. What will be their new percentage?

d By how much do Hawthorn need to win their next game to have a percentage of 100?

e If Port Adelaide plays Hawthorn in the next round and the final score is Port Adelaide 124 beats Hawthorn 71, will Port Adelaide's percentage become higher than Hawthorn's?

18 Create your own AFL-style ladder using a spreadsheet program. After inputting the results, the program should automatically update the points column and the percentage column.

When carrying out a sort on the data, ensure that your program will automatically change any team's position on the ladder, if necessary.



Investigation

Best buy

The concept 'best buy' relates to purchasing a product that is the best value for money.

To determine the 'best buy' you need to compare the prices of similar products for the same weight.



STRAWBERRY JAM jar 375 g
\$3.95
\$10.53 per kg



STRAWBERRY JAM jar 250 g
\$2.95
\$11.80 per kg

Converting units

a Convert the following to a price per kg.

i 2 kg of apples for \$3.40

iii 1.5 kg of cereal for \$4.50

ii 5 kg of sugar for \$6.00

iv 500 g of butter for \$3.25

b Convert the following to a price per 100 g.

i 300 g of grapes for \$2.10

iii 700 g of yogurt for \$7.49

ii 1 kg of cheese for \$9.60

iv 160 g of dip for \$3.20

Finding 'best buys'

a By converting to a price per kg, determine which is the best buy.

i 2 kg of sauce A for \$5.20 or 1 kg of sauce B for \$2.90

ii 4 kg of pumpkin A for \$3.20 or 3 kg of pumpkin B for \$2.70

iii 500 g of honey A for \$5.15 or 2 kg of honey B for \$19.90

iv 300 g of milk A for \$0.88 or 1.5 kg of milk B for \$4.00

b By converting to a price per 100 g, determine which is the best buy.

i 500 g of paper A for \$3.26 or 200 g of paper B for \$1.25

ii 250 g of salami A for \$4.50 or 150 g of salami B for \$3.10

iii 720 g of powder A for \$3.29 or 350 g of powder B for \$1.90

iv 1.1 kg of shampoo A for \$12.36 or 570 g of shampoo B for \$6.85

Problem solving

- a** Star Washing Liquid is priced at \$3.85 for 600 g, while Best Wash Liquid is priced at \$5.20 for 1 kg. Find the difference in the price per 100 g, correct to the nearest cent.
- b** Budget apples cost \$6.20 per 5 kg bag. How much would a 500 g bag of Sunny apples have to be if it was the same price per 100 g?
- c** 1.5 kg of cheddar cheese costs \$11.55, and 800 g of feta cheese costs \$7.25. Sally works out the best value cheese, then buys \$5 worth of it. How much and what type of cheese did Sally buy?

Investigate

Go to a local supermarket and choose a type of product where there are many brands to choose from.

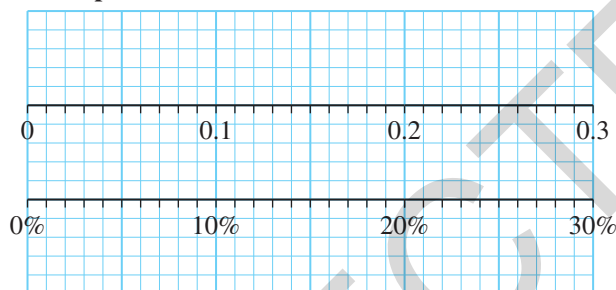
- a** Record the following information for each brand of the same type of product:
 - i** price
 - ii** weight
 - iii** brand name
- b** Calculate the price of each brand per:
 - i** kg
 - ii** 100 g
- c** Compare the prices of each brand. Comment on:
 - i** which brand is the 'best buy'
 - ii** the differences between the cheapest and most expensive brands
 - iii** reasons why some brands might be more expensive
- d** Most supermarkets now display an additional price for most items: the cost of the item per set amount. In effect, this allows the customer to see the best value. Take a photo of an item at a supermarket which displays this value and explain the prices.



Decimal vs percentage

Draw two horizontal lines on a long sheet of graph paper that is 100 small squares wide. On line 1, make a number line from 0 to 1, labelling every tenth and marking hundredths. On line 2, mark percentages from 0% to 100%, labelling every 10% and marking every %.

Example of the number lines



Answer the following questions, using your number lines to help you.

