

Mathspace

City Mission



Code X, the evil code-breaking master, is on a spree through the city's streets, decoding top secret information that is giving him access to all of the city's finances, gold and valuables. Your mission is to answer the questions he has left on different devices at various locations around the city, starting at the police station. Answering the questions correctly will spell the access code to his computer files and give you the location of the next clue. The path taken will lead you to Code X's hideout. Can you break the code before he escapes?

- The length of this single carriage train could be:
- Y** 0.07 km (go to police station)
 - Z** 200 m (go to train map)
 - A** 2000 cm (go to library)
 - B** 1200 mm (go to bank)

- 0.67 km is equal to:
- N** 6700 cm (go to Pop's Pizza)
 - O** 670 m (go to telephone booth)
 - P** 6.7 m (go to library)
 - Q** 0.0067 m (go to train carriage)

- The volume of air that can fit inside this telephone booth is:
- K** $12\ 800 \text{ m}^3$ (go to newspaper stand)
 - L** 6400 m^3 (go to library)
 - M** 360 m^3 (go to police station)
 - N** 1.28 m^3 (go to train map)

- The length of this train line is:
- R** 4.6 km (go to train carriage)
 - S** 3.8 km (go to L'Hotel)
 - T** 42 km (go to museum)
 - U** 52 km (go to telephone booth)



The length of this police sign is:
A 40 cm (go to library)
B 1600 cm (go to telephone booth)
C 400 cm (go to bank)
D 800 cm (go to train map)

32 metres is equal to:
V 0.32 km (go to post office)
W 0.032 cm (go to bank)
X 320 cm (go to museum)
Y 3200 cm (go to rubbish bin)

The volume of this rubbish bin will give you his hideout:
E 0.36 m³ (go to Pig and Whistle Café)
F 3.6 m³ (go to park bench)
G .72 m³ (go to Ye Olde Bookstore)
H 7.2 m³ (go to train platform exit)

The volume of this stack of newspapers is:
C 1.3 m³ (go to rubbish bin)
D 3 m³ (go to post office)
E 0.075 m³ (go to L'Hotel)
F 0.75 m³ (go to library)

The volume of this shape is:
D 16 m³ (go to museum)
E 13 m³ (go to train map)
F 15 m³ (go to newspaper stand)
G 17 m³ (go to L'Hotel)

The area of this shape is:
P 36 m² (go to L'Hotel)
Q 32 m² (go to telephone booth)
R 30 m² (go to train carriage)
S 24 m² (go to newspaper stand)



Bookshop

op

POLICE

STATION

Area = 80 000 cm²

LIBRARY

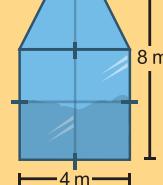
OPEN

L'Hotel



MUSEUM

MUSEUM



← EXIT

TRAIN MAP

1 cm = 1 km



LANDSCAPE GARDENING

Landscape gardening involves designing and creating outside spaces, such as the area around a house or building, and public parks. There are many DIY magazines and TV shows transforming the average backyard into a haven of 'outdoor rooms', lights, waterfalls and vegetable gardens. Before a garden can be transformed, a detailed design is drawn on grid or graph paper.

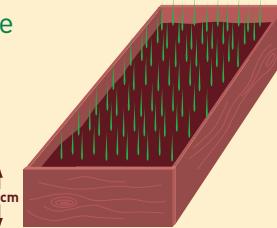
- 1 (a)** Why is it helpful to draw the design on a grid?
- (b)** The scale at the top of the grid states that 1 cm on the page represents 1 m in real life. What real life distance would 1 mm represent?

At the top of the following page is a design used to transform an Australian backyard.

Refer to the plan when answering Questions 2–8.

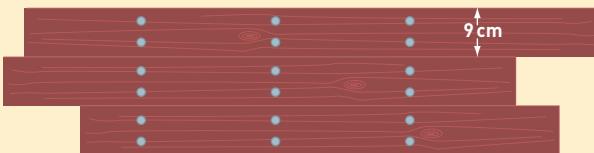
- 2** What is the total area of the backyard (not including the house)?
- 3** The lawn will be sown by seed. 30 g of grass seed is needed to cover each square metre.
 - (a)** What is the area to be covered in grass?
 - (b)** How much grass seed will you need to buy? Give your answer in kilograms.
- 4** The path that extends from the shed to and around the vegie garden will be paved with bricks. The base dimensions of one brick are 20 cm × 10 cm. Calculate:
 - (a)** How many bricks will cover each square metre?
 - (b)** What is the total number of bricks required to complete the path?

- 5** The vegetable garden will be constructed out of timber sleepers with a height of 30 cm. The box needs to be filled with a mixture of soil and compost.



