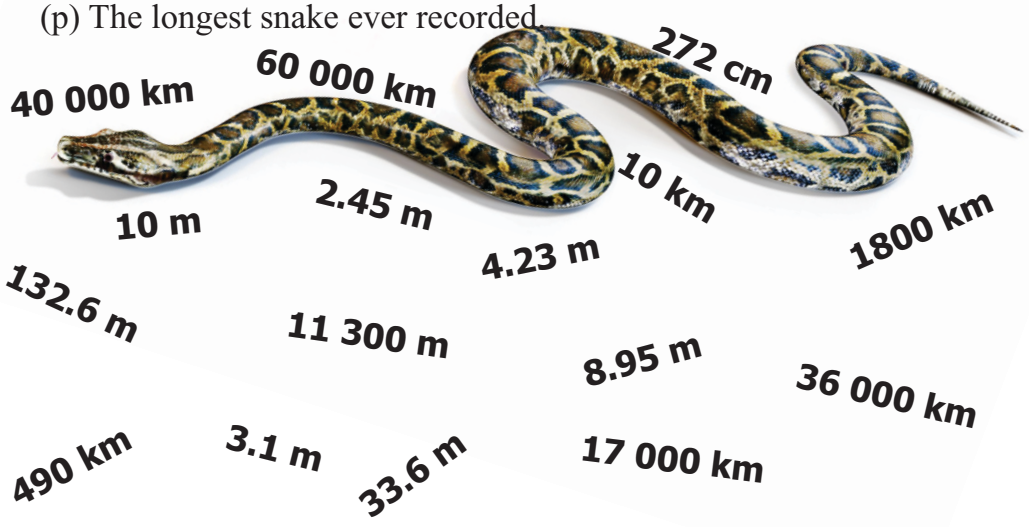
Measurement

Length

EXERCISE 11A

1. From the list below find the length of the following objects.

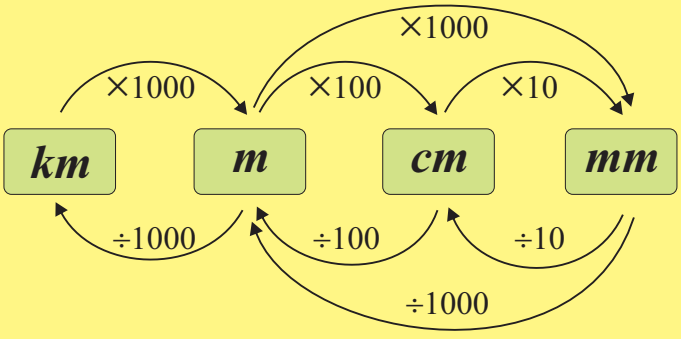
(a) The distance from Sydney to London.
(b) The height of a basketball ring above the court.
(c) The circumference of the Earth.
(d) The longest distance travelled by a hang glider.
(e) The altitude at which satellites orbit.
(f) The record height jumped by a high-jumper.
(g) The tallest person ever recorded.
(h) The length of Australia's coastline (including islands).
(i) The record distance jumped by a long-jumper.
(j) The height of the tallest tree ever recorded.
(k) The highest altitude reached by a bird.
(l) The length of the longest human hair ever recorded.
(m) The distance travelled by the Earth in one minute.
(n) The longest blue whale ever recorded.
(o) The cruising altitude of a Boeing 747.
(p) The longest snake ever recorded.



The standard unit of length is the ***metre***.
The abbreviation for metre is ***m***.
Other common units used are either multiples or fractions of a metre.
The most common are ***kilometres***, ***centimetres*** and ***millimetres***.

1 kilometre (km) = 1000 metres
1 metre = 100 centimetres (cm)
1 metre = 1000 millimetres (mm)

This diagram can be used to find the conversion factor when converting from one unit to another.



2. Change the following lengths to the units shown in the brackets.

Examples

1. 3.45 km (m)
= 3.45 × 1000
= **3450 m**

2. 26.785 m (mm)
= 26.785 × 1000
= **26 785 mm**

3. 9.705 m (cm)
= 9.705 × 100
= **970.5 cm**

4. 900 m (km)
= 900 ÷ 1000
= **0.9 km**

5. 0.8 mm (cm)
= 0.8 ÷ 10
= **0.08 cm**

6. 138.5 cm (m)
= 138.5 ÷ 100
= **1.385 m**

(a) 6 cm (mm)
(b) 8 m (cm)
(c) 20 km (m)
(d) 2.36 m (mm)
(e) 42.85 cm (mm)
(f) 0.68 km (m)
(g) 750 mm (cm)
(h) 75 cm (m)
(i) 76 850 m (km)
(j) 0.1 cm (m)
(k) 7.98 m (cm)
(l) 27.6 mm (m)
(m) 0.003 m (cm)
(n) 2.357 cm (mm)
(o) 0.5781 km (m)
(p) 0.3 km (cm)
(q) 0.43 km (mm)
(r) 0.0017 km (m)
(s) 0.0065 cm (mm)
(t) 4.76 cm (m)
(u) 0.006 mm (cm)
(v) 6.05 mm (m)
(w) 60 m (km)
(x) 56 450 mm (km)

3. Change the following lengths to the units shown in the brackets.

Examples

1. 3 m 2 cm (m)
= **3.02 m**

2. 2 m 18 mm (m)
= **2.018 m**

(a) 2 m 11 cm (m)
(b) 3 cm 2 mm (cm)
(c) 6 m 6 cm (m)
(d) 20 m 20 cm (m)
(e) 5 km 20 m (km)
(f) 18 m 5 cm (m)
(g) 5 m 8 cm (m)
(h) 6 m 23 cm 8 mm (m)
(i) 4 m 7 mm (m)
(j) 20 cm 4 mm (cm)
(k) 3 m 88 cm 2 mm (m)
(l) 10 m 57 mm (m)

4. Round the following lengths to the nearest metre.

(a) 2.8 m	(b) 66.2 m	(c) 14.09 m
(d) 29.7 m	(e) 15.56 m	(f) 20.199 m
(g) 3 m 15 cm	(h) 2 m 80 cm	(i) 15 m 56 cm
(j) 4 m 4 cm	(k) 8 m 9 cm	(l) 10 m 89 mm
(m) 11 m 256 mm	(n) 5 m 780 mm	(o) 48 m 458 mm

5. Round the following lengths to the nearest centimetre.

(a) 3.4 cm	(b) 2.8 cm	(c) 15.9 cm
(d) 1 cm 1 mm	(e) 13 cm 8 mm	(f) 25 cm 6 mm
(g) 9 mm	(h) 7 cm 2 mm	(i) 19 cm 9 mm

6. Janice is a marathon runner. A marathon is 42 km long and Janice wanted to calculate how many strides she would take while running a marathon. She ran 300 metres and counted 400 strides.

(a) What is the average length of her stride (in mm)?

(b) How many strides will she take in running a marathon?

(c) If she completed the marathon in 2 hours 32 minutes 10 seconds, how long would it take her to run 1500 metres running at the same speed? Give answer to the nearest second.

7. Janice decided to compete in the race up the Empire State Building. This race is up 1576 stairs to the 86th floor of the famous building in New York.

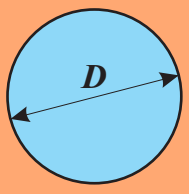
(a) The average height of each step is 195 mm. How high above the ground (in metres) is the 86th floor?

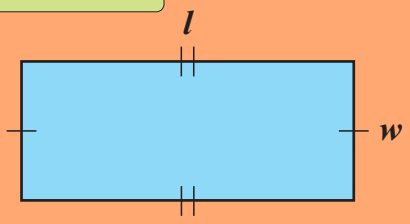
(b) Janice completed the race in 11 minutes 5 seconds. What was her rate of running in ***steps/second***? Give answer correct to one decimal place.

Perimeter

The following rules can be used to find the perimeter of a shape.