- a** Which is larger, 73% or 0.74?
- b** Which is smaller, 26% or 0.3?
- c** List in ascending order: 45%, 0.72, 49%, 37%, 0.58, 0.7, 51%, 0.64, 60%, 0.5.
- d** List in descending order: 37%, 0.03, 82%, 0.37, 0.8, 77%, 0.23, 38%, 2%, 0.4.
- e** List in ascending order: 78%, 0.683, 77.5%, 79.9%, 0.78452, 0.76, 0.784, 69.9%, 0.6885.
- f** Write three decimal numbers between 0.47 and 0.57.
- g** In decimal form, list all the whole tenths that are greater than 0.34 and less than 0.78.
- h** In decimal form, list all the decimal hundredths that are greater than 0.32 and less than 0.41.
- i** Write down three pairs of decimals so that each pair has a difference of 0.02. Now write each of your number pairs as percentages. What is the difference between these percentage values?
- j** Play some decimal/percentage games in pairs.
 - Person A gives a decimal (between 0 and 1) and person B states the percentage that is equivalent to two-tenths less than person A's decimal.
 - Person A states a percentage and person B gives the decimal that is equivalent to 5% more than person A's percentage.
 - Use your decimal and percentage number lines to make up your own games.

Problems and challenges



Up for a challenge? If you get stuck on a question, check out the 'Working with unfamiliar problems' poster at the end of the book to help you.



1 a When $\frac{3}{7}$ is written as a decimal, state the digit in the 20th decimal place.

b Given that $A \times 2.75 = 10.56$, write an expression for $1.056 \div 0.00275$.

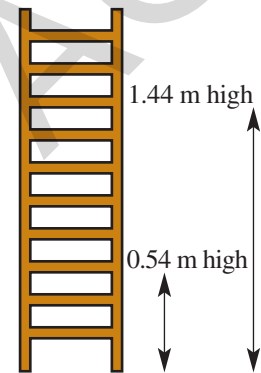
c Find this product:

$$(1 - 0.5)(1 - 0.\dot{3})(1 - 0.25)(1 - 0.2)$$

d Write the recurring decimal $1.4\overline{51}$ as an improper fraction.

e Callum pays \$4.10 for his coffee using eight coins. They are made up of \$1 coins and 50 and 20 cent pieces. How many of each coin did Callum use?

2 Consider the ladder in the diagram. The heights of each rung on the ladder are separated by an equal amount. Determine the heights for each rung of the ladder.



3 Find the digits represented by the letters in these decimal problems.

$$\begin{array}{r} \text{a} \quad \text{A}.2\text{B} \\ + 9.\text{C}5 \\ \hline 11.12 \end{array}$$

$$\begin{array}{r} \text{b} \quad 2\text{A}.43 \\ - 9.\text{B}4 \\ \hline \text{C}7.8\text{D} \end{array}$$

$$\begin{array}{r} \text{c} \quad 3.\text{A} \times \text{B}.4 = 8.16 \\ \text{d} \quad \text{A} \overline{) 2.2\text{B}1} \end{array}$$

4 We know that $\sqrt{9}$ is 3 since $3^2 = 9$, but what about $\sqrt{2}$?

a Find the value of:

i 1.4^2

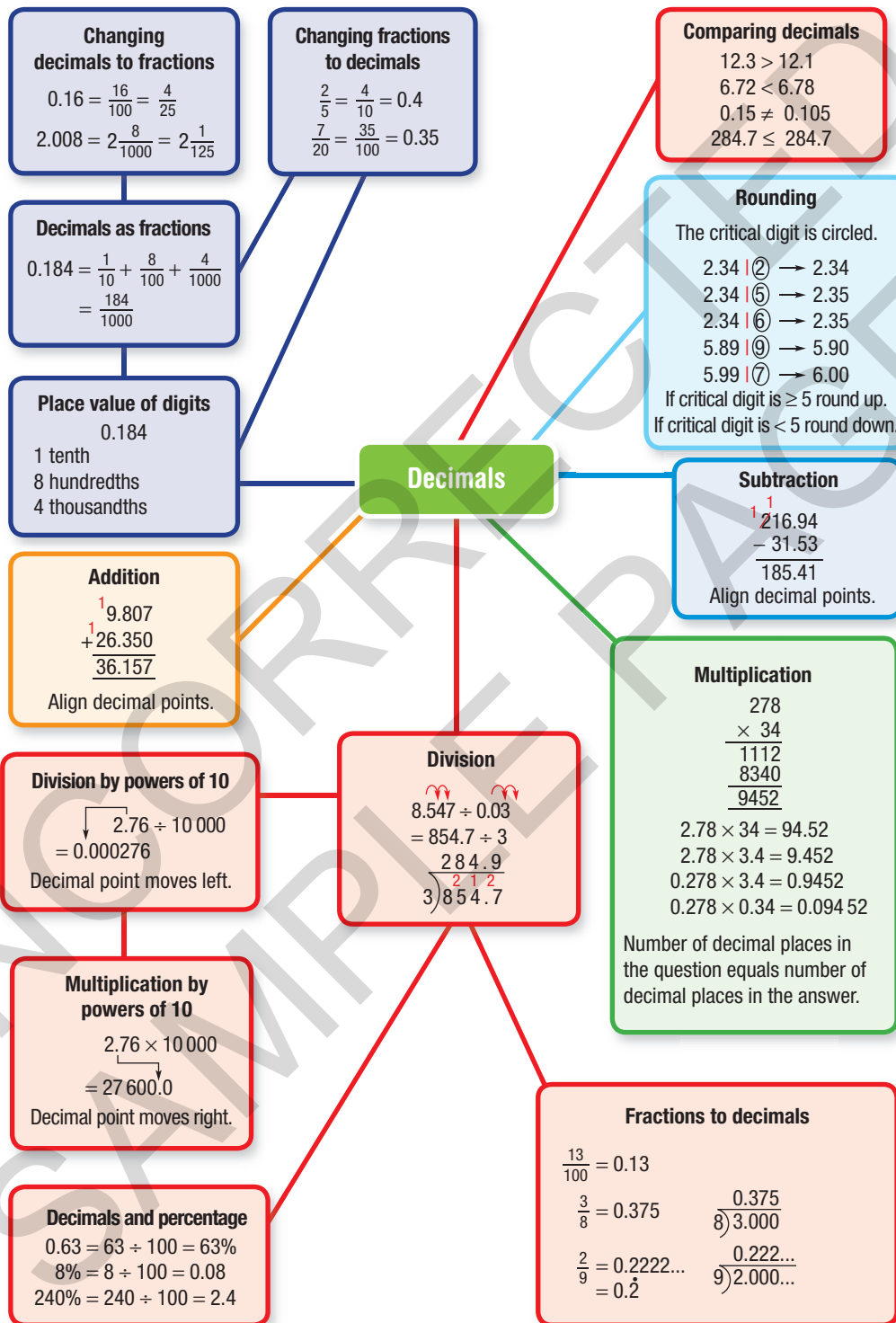
ii 1.5^2

iii 1.45^2

b Now try to find the value of $\sqrt{2}$ correct to:

i two decimal places

ii three decimal places



Multiple-choice questions

- 6A** 1 The next number in the pattern 0.023, 0.025, 0.027, 0.029 is:
A 0.0003 **B** 0.030 **C** 0.0031 **D** 0.031 **E** 0.033
- 6G** 2 0.05 is equivalent to:
A $\frac{5}{10}$ **B** $\frac{5}{100}$ **C** $\frac{5}{1000}$ **D** $\frac{5}{500}$ **E** 5
- 6A** 3 The smallest number out of 0.012, 10.2, 0.102, 0.0012 and 1.02 is:
A 0.012 **B** 0.102 **C** 0.0012 **D** 1.02 **E** 10.2
- 6F** 4 $0.36 \div 1000$ is equal to:
A 3.6 **B** 360 **C** 0.036 **D** 0.0036 **E** 0.000 36
- 6E** 5 6.2×0.2 is equal to:
A 1.24 **B** 12.4 **C** 0.124 **D** 124 **E** 0.0124
- 6E** 6 What is the answer to 0.08×0.6 ?
A 0.48 **B** 4.8 **C** 0.0048 **D** 0.048 **E** 48
- 6B** 7 When rounded to 1 decimal place, 84.553 becomes:
A 80 **B** 84 **C** 84.5 **D** 84.6 **E** 84.55
- 6G** 8 As a decimal, $\frac{23}{90}$ is equal to:
A 0.2 **B** 0.2 $\dot{5}$ **C** 0.26 **D** 0.2 $\dot{5}$ **E** 0.25 $\dot{6}$
- 6A/B** 9 $7 + 0.7 + 0.07 + 0.007$, to 2 decimal places, is:
A 7.78 **B** 7.77 **C** 7 **D** 7.7 **E** 7.777
- 6G** 10 $5.\overline{624}$ means:
A 5.62444... **B** 6.6242424... **C** 5.624624624...
D 5.6246464... **E** 5.62456245624...

Short-answer questions

- 6A** 1 Arrange each group in descending order, from largest to smallest.
a 0.4, 0.04, 0.44 **b** 2.16, 2.016, 2.026 **c** 0.932, 0.98, 0.895
- 6G** 2 Write each fraction as a decimal.
a $\frac{81}{10}$ **b** $\frac{81}{100}$ **c** $\frac{801}{100}$ **d** $\frac{801}{1000}$
- 6A** 3 What is the place value of the digit 3 in the following numbers?
a 12.835 **b** 6.1237 **c** 13.5104

6A

4 State whether each of the following is true or false.

a $8.34 < 8.28$

b $4.668 > 4.67$

c $8.2 > 8.182$

d $3.08 \leq \frac{308}{100}$

e $\frac{62}{100} \geq 6.20$

f $\frac{7}{10} = \frac{70}{100}$

6B

5 List all possible numbers with 3 decimal places that, when rounded to 2 decimal places, always result in 45.27.

6B

6 Round each of the following to the specified number of decimal places (which is given in brackets).

a 423.46 (1)

b 15.8892 (2)

c 7.25432 (1)

d 69.999531 (3)

e $2\frac{3}{4}$ (1)

f $\frac{2}{3}$ (2)

g $\frac{5}{11}$ (3)

h $\frac{1}{81}$ (44) (Hint: Look for the short method!)