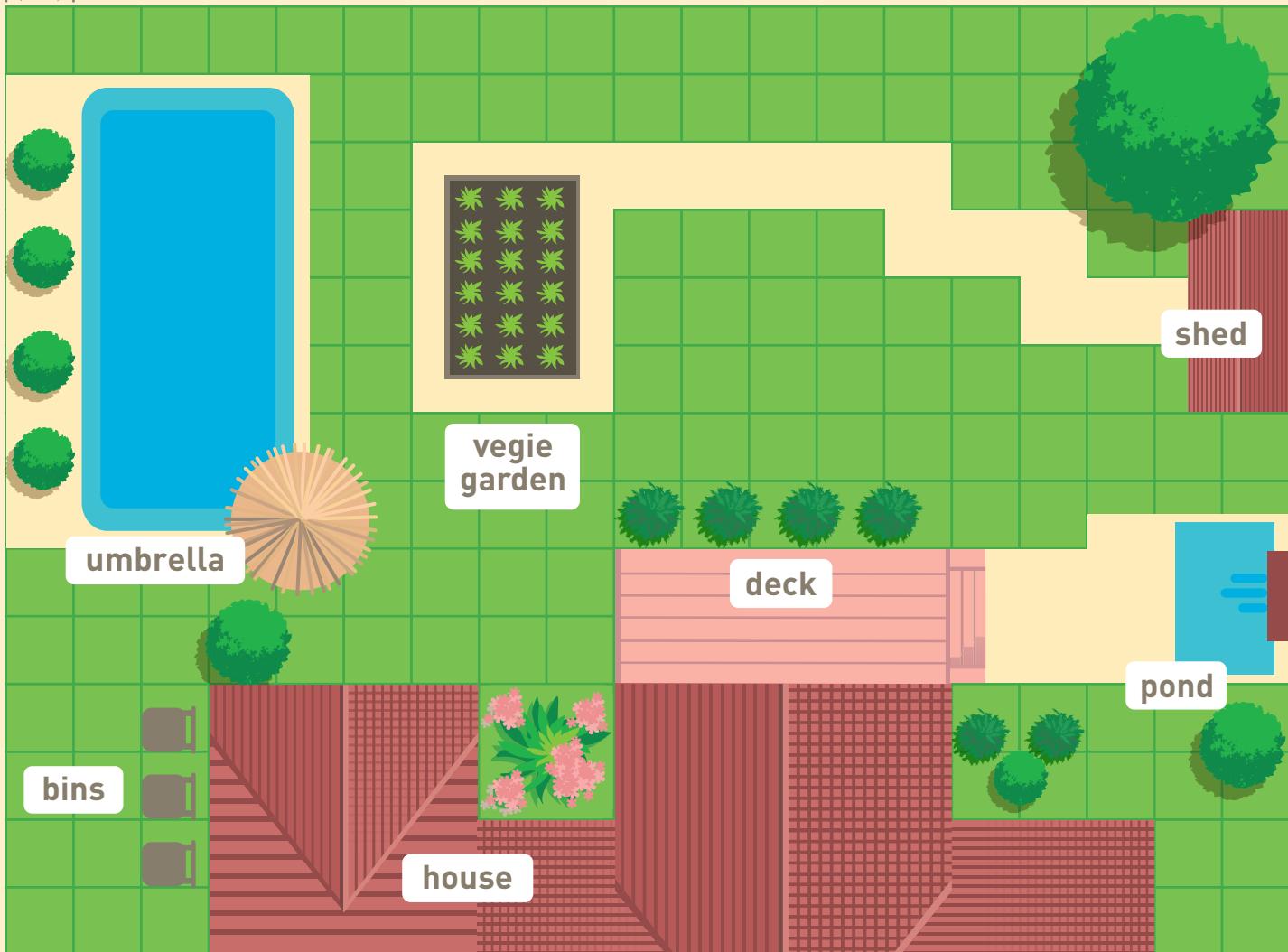
- (a)** What is the total length of the timber sleepers needed to make the vegetable garden box?
- (b)** Find the area of the topsoil of the vegetable garden.
- (c)** What volume of soil mixture will be needed to fill the box to the top?

- 6** The deck will be made using hardwood boards that are 9 cm wide. Decking boards are sold in different lengths and then cut to size.



- (a)** What area is to be decked? (Include the step in your calculations.)
- (b)** How many boards are needed to cover a width of one metre?
- (c)** What length of decking will need to be bought to make the deck?

1 cm
scale: 1 cm = 1 m



An important consideration when designing a backyard is cost. A detailed budget needs to be completed before the project can begin.