Common Shapes





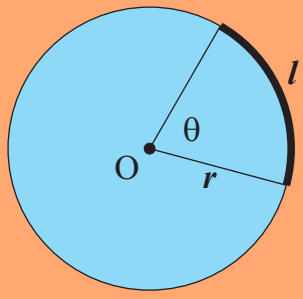
$$Circumference = \pi D$$

$$Perimeter = 2l + 2w$$

Arc Length

The length of an arc can be found using the following formula.

$$l = \frac{\theta}{360} \times 2\pi r$$

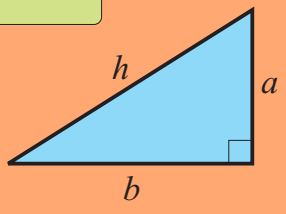


where:

l = arc length
θ = centre angle formed by the arc
r = the radius of the circle

Pythagoras' Theorem

$$h^2 = a^2 + b^2$$

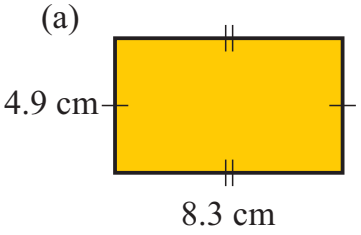


Chapter 12 details Pythagoras' Theorem

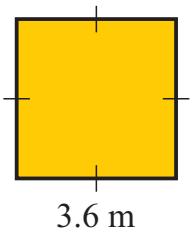
EXERCISE 11B

1. Find the perimeter of the following shapes.

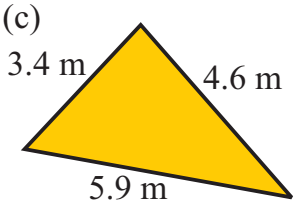
(a)



(b)

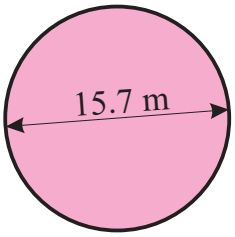


(c)

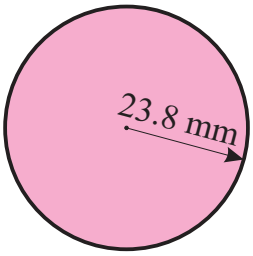


2. Calculate the circumference of each of the circles below.
Give answers correct to one decimal place.

(a)

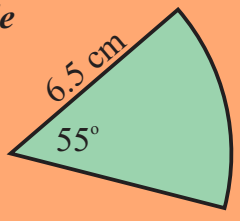


(b)



3. Calculate the perimeter of the following shapes.
Give answers correct to one decimal place.

Example



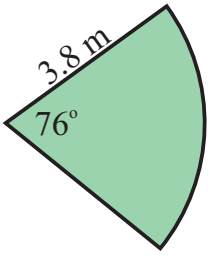
$$\text{arc length} = \frac{\theta}{360} \times 2\pi r$$

$$= \frac{55}{360} \times 2\pi \times 6.5$$

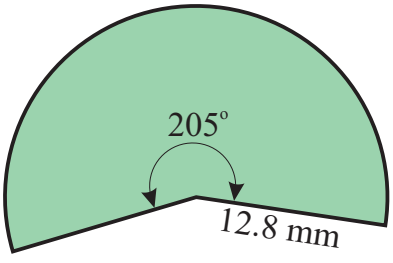
$$= 6.2 \text{ cm (one decimal place)}$$

perimeter = 6.5 + 6.5 + 6.2
= **19.2 cm**

(a)



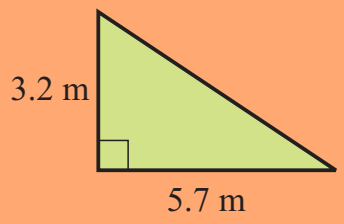
(b)



4. Find the perimeter of the shapes below.
Give answers correct to one decimal place.

Examples

1.



Use Pythagoras' Theorem to find the length of the hypotenuse

$h^2 = a^2 + b^2$

$= 3.2^2 + 5.7^2$

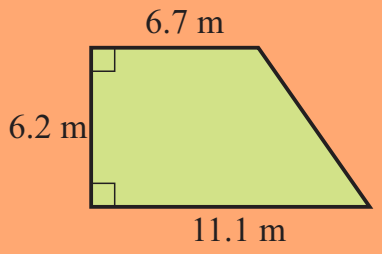
$h = \sqrt{3.2^2 + 5.7^2}$

$h = 6.5$ m (one dec. pl.)

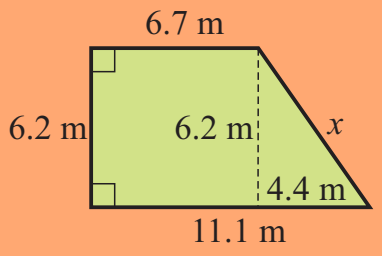
perimeter = 6.5 +3.2 + 5.7

= **15.4 m**

2.



Pythagoras' Theorem can be used to find the length of the unknown side



$x^2 = 6.2^2 + 4.4^2$

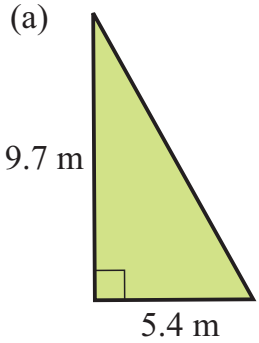
$x = \sqrt{6.2^2 + 4.4^2}$

$x = 7.6$ m (one dec. pl.)

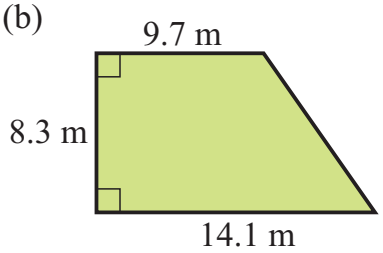
perimeter = 7.6 + 11.1 + 6.2 + 6.7

= **31.6 m**

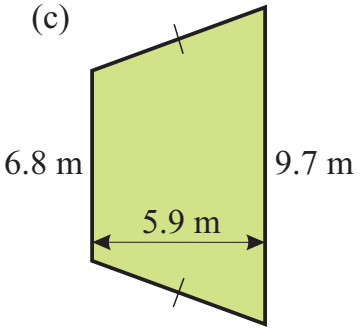
(a)



(b)

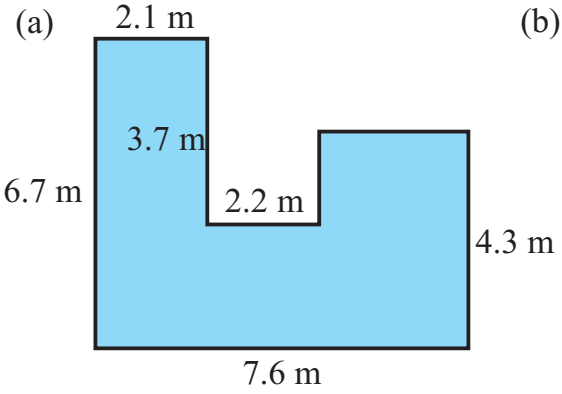


(c)

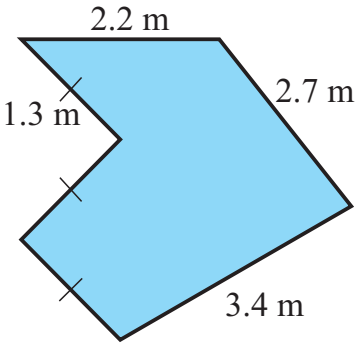


5. Find the perimeter of the following shapes.
Give answers correct to one decimal place.

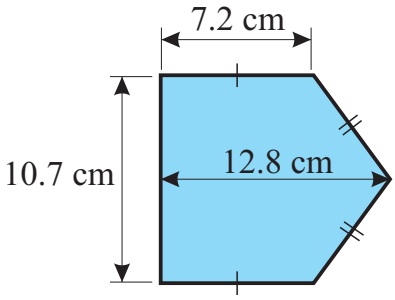
(a)



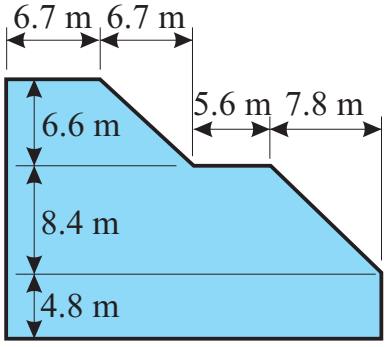
(b)



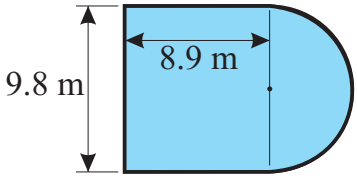
(c)



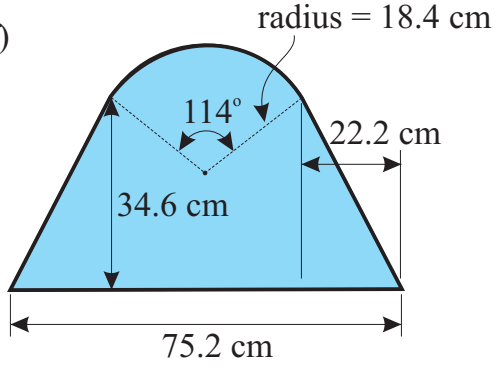
(d)