6C

7 Evaluate:

a $13.85 - 4.32$

b $19.12 - 14.983$

c $27.6 + 15.75$

d $204.70837 + 35.7902$

e $472.427 - 388.93$

f $210.8 - (26.3 - 20.72)$

6A/B/D

8 State whether each of the following is true or false.

a $10.34 \div 100 = 0.1034$

b $3.125 \times 0.1 = 31.25$

c $115.23 \div 10 = 1.1523 \times 1000$

d 115.23 has 3 decimal places

e $24.673 = 24.7$ when rounded to 1 decimal place

6E

9 State the number of decimal places in each answer to these calculations.

a A number with 2 decimal places \times a number with 3 decimal places.b A number with 1 decimal place \times a number with 4 decimal places.c A number with 2 decimal places \times a number with 2 decimal places.d A number with 2 decimal places \times a number with 0 decimal places.

6D

10 Solve each of the following, using the order of operations.

a 1.37×100

b 0.79×1000

c $225.1 \div 10$

d $96.208 \div 1000$

e $75.68 + 6.276 \times 100 - 63.24 \div 10$

f $3.56 \times 100 + 45 \div 10$

g $100 \times (56.34 \times 100 + 0.893)$

6E/F

11 Calculate the following.

a 2.4×8

b 9×7.11

c 2.3×8.4

d $3.8 \div 4$

e $12.16 \div 8$

f $3 \div 0.5$

g $4 \div 0.25$

h $1.2 \div 0.4$

i $3.42 \div 1.1$

6F/G/H

- 12** Copy and complete this table, stating fractions both with the denominator 100 and in their simplest form.

Decimal	Fraction	Percentage
0.45		
	$\frac{?}{100} = \frac{7}{10}$	
		32%
0.06		
	$\frac{79}{100}$	
1.05		
	$\frac{?}{100} = \frac{7}{20}$	
		65%
	$\frac{?}{1000} = \frac{1}{8}$	

Extended-response questions

- 1** Find the answer in these practical situations.
 - a** Jessica is paid \$125.70 for 10 hours of work and Jaczinda is paid \$79.86 for 6 hours of work. Who receives the higher rate of pay per hour, and by how much?
 - b** Petrol is sold for 124.9 cents per litre. Jacob buys 30 L of petrol for his car. Find the total price he pays, to the nearest 5 cents.
 - c** The Green family are preparing to go to the Great Barrier Reef for a holiday. For each of the four family members, they purchase a goggles and snorkel set at \$37.39 each, fins at \$18.99 each and rash tops at \$58.48 each. How much change is there from \$500?
 - d** For her school, a physical education teacher buys 5 each of basketballs, rugby union and soccer balls. The total bill is \$711.65. If the rugby balls cost \$38.50 each and the basketballs cost \$55.49 each, what is the price of a soccer ball?
- 2** A car can use 25% less fuel per km when travelling at 90 km/h than it would when travelling at 110 km/h. Janelle's car uses 7.8 litres of fuel per 100 km when travelling at 110 km/h, and fuel costs 155.9 cents per litre.
 - a** How much money could Janelle save on a 1000-km trip from Sydney to Brisbane if she travels at a constant speed of 90 km/h instead of 110 km/h?
 - b** During a 24-hour period, 2000 cars travel the 1000-km trip between Sydney and Brisbane. How much money could be saved if 30% of these cars travel at 90 km/h instead of 110 km/h?
- 3** Siobhan is on a 6-week holiday in the United Kingdom, and is using her phone to keep in contact with her friends and family in Australia. The phone charge for voice calls is \$0.40 'flagfall' and \$0.65 per 45 seconds; text messages are \$0.38 each. During her holiday, Siobhan makes 27 voice calls and sends 165 text messages to Australia. If her phone bill is \$832.30, determine the average length of Siobhan's voice calls.

Semester review 1

Whole numbers

Multiple-choice questions

- 1 Using numerals, thirty-five thousand, two hundred and six is:
A 350 260 **B** 35 260 **C** 35 000 206 **D** 3526 **E** 35 206
- 2 The place value of 8 in 2 581 093 is:
A 8 thousand **B** 80 thousand **C** 8 hundred **D** 8 tens **E** 8 ones
- 3 The remainder when 23 650 is divided by 4 is:
A 0 **B** 4 **C** 1 **D** 2 **E** 3
- 4 $18 - 3 \times 4 + 5$ simplifies to:
A 65 **B** 135 **C** 11 **D** 1 **E** 20
- 5 $800 \div 5 \times 4$ is the same as:
A 160×4 **B** $800 \div 20$ **C** $800 \div 4 \times 5$ **D** 40 **E** $4 \times 5 \div 800$