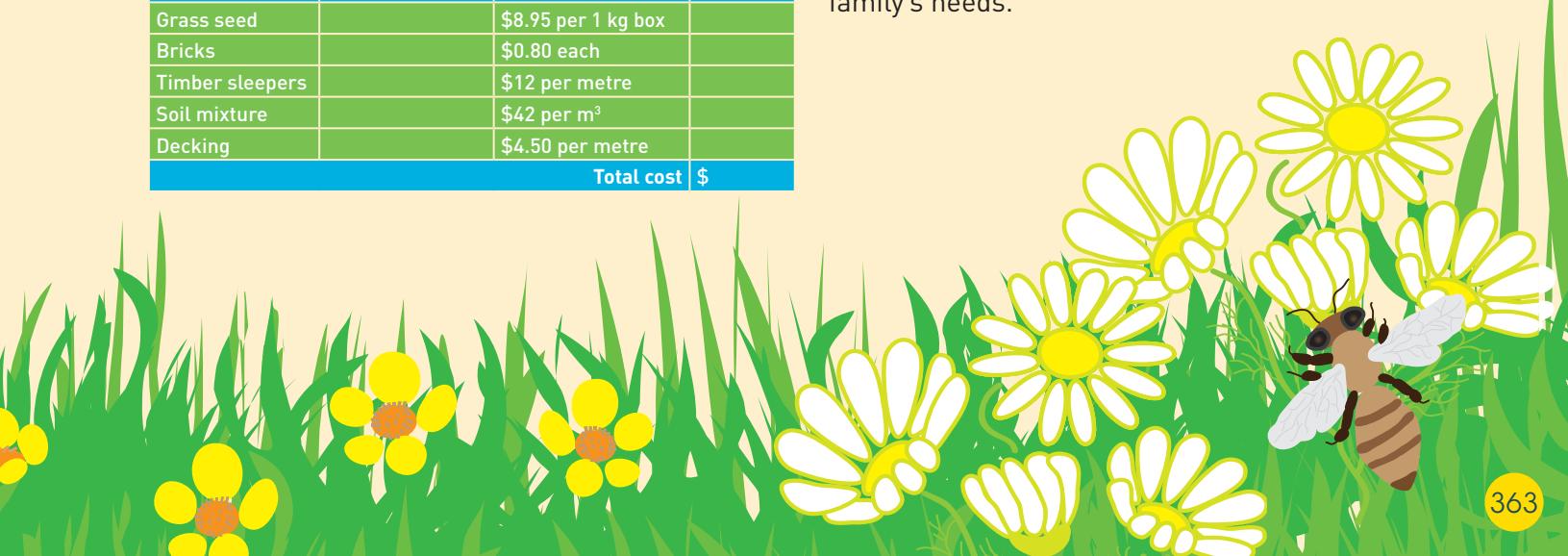
7 Using the figures you have calculated in Questions 2–6, copy and complete the budget below.

Item	Number of items required or area to cover (m^2)	Cost	Total cost of each item
Grass seed		\$8.95 per 1 kg box	
Bricks		\$0.80 each	
Timber sleepers		\$12 per metre	
Soil mixture		\$42 per m^3	
Decking		\$4.50 per metre	
Total cost \$			

8 What other costs in making this backyard have not been included in the above budget?

Research

Design your own 'ideal' backyard. Make a scale drawing of it using similar symbols as above. Consider aspects such as space, cost, slope of the land, water restrictions, pets and your family's needs.



Investigation

Equipment required: 1 brain, (2 brains may be used for Question 2), centimetre cubes (optional), graph paper or isometric dot paper



Blocks of chocolate

The dimensions of a Cadbury Cherry Ripe® chocolate bar are shown below.

The surface area of a chocolate bar is the combined area of the top, bottom and all four sides. It is the area that is covered in chocolate.

The smaller the surface area of a chocolate bar, the less packaging will be required to wrap around it.



The Big Question

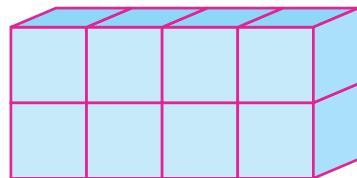
What is the smallest possible surface area for a Cadbury Cherry Ripe® that has a volume of 36 cm^3 ?

Engage

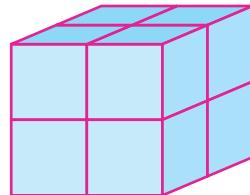
Chocolate comes in blocks that resemble rectangular prisms. The volume of a rectangular prism can be calculated using the formula: Volume = length \times width \times height. If the volume is known to be 8 cm^3 and we want to find the possible dimensions for the rectangular prism, we need to find three numbers that multiply to give 8:

For example: $8 \text{ cm}^3 = 4 \times 2 \times 1$

These dimensions give the following rectangular prism.



These eight cubes can be arranged to make two other rectangular prisms:



- 1 The surface area of a rectangular prism can be found by counting or calculating the number of squares on the surface of each face (including the bottom) and adding them together. The surface area of a rectangular prism with length 4 cm, width 1 cm and height 2 cm is shown in the table below.

Dimensions	
	$4 \text{ cm} \times 2 \text{ cm} \times 1 \text{ cm}$
Area of front and back	
Area of top and bottom	
Area of sides	
Total surface area	



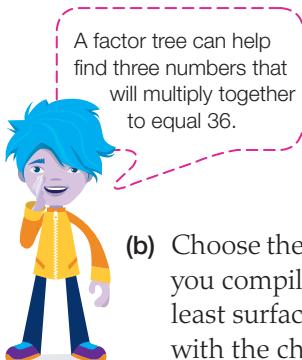
- (a) Calculate the surface area of the other two rectangular prisms with volume 8 cm^3 . If you have centimetre cubes, use them to help you.
- (b) All three rectangular prisms have a volume of 8 cm^3 . What are the dimensions of the one with the smallest surface area?
- (c) Draw the actual Cherry Ripe® bar as a rectangular prism on graph paper or dot paper.
- (d) What is the surface area of the Cherry Ripe®?