(e)

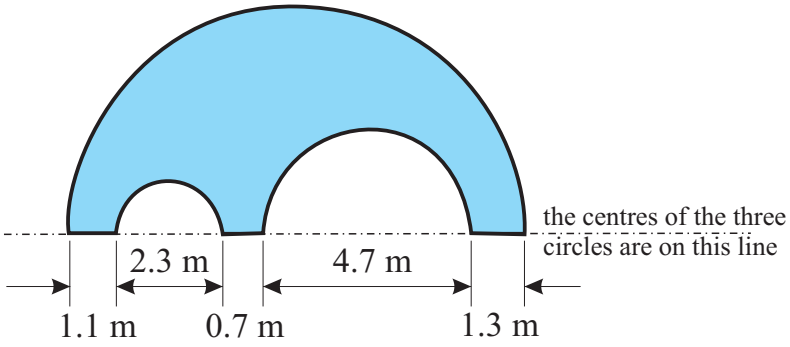


(f)

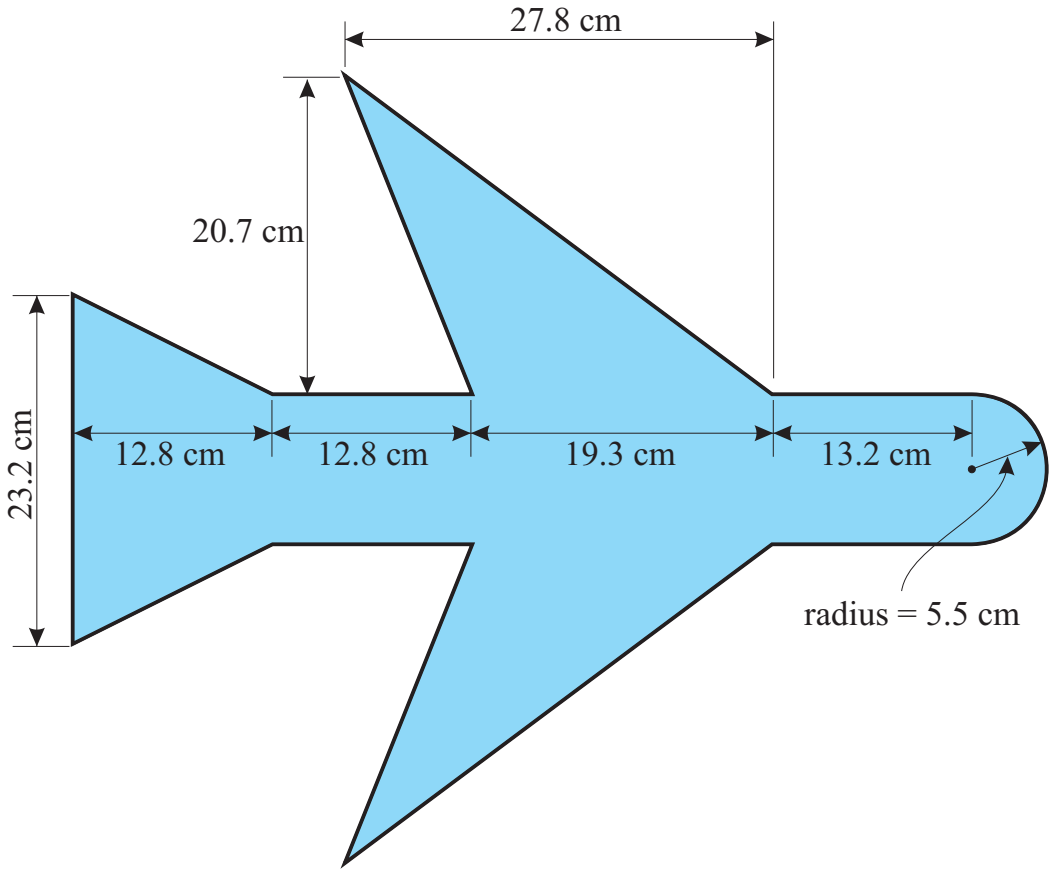


This shape is symmetrical

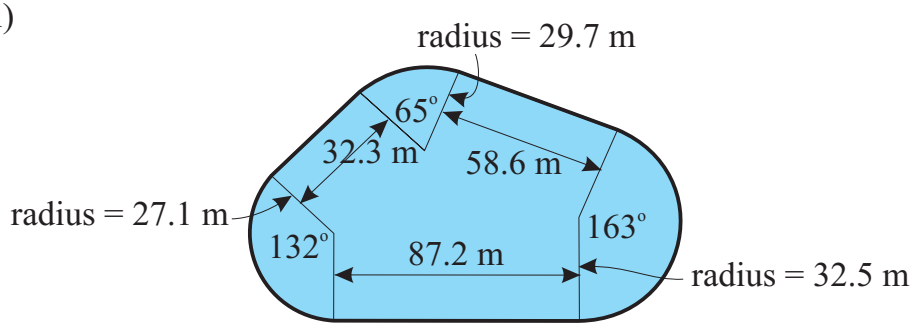
(g)



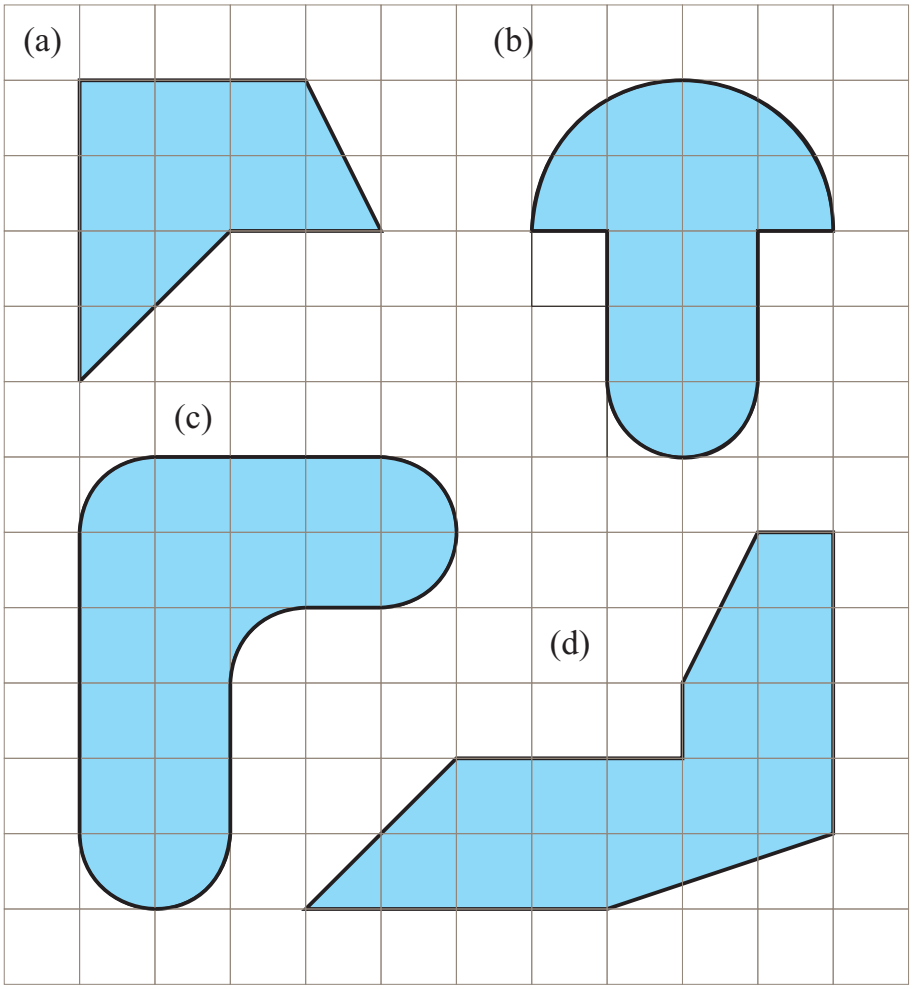
(h) This shape is symmetrical.



(i)



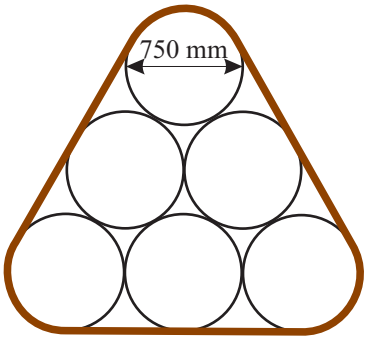
6. The grid below consists of 1 cm squares. Find the perimeter of the shapes on the grid. Give answers correct to one decimal place.