Short-answer questions

- 1 Write the number seventy-four in:
 - a** Babylonian numerals
 - b** Roman numerals
 - c** Egyptian numerals
- 2 Write the numeral for:
 - a** $6 \times 10\,000 + 7 \times 1000 + 8 \times 100 + 4 \times 10 + 9 \times 1$
 - b** $7 \times 100\,000 + 8 \times 100 + 5 \times 10$
- 3 Calculate:

a $96\,481 + 2760 + 82$	b $10\,963 - 4096$	c 147×3
d 980×200	e $4932 \div 3$	f $9177 \div 12$
- 4 State whether each of the following is true or false.

a $18 < 20 - 2 \times 3$	b $9 \times 6 > 45$	c $23 = 40 \div 2 + 3$
---------------------------------	----------------------------	-------------------------------
- 5 How much more than 17×18 is 18×19 ?
- 6 Calculate:

a $7 \times 6 - 4 \times 3$	b $8 \times 8 - 16 \div 2$	c $12 \times (6 - 2)$
d $16 \times [14 - (6 - 2)]$	e $24 \div 6 \times 4$	f $56 - (7 - 5) \times 7$

7 State whether each of the following is true or false.

a $4 \times 25 \times 0 = 1000$

b $0 \div 10 = 0$

c $8 \div 0 = 0$

d $8 \times 7 = 7 \times 8$

e $20 \div 4 = 20 \div 2 \div 2$

f $8 + 5 + 4 = 8 + 9$

8 Insert brackets to make $18 \times 7 + 3 = 18 \times 7 + 18 \times 3$ true.

9 How many times can 15 be subtracted from 135 before an answer of zero occurs?

10 Write 3 859 643 correct to the nearest:

a 10

b thousand

c million

Extended response question

1 Tom works as a labourer, earning \$25 an hour on weekdays and \$60 an hour on weekends.

a During a particular week, Tom works 7:00 am to 2:00 pm Monday to Thursday. How many hours does he work that week?

b How much does Tom earn for this work?

c If Tom works 5 hours on Saturday in the same week, what is his total income for the week?

d How many more hours on a Friday must Tom work to earn the same amount as working 5 hours on a Saturday?

Geometry

Multiple-choice questions

1 Which statement is correct?

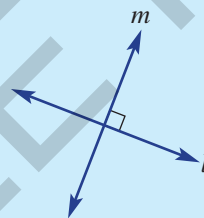
A Line m is perpendicular to line l .

B Line m bisects line l .

C Line m is parallel to line l .

D Line m is shorter than line l .

E Line m is longer than line l .



2 An angle of 181° is classified as:

A acute

B reflex

C straight

D obtuse

E sharp

3 Which two angles represent alternate angles?

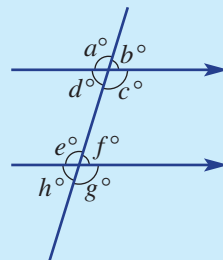
A a° and e°

B d° and f°

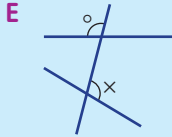
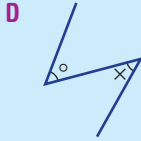
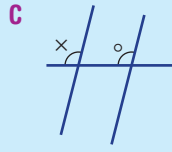
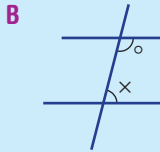
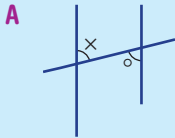
C a° and f°

D g° and b°

E c° and f°

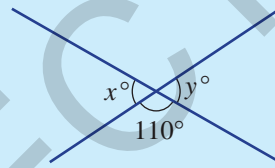


4 Which of the following shows a pair of supplementary angles?



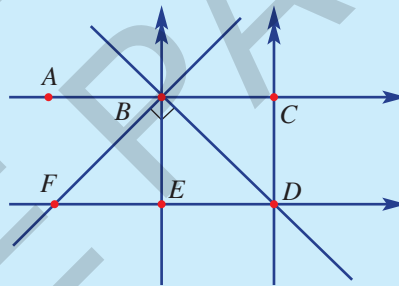
5 The value of $x + y$ is:

- A** 70
- B** 220
- C** 35
- D** 140
- E** 110

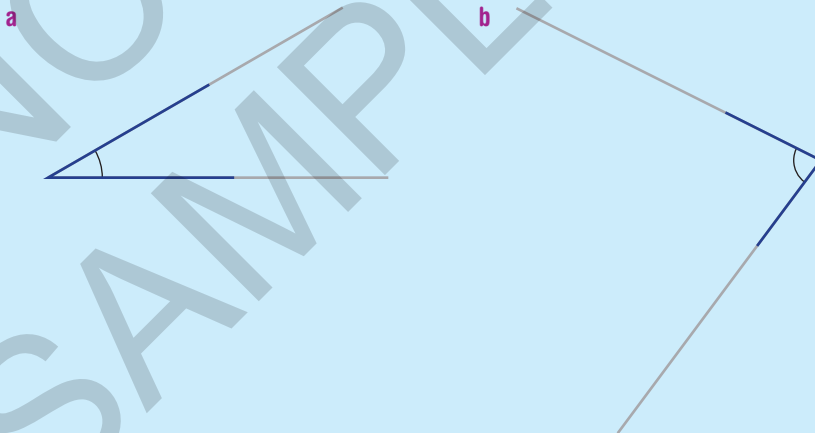


Short-answer question

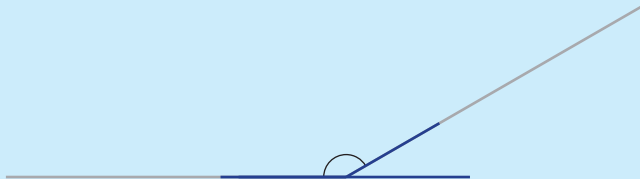
- 1
 - a** Name two pairs of parallel lines.
 - b** Name a pair of perpendicular lines.
 - c** List any three lines that are concurrent.
At what point do they cross?
 - d** Name two points that are collinear with point C .
 - e** Name the point at which line BE and line FD intersect.



2 Measure these angles.

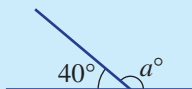


c

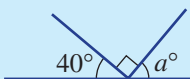


- 3 What is the complement of 65° ?
- 4 What is the supplement of 102° ?
- 5 Find the value of a in each of the following angles.

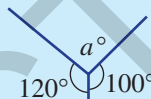
a



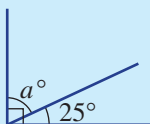
b



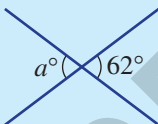
c



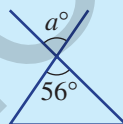
d



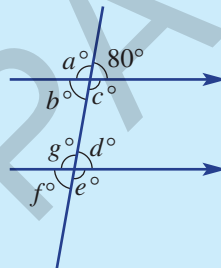
e



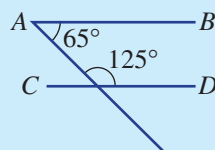
f



- 6 Find the value of each angle formed when these two parallel lines are crossed by the transversal, as shown.



- 7 Explain why AB is *not* parallel to CD .



- 8 Use your ruler and pair of compasses to draw a 60° angle. Bisect it to form two 30° angles.

Extended-response question

- 1 Consider the diagram shown.

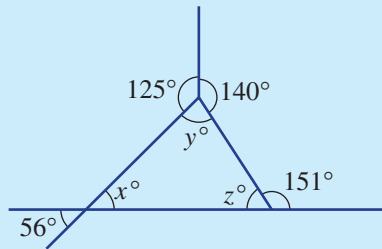
a Find the value of:

i x

ii y

iii z

b What is the value of $x + y + z$?



Number properties and patterns


Multiple-choice questions

- 1 The first prime number after 90 is:
A 91 **B** 92 **C** 97 **D** 95 **E** 93
- 2 The highest common factor (HCF) of 12 and 18 is:
A 6 **B** 12 **C** 4 **D** 2 **E** 9
- 3 $2 \times 2 \times 2 \times 3$ is the same as:
A 6×3 **B** $2^3 \times 3$ **C** 8^3 **D** 6^3 **E** 4^3
- 4 Evaluating $3^2 - \sqrt{25} + 3$ gives:
A 8 **B** 5 **C** 4 **D** 17 **E** 7
- 5 The number 48 in prime factor form is:
A $2^4 \times 5$ **B** $2 \times 3 \times 5$ **C** $2^3 \times 3^2$ **D** $2^4 \times 3$ **E** $2^3 \times 3$


Short-answer questions

- 1 List the factors of:
a 15 **b** 30 **c** 100
- 2 List the first five multiples of:
a 3 **b** 7 **c** 11
- 3 List all factors common to 30 and 36.
- 4 What is the highest factor common to 36 and 40?
- 5 Find the value of:
a 11^2 **b** $6^2 \times 2^2$ **c** $33 - 2^3$
- 6 What is the square root of 14 400?
- 7 Is the expression $\sqrt{3^2 + 4^2} = 3 + 4$ true or false?
- 8 Find the smallest number that must be added to 36 791 so that it becomes divisible by:
a 2 **b** 3 **c** 4
- 9 A pattern is shown using matchsticks.


term 1



term 2



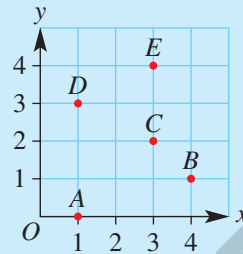
term 3



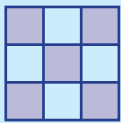
 - a** How many matchsticks are needed to build the 12th term in this pattern?
 - b** Which term in this pattern uses exactly 86 matchsticks?
- 10 Find the missing values in the table.

input	4	5	6			
output	19	23		39	47	403

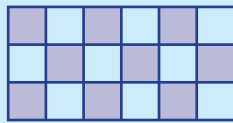
- 11 Write down the coordinates of each point.