Explore

- 2 The volume of the Cherry Ripe® shown is $12 \times 3 \times 1 = 36 \text{ cm}^3$.

- (a) Other whole number dimensions of a rectangular prism will give a volume of 36 cm^3 . List all the different combinations of whole numbers that will make this statement true.

$$36 \text{ cm}^3 = \underline{\quad} \times \underline{\quad} \times \underline{\quad}$$



Strategy options

- Make a table.
- Have I seen a similar problem?
- Make a model.

- (b) Choose the three sets of dimensions from the list you compiled in (a) that you think will have the least surface area. Draw three chocolate bars with the chosen dimensions on graph paper or dot paper.
- (c) Copy and complete the table below to find the total surface area of the three prisms:

Dimensions of chocolate bar	Area of front and back	Area of top and bottom	Area of sides	Total surface area

Explain

- 3 (a) Use your results from Question 2 to answer the Big Question. Include dimensions of the bar and its surface area in your answer.
- (b) How much less packaging would this new bar require, compared to the current one?

Elaborate

- 4 (a) Explain how you can predict which dimensions of a rectangular prism will have the smallest surface area.
- (b) Write a statement that explains how you would find the dimensions that give the smallest surface area for a rectangular prism.

Evaluate

- 5 (a) Describe, using a step-by-step method, the approach you used to solve this problem. Did you use any of the information you found in Question 1?
- (b) Can this problem be solved another way? What other methods or shortcuts could be used when approaching problems like this one?
- (c) Why do you believe current chocolate bars are the shape they are? Do you think that chocolate companies may consider changing the dimensions of chocolate bars? List some advantages and disadvantages of doing this.

Extend

- 6 (a) Construct a model of your alternative Cherry Ripe® chocolate bar that has the smallest surface area. Design the packaging and then fold it into a rectangular prism.
- (b) Prepare a report for the Cadbury Schweppes company on the size, dimensions and packaging of your new Cherry Ripe® chocolate bar. Your report should include:
- the dimensions and surface area of your newly designed Cherry Ripe®
 - environmental reasons for reducing the amount of packaging used for individual chocolate bars
 - financial reasons for reducing the amount of packaging used for individual chocolate bars
 - an example of what your new Cherry Ripe® will look like (your design).

Challenge 6

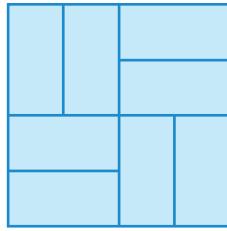
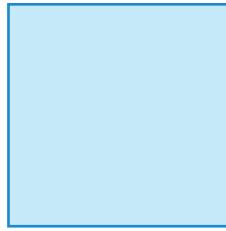


1 If a \$2 coin is about 2 mm thick, how much is a kilometre-high stack of \$2 coins worth?

2 The perimeter of this square paddock is 800 m. It is divided into eight identical paddocks as shown.

The perimeter, in metres, of each of the eight smaller paddocks is:

- A 150 B 200
C 300 D 400

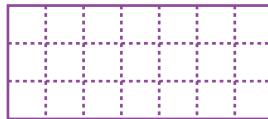


3 The weight limit for a lift is 1500 kilograms. The average weight of the people in the lift is 80 kilograms. If the combined weight of the people is 100 kilograms over the limit, how many people are in the lift?

- A 13 B 16 C 17 D 20

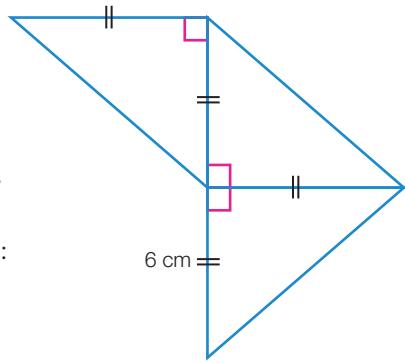
4 When a square piece of paper is folded in half vertically, the resulting rectangle has a perimeter of 39 cm. Find the area of the original sheet of paper, in square centimetres.

5 A rectangular area on a wall measuring 7 units by 3 units is covered with 7 rectangular tiles measuring 1 unit by 3 units. In how many ways can this be done?



6 The area of the entire figure shown is:

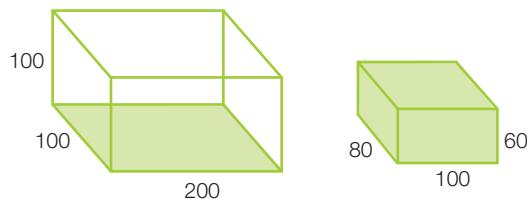
- A 36 cm^2 B 54 cm^2
C 72 cm^2 D 108 cm^2



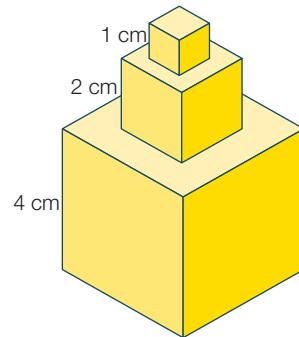
7 A rectangular sign has the dimensions 10 m by 16 m. If a square advertisement to be painted on it must have a border at least 1.5 m wide, the area of the largest square advertisement that can be painted on the sign is:

- A 49 m^2 B 72.25 m^2
C 91 m^2 D 160 m^2

8 A fish tank has a base of 100 cm by 200 cm and a depth of 100 cm. A solid metal rectangular prism with dimensions 80 cm by 100 cm by 60 cm is placed in the tank and water is poured into the tank until it is level with the top of the metal prism. After the prism is carefully removed from the tank, the depth of the water remaining is measured. What are the three possible depths?