7. (a) The diameter of each wheel on a car was 560 mm. It was recommended that each wheel be replaced after the car had travelled 30 000 km. How many revolutions of each wheel would occur in travelling 30 000 km? Give answer to the nearest revolution.

(b) A new tyre was produced with a guaranteed life of 25 million revolutions. If the diameter of the tyre was 560 mm, how far could a driver expect to travel on these tyres? Give answer to the nearest km.

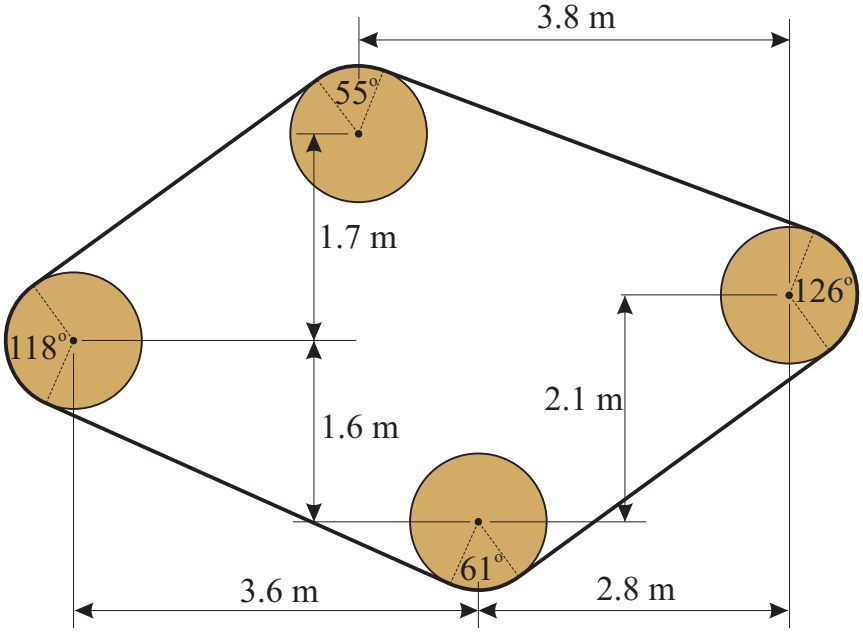
8. A strap is used to contain six pipes as shown here.
The pipes have a diameter of 750 mm.
Calculate the length of the strap.
Give answer to the nearest mm.



9. A conveyer belt is shown below. The diameter of each wheel is 1.2 m. The distances between the centres of the wheels are shown. The angles that the belt is in contact with the wheels are shown.

(a) How long is the belt? Give answer to the nearest mm.

(b) The belt is moving at a speed of 100 mm/sec. How long will it take (to the nearest second) for the belt to complete one circuit?

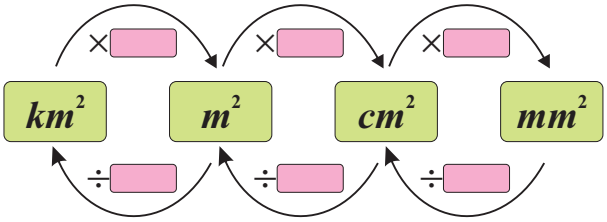


Area - Conversions

EXERCISE 11C

1. (a) How many square millimetres are in one square centimetre?
(b) How many square centimetres are in one square metre?
(c) How many square metres are in one square kilometre?

2. Copy and complete this conversion diagram.



3. Convert the following areas to the units shown in the brackets.

(a) 500 mm^2 (cm^2)
(b) 0.2 cm^2 (mm^2)
(c) 700 000 cm^2 (m^2)
(d) 3.4 m^2 (cm^2)
(e) 19 000 000 cm^2 (m^2)
(f) 60 000 cm^2 (m^2)
(g) 0.031 m^2 (cm^2)
(h) 0.0083 km^2 (m^2)
(i) 70 000 000 m^2 (km^2)
(j) 630 000 000 mm^2 (m^2)

4. A hectare is an area of 10 000 m^2.
Convert the following areas to hectares (ha).

(a) 60 000 m^2
(b) 230 000 m^2
(c) 4000 m^2
(d) 86 000 m^2
(e) 3 km^2
(f) 5.6 km^2
(g) 0.07 km^2
(h) 320 km^2

5. A rectangular piece of board is 320 mm wide and 550 mm long.
Calculate its area in the following units:

(a) mm^2 (b) cm^2 (c) m^2

6. A rectangular trench is 800 mm wide and 18 m long. Calculate the area of the trench in m^2.

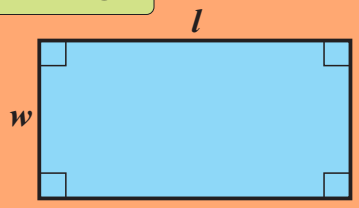
7. A rectangular paddock is 500 m long and 350 m wide. How many hectares in this paddock?

8. A square property has side lengths of 2.3 km. How many hectares is this property?

Area - Shapes

The following formulae can be used to find the area of common shapes

Rectangle

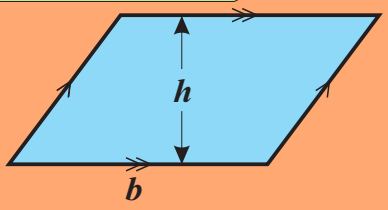


Area = length × width

$= l \times w$

$A = l\,w$

Parallelogram

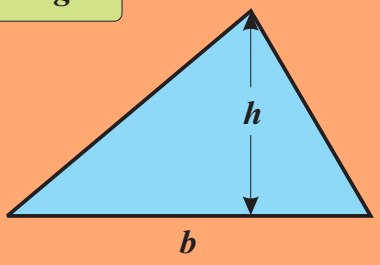


Area = base × height

$= b \times h$

$A = bh$

Triangle

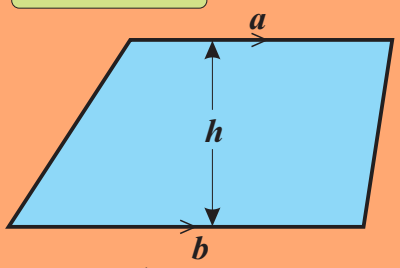


Area = $\frac{1}{2}$ × base × height

$= \frac{1}{2} \times b \times h$

$A = \frac{1}{2}\,bh$

Trapezium

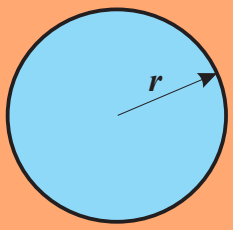


Area = $\frac{1}{2} \times (a + b) \times$ height

$= \frac{1}{2} \times (a + b) \times h$

$A = \frac{1}{2}\,(a + b)h$

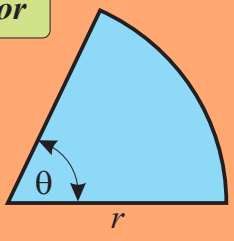
Circle



Area = $\pi \times r^2$

$A = \pi r^2$

Sector

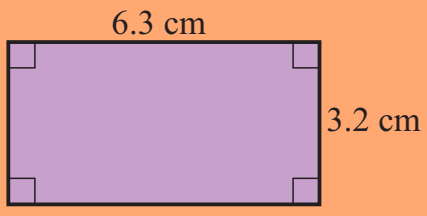


Area = $\frac{\theta}{360} \times \pi \times r^2$

$A = \frac{\theta}{360}\,\pi r^2$

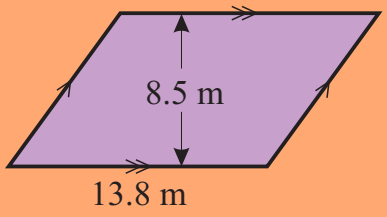
Examples

Rectangle



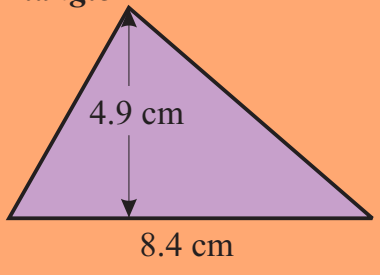
Area = length × width
= 6.3 × 3.2
***Area* = 20.16 cm²**

Parallelogram



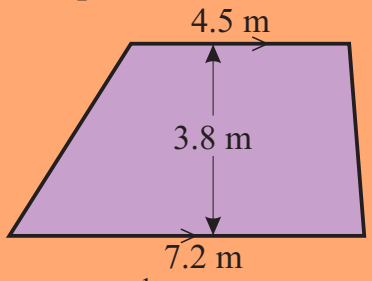
Area = base × height
= 13.8 × 8.5
***Area* = 117.3 m²**