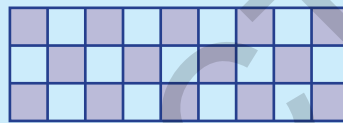
Extended-response question



term 1



term 2



term 3

- 1 The diagrams above shows the tile pattern being used around the border of an inground swimming pool.
- Draw the fourth term in the pattern.
 - How many coloured tiles are used in term 4 of the pattern?
 - Which term uses 41 coloured tiles in its construction?
 - If each coloured tile costs \$1 and each white tile costs 50 cents, what is the cost of completing the pattern using 41 coloured tiles?

Fractions

Multiple-choice questions

- 1 Which of the following is equivalent to $\frac{12}{7}$?
- A $\frac{24}{7}$ B $1\frac{5}{7}$ C $1\frac{5}{12}$ D $\frac{112}{17}$ E $\frac{7}{12}$
- 2 $\frac{1}{2} + \frac{1}{3}$ is equal to:
- A $\frac{2}{5}$ B $\frac{2}{6}$ C $\frac{5}{6}$ D $\frac{1}{5}$ E $\frac{7}{6}$
- 3 $\frac{350}{450}$ in simplest form is:
- A $\frac{35}{45}$ B $\frac{4}{5}$ C $\frac{3}{4}$ D $\frac{3.5}{4.5}$ E $\frac{7}{9}$
- 4 What fraction of \$2 is 40 cents?
- A $\frac{1}{20}$ B $\frac{20}{1}$ C $\frac{5}{1}$ D $\frac{1}{5}$ E $\frac{1}{40}$
- 5 $2\frac{1}{2} \div \frac{3}{4}$ is the same as:
- A $\frac{5}{2} \times \frac{4}{3}$ B $\frac{5}{2} \times \frac{3}{4}$ C $\frac{2}{5} \div \frac{3}{4}$ D $\frac{2}{5} \times \frac{4}{3}$ E $\frac{3}{2} \times \frac{3}{4}$

Short-answer questions

- 1 Arrange $\frac{1}{2}$, $\frac{1}{3}$, $\frac{2}{5}$ and $\frac{3}{10}$ in *ascending* order.
- 2 Express $5\frac{2}{3}$ as an improper fraction.
- 3 Find each of the following.

a $\frac{2}{3} + \frac{1}{4}$	b $4 - 1\frac{1}{3}$	c $2\frac{1}{2} + 3\frac{3}{4}$
d $\frac{2}{5} \times \frac{1}{2}$	e $\frac{2}{3} \div \frac{1}{6}$	f $1\frac{1}{5} \times \frac{5}{12}$
- 4 Write 15% as a simple fraction.
- 5 Find 25% of \$480.
- 6 Find $12\frac{1}{2}\%$ of \$480.
- 7 State whether each of the following is true or false.

a 25% of $x = x \div 4$	b 10% of $w = \frac{w}{10}$
c 20% of 50 = 50% of 20	d 1% of $x = 100x$
- 8 Which is larger, $\frac{2}{3}$ or 67%?

Extended-response question

- 1 Caleb's cold and flu prescription states: 'Take two pills three times a day with food.' The bottle contains 54 pills:
 - a** How many pills does Caleb take each day?
 - b** What fraction of the bottle remains after Day 1?
 - c** How many days will it take for the pills to run out?
 - d** If Caleb takes his first dose Friday night before going to bed, on what day will he take his last dose?

Algebra**Multiple-choice questions**

- 1 $12 - x$ means:

A 12 less than x	B x less than 12	C x has the value of 12
D x is less than 12	E x is more than 12	
- 2 Double the sum of x and y is:

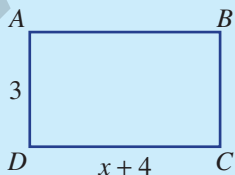
A $2(x+y)$	B $2x+y$	C $x+2y$	D $(x+y)^2$	E $x+y+2$
-------------------	-----------------	-----------------	--------------------	------------------
- 3 Half the product of a and b is:

A $2ab$	B $\frac{a+b}{2}$	C $\frac{ab}{2}$	D $\frac{1}{2}a + \frac{1}{2}b$	E $\frac{a}{2} + b$
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- 4 $4a + 3b + c + 5b - c$ is the same as:
 A $32ab$ B $4a + 8b + 2c$ C $8a + 4b$ D $64abc$ E $4a + 8b$
- 5 If $a = 3$ and $b = 7$, then $3a^2 + 2b$ is equal to:
 A 66 B 95 C 23 D 41 E 20