9 Three cubes are sitting on top of each other. The bottom cube has a side length of 4 cm, the cube on top of it has a side length of 2 cm and the very top cube has a side length of 1 cm. What is the visible area of the cube stack?



Chapter review 6

D.I.Y. Summary

Key Words

area	height	metric	perpendicular
base	kilometre	millimetre	rectangular prism
centimetre	length	parallelogram	volume
composite shape	metre	perimeter	width

Copy and complete the following using the words and phrases from this list, where appropriate, to write a summary for this chapter. A word or phrase may be used more than once.

- 1 _____ is the distance around the outside of a shape.
- 2 To calculate the _____ of a rectangle, you multiply the _____ by the width.
- 3 The area of a triangle is half the _____ multiplied by the perpendicular _____.
- 4 The _____ of a rectangular prism is found by multiplying the length, width and height together.
- 5 The system of measurement used in Australia is called the _____ system.
- 6 To find the area of a _____ we break it up into simpler shapes.
- 7 Multiplying the base length by the perpendicular height will find the area of a _____.

Fluency

- 1 (a) The height of an average house ceiling is approximately:

A 260 mm B 2.6 m C 0.26 km D 2600 m

Ex. 6.1

- (b) The length of a classroom desk is approximately:

A 18 cm B 280 mm C 180 cm D 180 m

- 2 Copy and complete the following length conversions.

(a) $45.9 \text{ km} = \underline{\hspace{2cm}} \text{ m}$ (b) $58\,000 \text{ cm} = \underline{\hspace{2cm}} \text{ km}$

Ex. 6.1

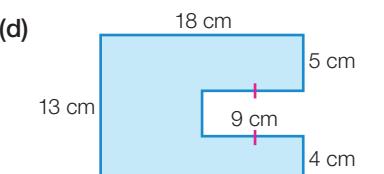
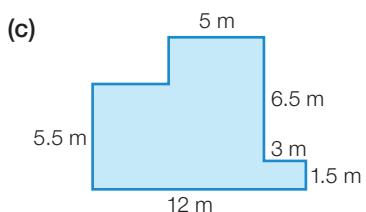
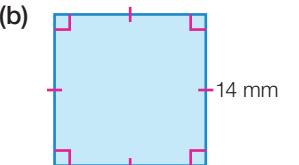
(c) $9.2 \text{ m} = \underline{\hspace{2cm}} \text{ mm}$

(d) $42 \text{ m} = \underline{\hspace{2cm}} \text{ cm}$

(e) $980 \text{ m} = \underline{\hspace{2cm}} \text{ km}$

(f) $0.006\,73 \text{ km} = \underline{\hspace{2cm}} \text{ mm}$

- 3 Find the (i) perimeter and (ii) area of each of the following shapes.



Ex. 6.2

Ex. 6.3

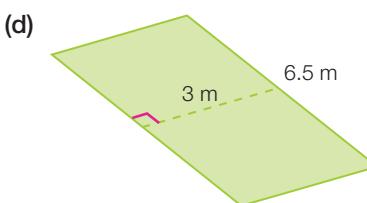
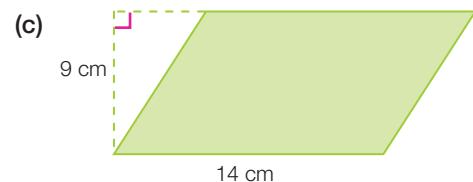
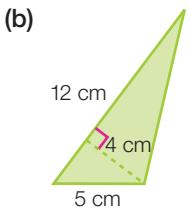
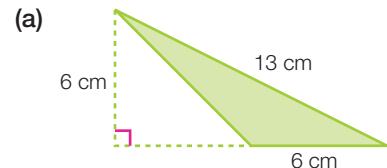
Ex. 6.5

4 Find the perimeter and area of a squash court 9.75 m long and 6.4 m wide.

Ex. 6.2, 6.3

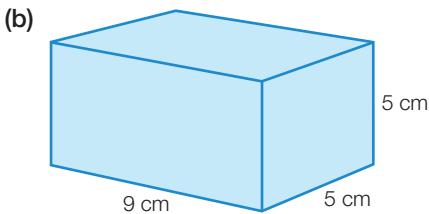
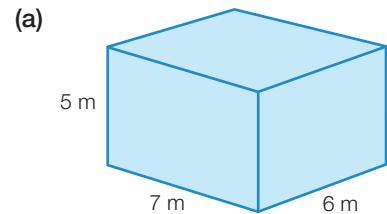
5 Find the area of each of the following shapes.