Triangle



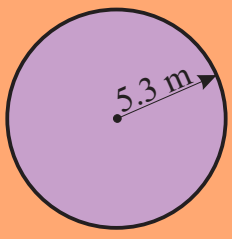
Area = $\frac{1}{2}$ × base × height
= $\frac{1}{2}$ × 8.4 × 4.9
***Area* = 20.58 cm²**

Trapezium



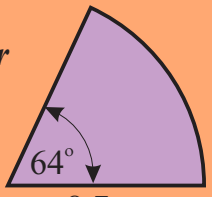
Area = $\frac{1}{2}$ × (a + b) × height
= $\frac{1}{2}$ × (4.5 + 7.2) × 3.8
***Area* = 22.23 m²**

Circle



Area = π × r^2
= π × 5.3^2
***Area* = 88.2 m² (1 dec. pl.)**

Sector

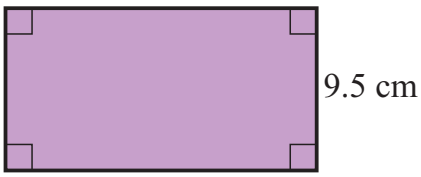


Area = $\frac{\theta}{360}$ × π × r^2
= $\frac{64}{360}$ × π × 8.7^2
***Area* = 42.3 cm² (1 dec. pl.)**

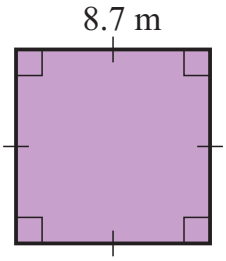
EXERCISE 11D

1. Calculate the area of the following shapes.

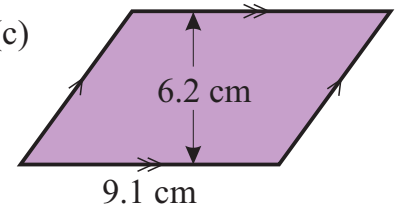
(a)



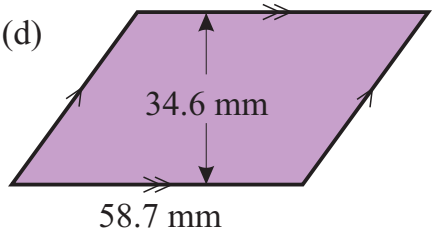
(b)



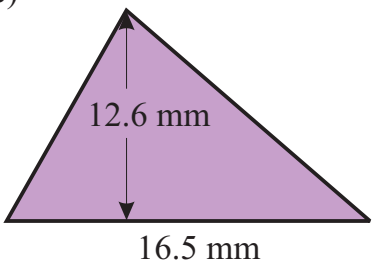
(c)



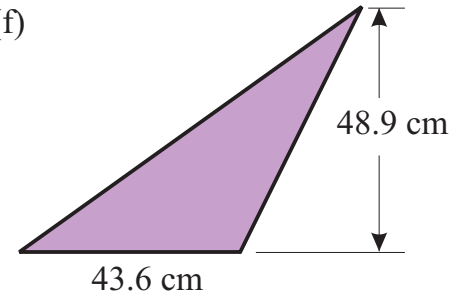
(d)



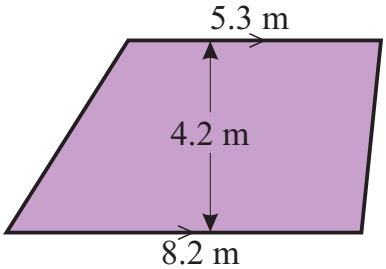
(e)



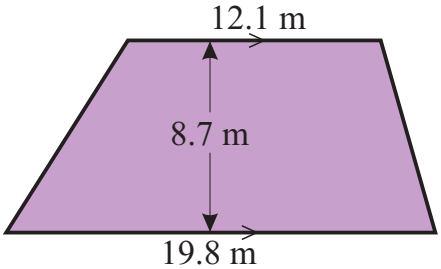
(f)



(g)

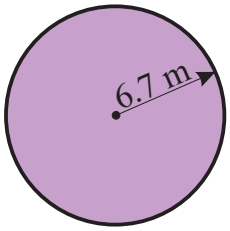


(h)

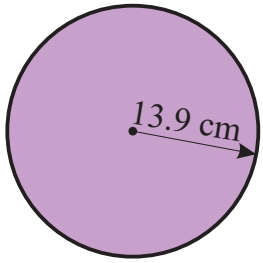


2. Find the area of the following shapes.
Give answers correct to one decimal place.

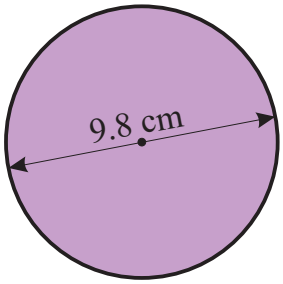
(a)



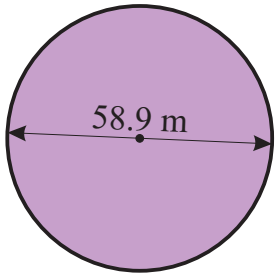
(b)



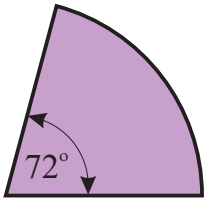
(c)



(d)

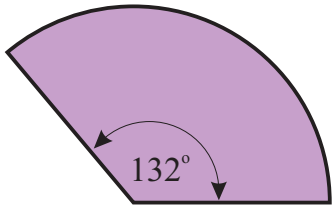


(e)



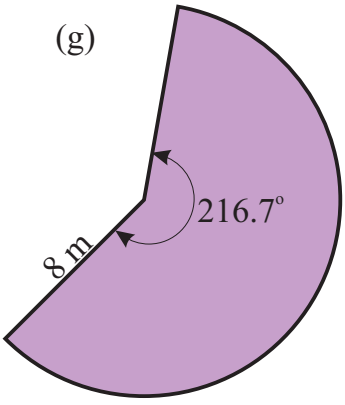
11.7 cm

(f)

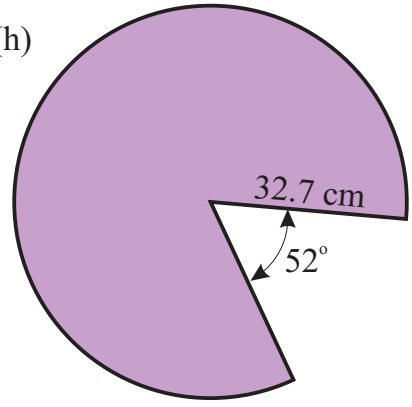


85.9 mm

(g)



(h)

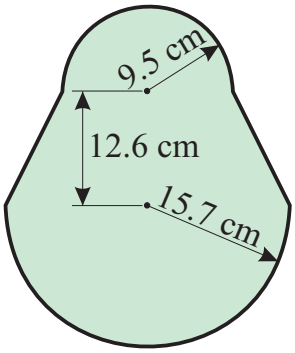


Area - Composite Shapes

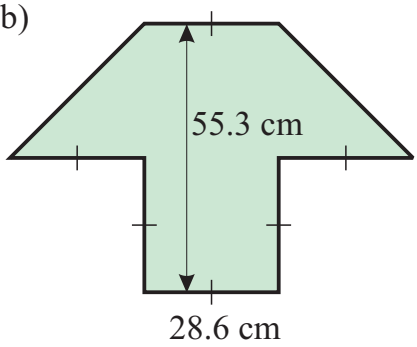
EXERCISE 11E

1. Find the area of the following ***symmetrical*** shapes.
Give answers correct to one decimal place.

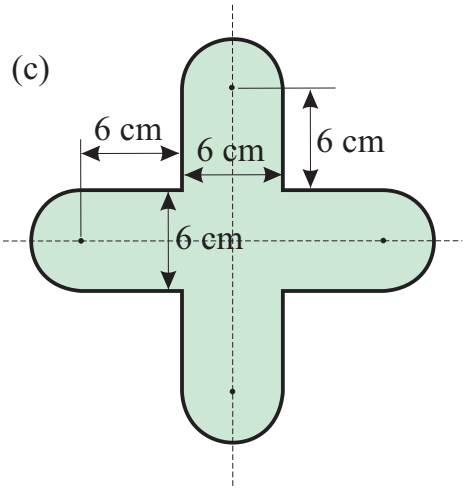
(a)