Short-answer questions

- 1 Consider the expression $5x + 7y + 3x + 9$.
 a How many terms are in this expression?
 b Can the expression be simplified?
 c What is the value of the constant term?
 d What is the coefficient of y ?
- 2 Write an algebraic expression for each of the following.
 a the sum of x and 3
 b the product of a and 12
 c the sum of double x and triple y
 d w divided by 6
 e double x taken from y
- 3 Find how many:
 a cents are in $\$m$ b hours are in x days
 c millimetres are in p kilometres d days are in y hours
- 4 If $m = 6$, find the value of each of the following.
 a $m + 7$ b $2m - 1$ c $6m + 3$
 d $2(m - 3)$ e $\frac{m + 6}{2}$ f $\frac{m}{2} + 4m - 3$
- 5 Evaluate the expression $3(2x + y)$ when $x = 5$ and $y = 2$.
- 6 Simplify each of the following.
 a $6a + 4a$ b $7x - 3x$ c $9a + 2a + a$
 d $m + m - m$ e $6 + 2a + 3a$ f $x + y + 3x + y$
- 7 a Write an expression for the perimeter of rectangle $ABCD$.
 b Write an expression for the area of rectangle $ABCD$.



- 8 Find the missing term.
 a $3a \times \underline{\hspace{1cm}} = 18abc$ b $10ab \div \underline{\hspace{1cm}} = 2a$
 c $2p + 2p + 2p = 6\underline{\hspace{1cm}}$

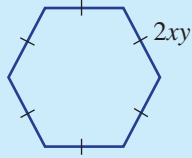
9 Expand:

a $2(a + 3)$

b $12(a - b)$

c $8(3m + 4)$

10 Write the simplest expression for the perimeter of this figure.



Extended-response question

1 A bottle of soft drink costs \$3 and a pie costs \$2.

a Find the cost of:

i 2 bottles of soft drink and 3 pies

ii x bottles of soft drink and 3 pies

iii x bottles of soft drink and y pies

b If Anh has \$50, find his change if he buys x bottles of soft drink and y pies.

Decimals

Multiple-choice questions

1 $80 + \frac{6}{10} + \frac{7}{1000}$ is the same as:

A 8067

B 867

C 80.67

D 80.067

E 80.607

2 Select the incorrect statement.

A $0.707 > 0.7$

B $0.770 = \frac{77}{100}$

C $0.07 \times 0.7 = 0.49$

D $0.7 \times \frac{1}{10} = 0.07$

E $0.7 \times 10 = 7$

3 The best estimate for 23.4×0.96 is:

A 234

B 230

C 0.234

D 23

E 20

4 $\frac{3}{8}$ is the same as:

A 0.375

B 3.8

C 0.38

D $2.\dot{6}$

E 38%

5 $6.8 \div 0.04$ is the same as:

A $68 \div 4$

B $680 \div 4$

C 17

D $\frac{4}{68}$

E $7 \div 0.05$

Short-answer questions

- 1 Write each of the following as a decimal.

a two-tenths	b $\frac{13}{100}$	c $\frac{17}{10}$
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- 2 In the decimal 136.094:

a What is the value of the 6?	b What is the value of the 4?	c What is the decimal, correct to the nearest tenth?
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- 3 Round 18.398 741 correct to:

a the nearest whole	b 1 decimal place	c 2 decimal places
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- 4 Evaluate:

a $15 - 10.93$	b $19.7 + 240.6 + 9.03$	c $20 - 0.99$
d 0.6×0.4	e $(0.3)^2$	f $\frac{12}{0.2}$
- 5 Find:

a $1.24 - 0.407$	b $1.2 + 0.6 \times 3$	c $1.8 \times 0.2 \div 0.01$
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- 6 If $369 \times 123 = 45\,387$, write down the value of:

a 3.69×1.23	b 0.369×0.123	c $45.387 \div 36.9$
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- 7 Find:

a 36.49×1000	b $1.8 \div 100$	c 19.43×200
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- 8 For each of the following, circle the larger of each pair.

a $\frac{4}{5}$, 0.79	b 1.1, 11%	c $\frac{2}{3}$, 0.6
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- 9 State if each of the following is true or false.

a $0.5 = 50\%$	b $0.15 = \frac{2}{20}$	c $38\% = 0.19$
d $126\% = 1.26$	e $\frac{4}{5} = 0.08$	f $1\frac{3}{4} = 1.75$

Extended-response question

- 1 The cost of petrol is 116.5 cents per litre.
 - a** Find the cost of 55 L of petrol, correct to the nearest cent.
 - b** Mahir pays cash for his 55 L of petrol. What is the amount that he pays, correct to the nearest 5 cents?
 - c** If the price of petrol is rounded to the nearest cent before the cost is calculated, how much would 55 L of petrol cost now?
 - d** By how much is Mahir better off if the rounding occurs at the end rather than the beginning?
 - e** If the price drops to 116.2 cents per litre, is the comparison between rounding at the end versus rounding at the beginning the same as it was above?