Ex. 6.3, 6.4



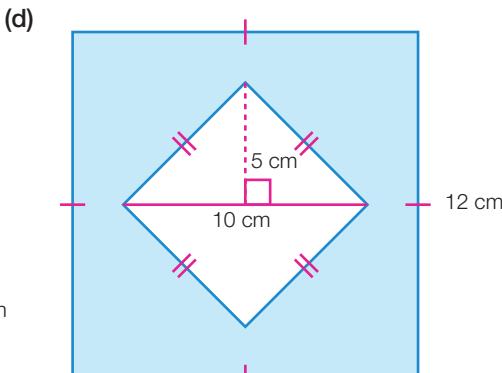
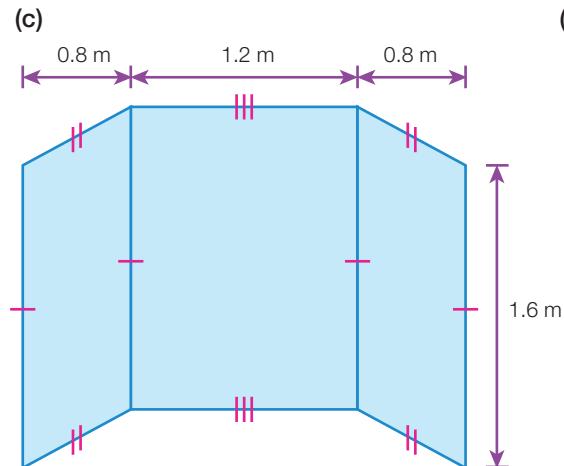
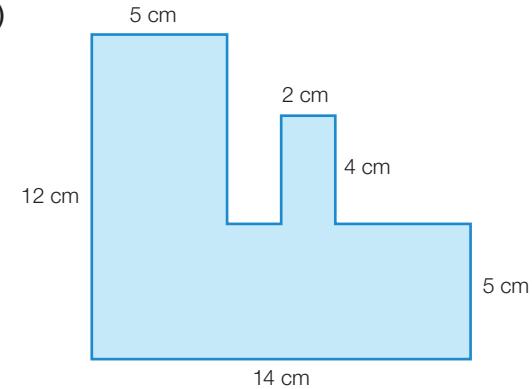
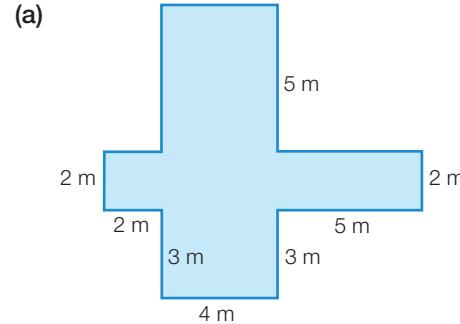
6 Determine the volume of the following solids.

Ex. 6.6



Understanding

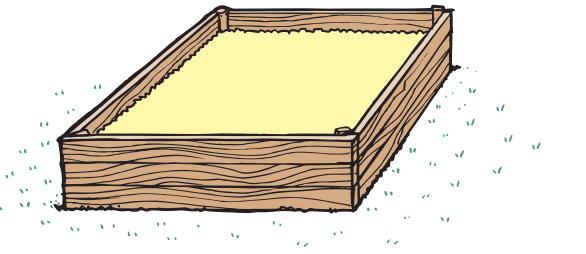
7 Find the area of each composite shape below.



- 8 A carpenter calculates that the length of timber she requires to make a book case is 4850 mm.
- (a) How many metres is this?
- (b) If timber costs \$6 per metre at the hardware store, how much will she pay?
- 9 Robbie is tiling the floor of his bathroom, which is a rectangle measuring 3 m by 2.5 m.
- (a) Write these measurements in centimetres, then calculate the area of the floor in square centimetres.
- (b) Robbie is using square tiles that have a side length of 25 cm. Calculate the number of tiles needed to cover the floor.
- (c) If the tiles cost 80 cents each, calculate how much Robbie will pay for the required number of tiles.

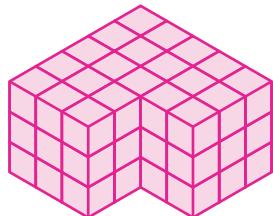


- 10 Theresa is constructing a sand pit for her children. She has created a rectangular wooden box that is 2 m long, 1.5 m wide and 0.3 m high.
- (a) Calculate the perimeter of the box.
- (b) Calculate the volume of the box.
- (c) If one cubic metre of sand costs \$15, calculate how much it will cost to fill the box to a depth of 25 cm with sand.

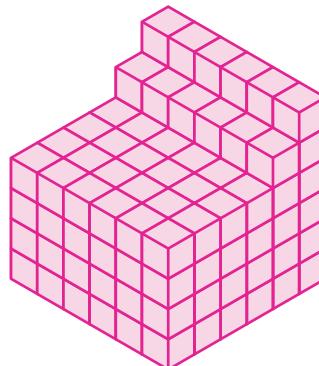


- 11 Tricia has obtained a quote of \$21 per square metre for her driveway to be resurfaced. If her driveway is rectangular and measures 12 m long and 3.2 m wide, what will the job cost her?
- 12 Determine the volume of each of the following solids. (The cubes are centimetre cubes.)