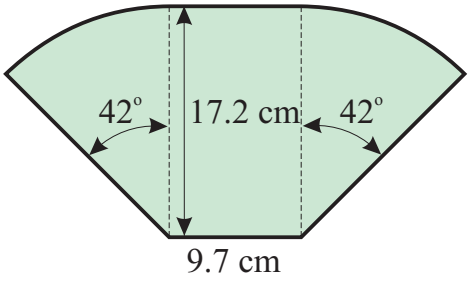
(b)



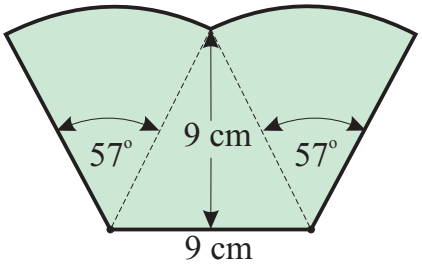
(c)



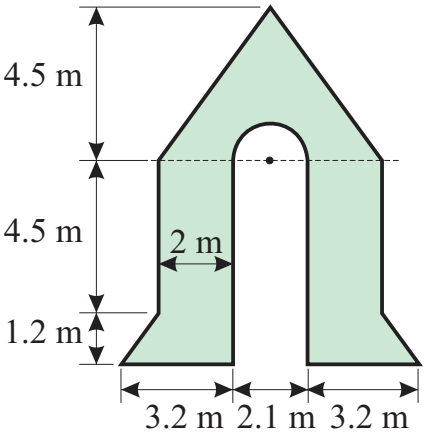
(d)



(e)

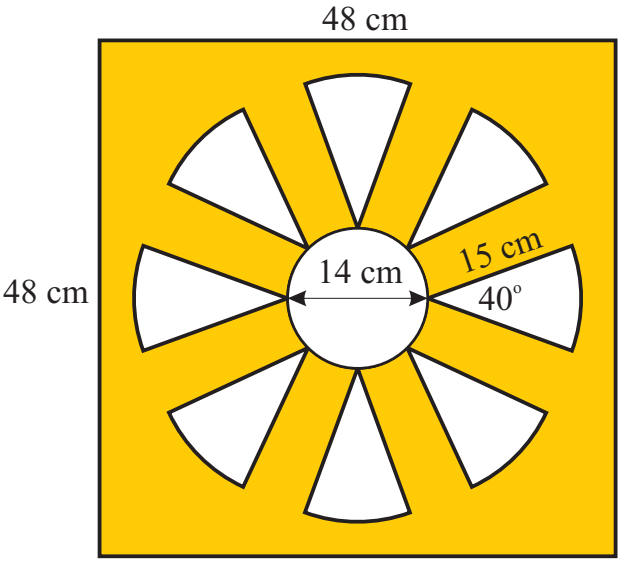


(f)

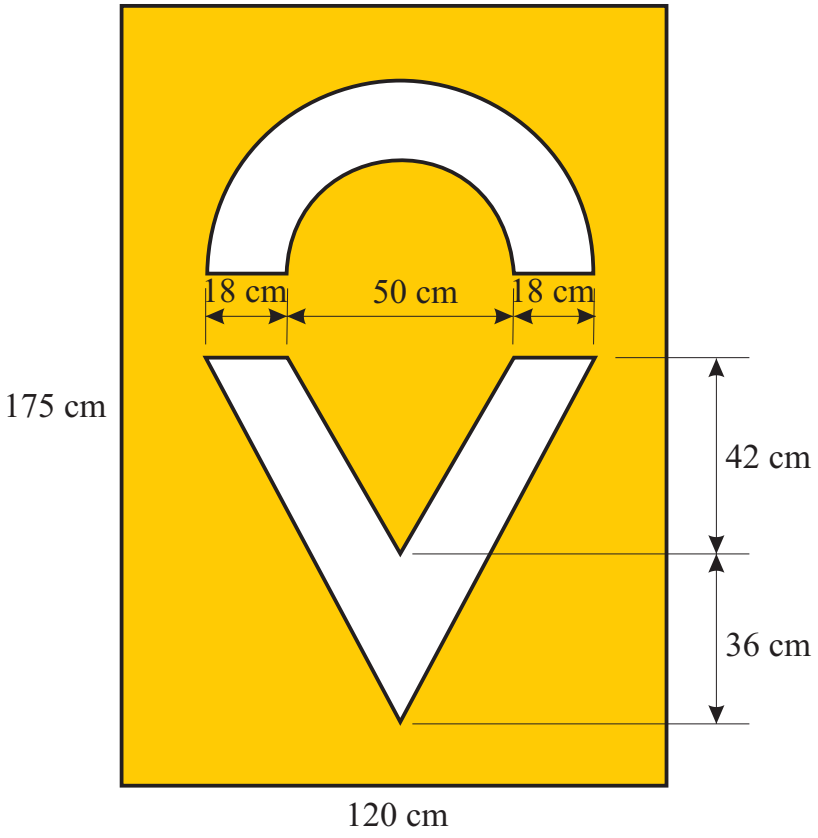


2. Find the area of the shaded regions below.

(a)



(b)



Hero's Formula (Heron's Formula)

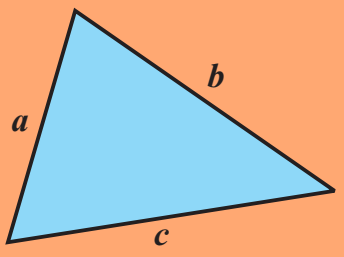
EXERCISE 11F

The area of a triangle can be found by using Hero's formula as shown below.

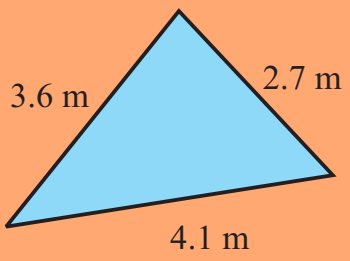
$$\textit{Area} = \sqrt{s(s-a)(s-b)(s-c)}$$

where $s = \frac{1}{2}(a+b+c)$

and a, b and c are the side lengths



Example



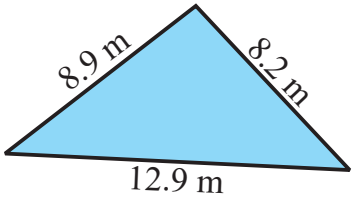
$$s = \frac{1}{2}(a+b+c)$$
$$= \frac{1}{2} \times (3.6 + 2.7 + 4.1)$$
$$s = 5.2$$

$$\textit{Area} = \sqrt{s(s-a)(s-b)(s-c)}$$
$$= \sqrt{5.2 \times (5.2 - 3.6)(5.2 - 2.7)(5.2 - 4.1)}$$

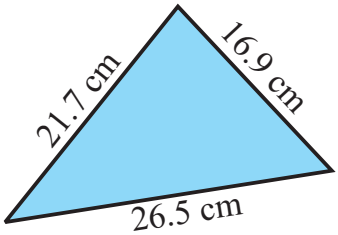
Area = **4.8 m^2 (one decimal place)**

Use Hero's formula to calculate the area of the following triangles. Give answers correct to one decimal place.

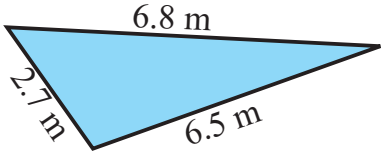
1.



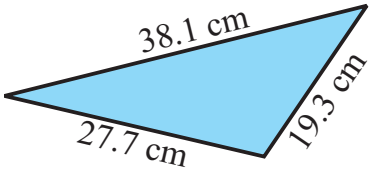
2.



3.



4.



Area - Problem Solving

EXERCISE 11G

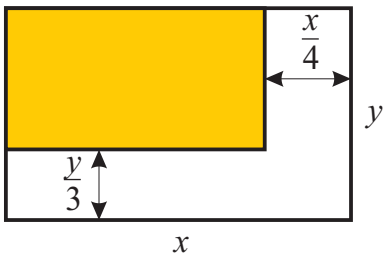
1. (a) A farmer has a property that is 2 km long and 1.5 km wide. How many hectares is the property?

(b) He has three paddocks on this property where his cattle graze. The sizes of the paddocks are 400 m × 400 m, 600 m × 500 m and 700 m × 200 m. What percentage of the area of his farm is the total area of these three paddocks?

2. William has 120 metres of chicken wire that he is going to use to make a yard for his chooks. A keen mathematician, he wanted to calculate the area of the yard for different lengths (l) and widths (w). Calculate the area of the yard for the following dimensions. Assume all the 120 metres of wire are used.

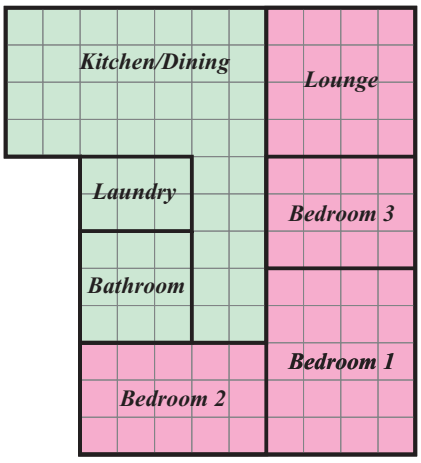
(a) $l = w$ (b) $l = 2w$ (c) $l = 3w$ (d) $l = 4w$ (e) $l = 5w$

3. A rectangular piece of board with length x and width y has area A. One quarter of the length is cut off and one third of the width is cut off leaving the shaded region. Which of the following alternatives is an expression for the area of the shaded region?



A $\frac{7A}{12}$ **B** $\frac{6A}{7}$ **C** $\frac{5A}{12}$ **D** $\frac{5A}{7}$ **E** $\frac{A}{2}$ **F** $\frac{A}{7}$ **G** $\frac{A}{12}$ **H** $\frac{11A}{12}$

4. Emma wants to replace the floor coverings in her house. The floor plan is shown here. The grid shown is 1 metre squares. She wants to cover the floors in the bedrooms and lounge with carpet that costs $45 per square metre. In the remainder of the house she is going to use timber laminate that costs $25 per square metre. What is the total cost of the floor coverings?



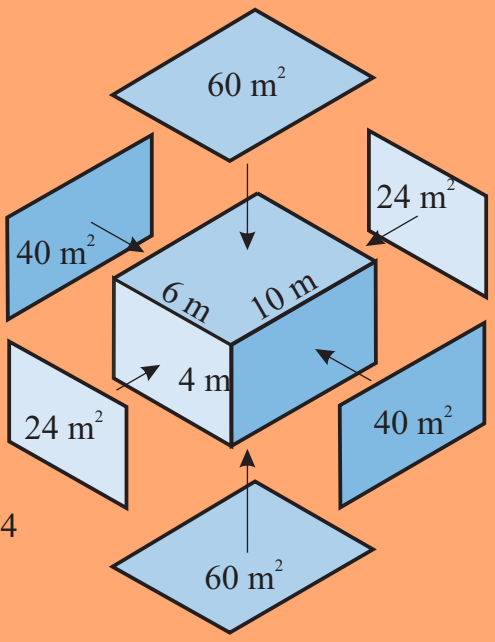
Surface Area

The surface area of any object can be found by adding the areas of all the faces.

Rectangular Prism

Example

Find the area of each face of the prism. Add the areas of the faces to find the surface area (SA) of the prism.

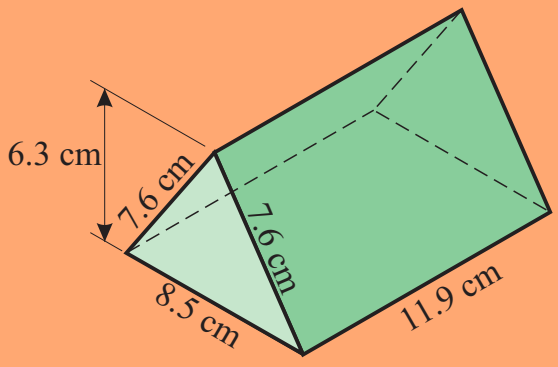


SA = 40 + 60 + 24 + 40 + 60 +24
= **248 m²**

Other Prisms

Example

In this example of a triangular prism the surface consists of three rectangles and two triangles.

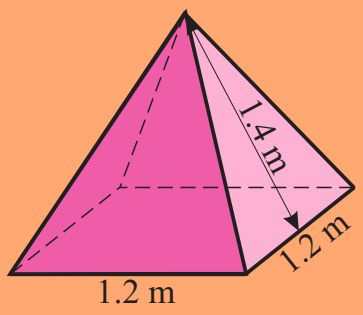


SA = (8.5 × 11.9) + (7.6 × 11.9) + (7.6 × 11.9) +
$(\frac{1}{2} \times 6.3 \times 8.5) + (\frac{1}{2} \times 6.3 \times 8.5)$

SA = 335.58 cm²

Pyramid

A pyramid consists of four triangles and a base.
In this example the base is a square and the four triangles are all the same size.



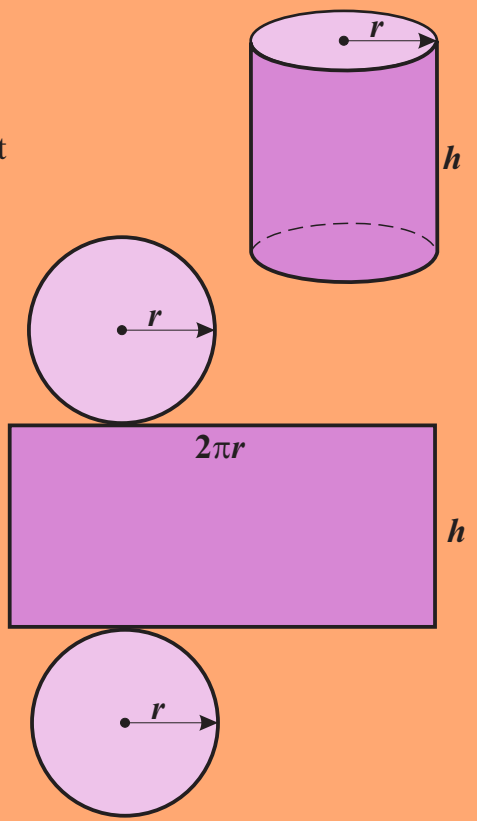
Area of base $= 1.2 \times 1.2$
$= 1.44 \text{ m}^2$

Area of each triangle $= \frac{1}{2}$ base $\times$ height
$= \frac{1}{2} \times 1.2 \times 1.4$
$= 0.84 \text{ m}^2$

SA $= 1.44 + 4 \times 0.84$
$= \mathbf{4.8 \text{ m}^2}$

Cylinder

The surface area of a cylinder can be found by considering its net as shown below.
The length of the rectangle that wraps around to form the curved surface $= 2\pi r$

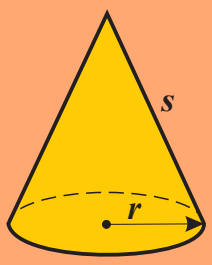


SA = area of the two circles + the area of the rectangle

$SA = 2 \times \pi r^2 + 2\pi r \times h$
$= 2\pi r^2 + 2\pi r h$
$= 2\pi r (r + h)$

$\boldsymbol{SA = 2\pi r (r + h)}$

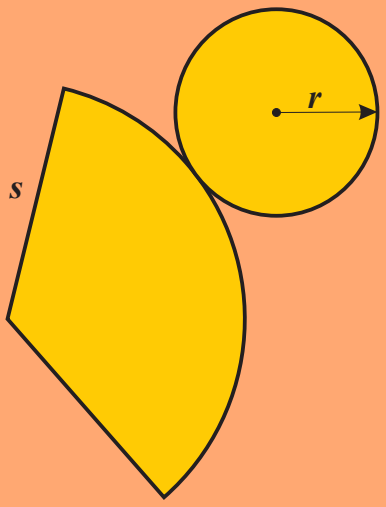
Cone



The surface of a cone can be seen by considering its net as shown below. The circle is its base and the sector is the cone surface opened out.

r = radius of base

s = length of sloping edge



SA = area of circle + area of sector

area of circle $= \pi r^2$

The area of the sector can be calculated by realising the curved length of the sector is equal to the circumference of the base $= 2\pi r$.

The sector is a part of the circle with radius s and circumference $2\pi s$.