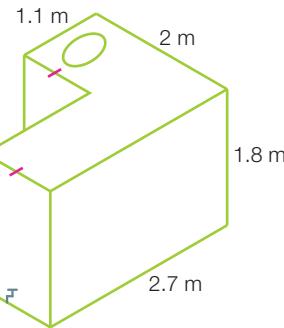
(a)



(b)

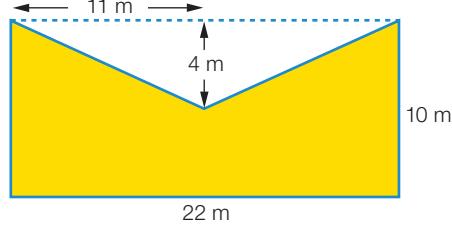


- 13 Cameron has had a water tank specially made to fit the side of his house. Calculate the volume of the tank, in cubic metres.



Reasoning

- 14 What is the perimeter of a square with an area of 25 cm^2 ?
- 15 What is the area of a rectangle with a perimeter of 32 cm and a length of 10 cm?
- 16 At right is a diagram of the available floor space (shaded) in an unoccupied car show-room. Calculate the area available for a display.

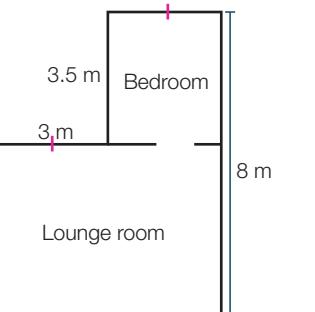


- 17 Five blocks of dimensions $3 \text{ cm} \times 5 \text{ cm} \times 6 \text{ cm}$ are placed in a toy box of length 40 cm, width 20 cm and height 9 cm. Find the volume of space left in the box.
- 18 Draw a diagram to help you explain:
- how to turn a parallelogram into a rectangle
 - how to turn a triangle into a rectangle.

NAPLAN practice 6

Numeracy: Non-calculator

- Which has the larger area: A rectangle with a length of 20 cm and a width of 15 cm, or a triangle with a base of 20 cm and a height of 15 cm?
- Li is having new carpet laid in the lounge room and bedroom of her apartment. What area is to be carpeted?



- What is the perimeter of a square that has an area of 100 cm^2 ?
- A rectangular picture frame has a perimeter of 80 centimetres. The frame has a length of 25 centimetres.

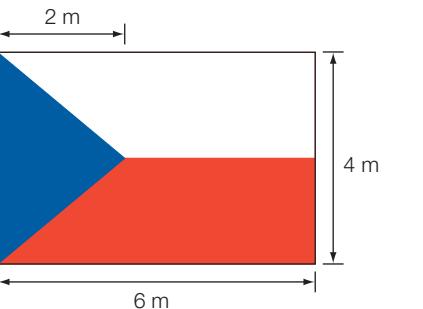
What is the width of the picture frame? _____ cm

Numeracy: Calculator allowed

- The flag of the Czech Republic is shown here.

The line where the red and white sections meet is halfway up the flag. If the blue triangle has a height of 2 m, the area of the flag that is red is:

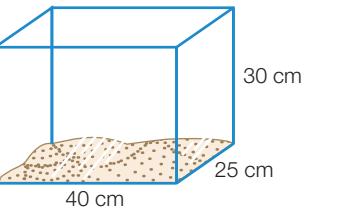
- A 8 m^2 B 9 m^2
C 10 m^2 D 16 m^2



- A pack of playing cards is 2.6 cm high. If there are 52 cards in the pack, what is the thickness of each card?
- The Hudson family have bought a new fish tank, requiring a 20 mm deep layer of pebbles on the bottom. Which volume of pebbles should they buy?

A 1000 cm^3 B 2000 cm^3
C 20000 cm^3 D 30000 cm^3
- Sanjay used identical cubes to build a rectangular prism. There were 18 cubes in its base. She used 54 cubes altogether. Which of these could be the dimensions of Sanjay's prism?

A $6 \times 3 \times 2$ B $3 \times 2 \times 9$ C $9 \times 3 \times 3$ D $6 \times 3 \times 9$



Mixed review C



Fluency

1 Write the following in algebra.

Ex. 5.1

- (a) Akash has n pencils in his pencil case. He takes 8 out and lends them to a friend.
How many pencils are in the case now?
- (b) k dollars is divided evenly among 6 people. How much money does each person receive?
- (c) There are 50 matches in one box. How many matches are there in h boxes?

2 Arrange the following decimals in order from smallest to largest.

Ex. 4.1

- (a) 2.3, 2.003, 2.33, 2.323, 2.302 (b) 0.089, 0.129, 0.091, 0.0909, 0.0199

3 Write the following as fractions or mixed numbers in simplest form.

Ex. 3.1

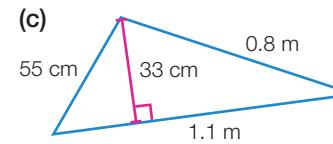
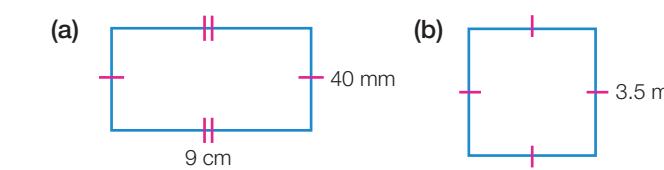
- (a) 6 out of 24 students in the class have black hair.
- (b) 5 full dozen egg cartons and 4 eggs in another carton.
- (c) 25 minutes out of an hour.

4 Write each of the following numbers as a product of their prime factors in index form.

Ex. 2.3

5 Find (i) the perimeter and (ii) the area of the following shapes, giving your answer in the larger unit where necessary.

Ex. 6.2, 6.3, 6.5



6 Calculate:

Ex. 1.5

- (a) $7 + 32 \div 4 \times 2$ (b) $(33 + 12) \div 3 + 19$ (c) $6 \times 9 \div 2 + 4$

7 Calculate the following, writing your answers in simplest form and as a mixed number, if appropriate.

Ex. 3.5, 3.6

- (a) $\frac{5}{6} \times \frac{4}{9}$ (b) $\frac{9}{10} \div \frac{7}{15}$ (c) $1\frac{3}{5} \times 2\frac{7}{8}$ (d) $4 \div \frac{2}{3}$

8 Copy and complete the following conversions.

Ex. 6.1

- (a) $6.09 \text{ km} = \underline{\hspace{2cm}} \text{ m}$ (b) $83 \text{ cm} = \underline{\hspace{2cm}} \text{ m}$ (c) $5400 \text{ cm} = \underline{\hspace{2cm}} \text{ km}$

9 Calculate the following.

Ex. 2.5–2.7

- (a) $-2 + 8$ (b) $14 - 17$ (c) $-15 + 3$ (d) $-5 - 6$
(e) $3 + (-9)$ (f) $-4 - (-1)$ (g) $11 - (-2)$ (h) $-7 - 10$

10 Use a mental or written strategy to calculate the following.

Ex. 1.1, 1.3

- (a) 28×43 (b) $990 \div 6$ (c) 57×4

11 There are 8 red, 12 blue and 4 black jelly beans in a packet.

Ex. 4.9

- (a) Write the ratio blue:red:black in simplest form.
- (b) Write the number of red jelly beans as a percentage of the total, rounded to one decimal place.

12 Write the following decimals as fractions in simplest form.

(a) 0.23

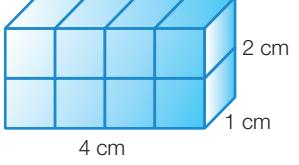
(b) 0.06

(c) 0.505

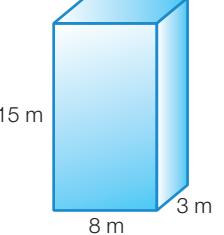
Ex. 4.3

13 Find the volume of the following rectangular prisms.

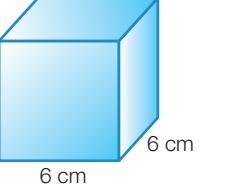
(a)



(b)



(c)



Ex. 6.6

14 Copy and complete the table using the rule $y = 3(x + 2)$.

Ex. 5.4

x	0	2	3	6	10
y					

15 Calculate:

(a) $4.67 + 8.8$

(b) $8.93 + 0.00635$

(c) $19.87 + 21.075$

Ex. 4.4

16 Calculate:

(a) $1.86 \div 600$

(b) $0.42 \div 1000$

(c) $10.605 \div 0.005$

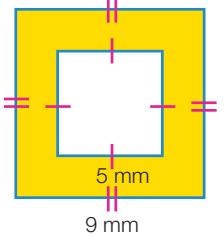
Ex. 4.6

Understanding

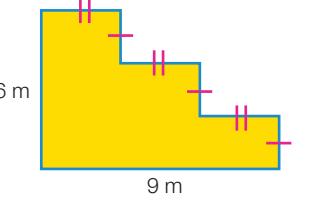
17 Joseph had \$578.97 in his bank account. After his pay was deposited, there was \$665.49. How much was Joseph's pay?

18 Find the area of the shaded regions.

(a)



(b)



19 Ben surveyed some Year 7 students to find out their favourite Australian animal. Here are his results:

Koala 8 students
Wombat 4 students

Bilby 6 students
Kangaroo 2 students

Write the preference for each animal (a) as a fraction in simplest terms, and (b) as a percentage of the total number of students.

Reasoning

20 Which is larger: 2^8 or 8^2 ?

21 The Hawksbury Magpies were playing in the U14 football grand final. All goals were scored by three boys. Johan scored $\frac{1}{3}$ of the goals, Rihbi scored $\frac{1}{2}$ of the goals and Kyle scored the rest. If the Magpies scored 24 goals, how many goals were scored by Kyle?

22 A rectangle has a length 5 cm greater than its width and a perimeter of 42 cm. What are the dimensions of the rectangle?

23 At a shop I can buy three cans of soft drink for the same price as a hamburger. How much is one can of drink if I can buy one can and a hamburger for \$9?