The ratio of the length of the curved part of the sector to the full circumference will be the same as the ratio of the areas.

$$\frac{\text{area of sector}}{\text{area of circle}} = \frac{2\pi r}{2\pi s}$$

$$\frac{\text{area of sector}}{\pi s^2} = \frac{r}{s}$$

$$\text{area of sector} = \pi s^2 \times \frac{r}{s}$$

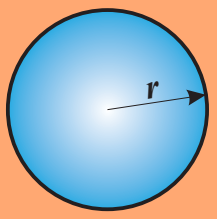
area of sector $= \pi rs$

$$\text{SA} = \pi r^2 + \pi rs$$
$$= \pi r(r + s)$$

SA $= \pi r(r + s)$

Sphere

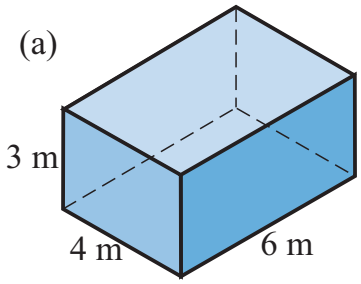
$SA = 4\pi r^2$



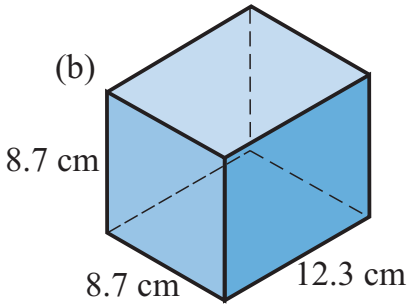
EXERCISE 11H

1. Find the surface area of the following objects.

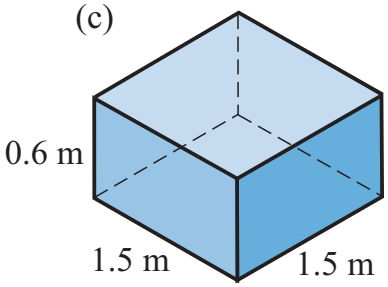
(a)



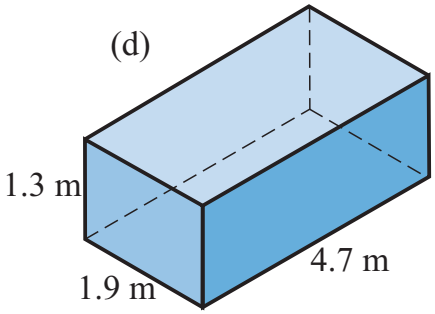
(b)



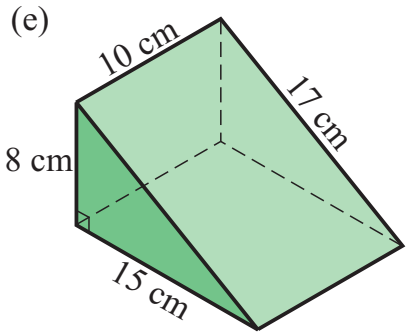
(c)



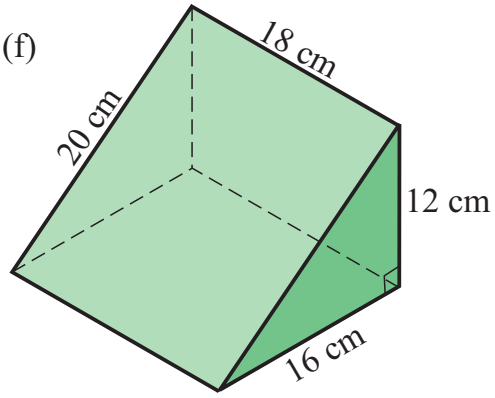
(d)



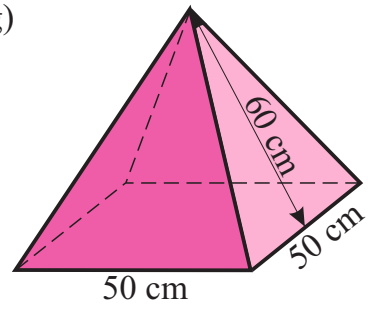
(e)



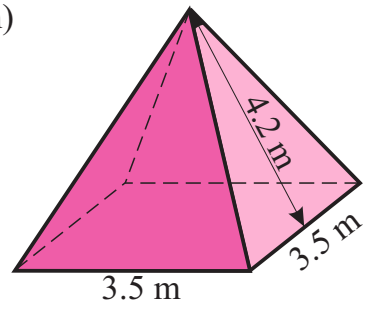
(f)



(g)

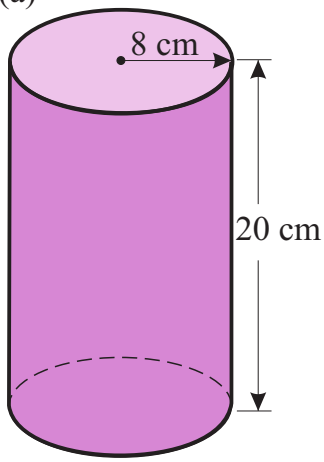


(h)

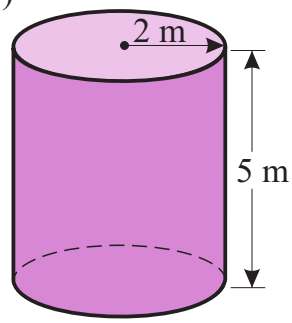


2. Find the surface area of the following objects correct to one decimal place.

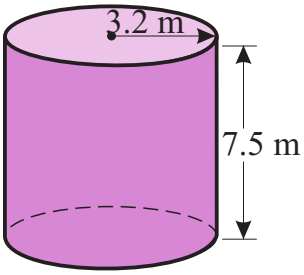
(a)



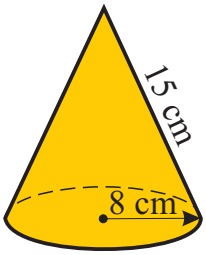
(b)



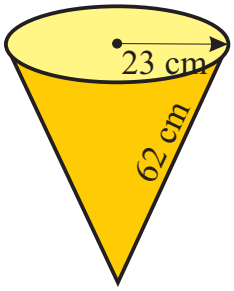
(c)



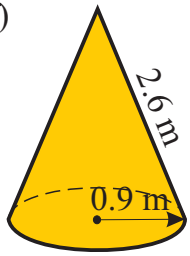
(d)



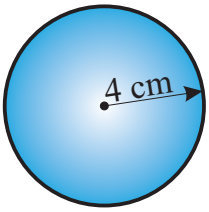
(e)



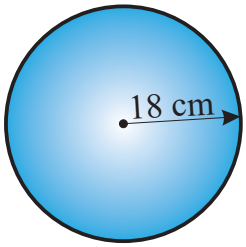
(f)



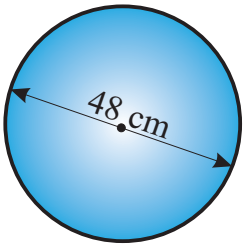
(g)



(h)

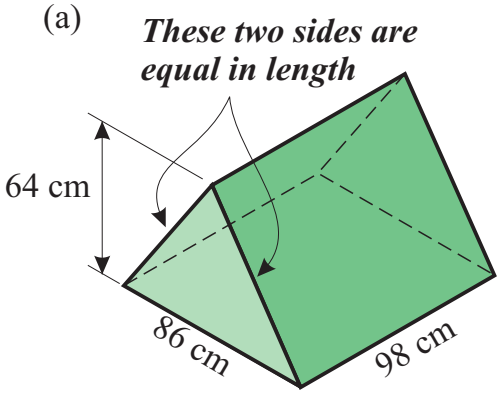


(i)

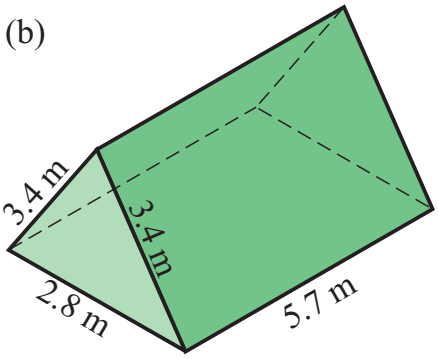


3. Find the surface area of the following objects correct to one decimal place. Pythagoras' Theorem will be needed.

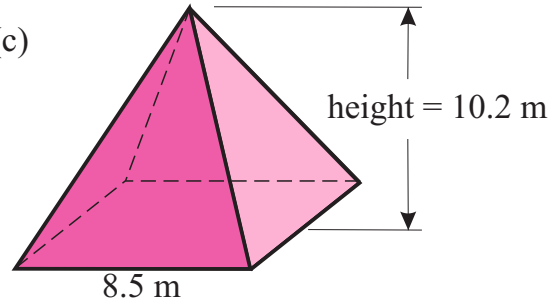
(a)



(b)



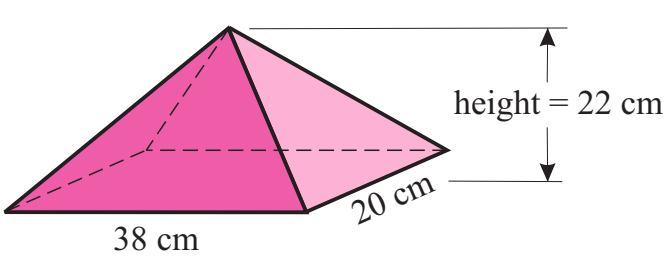
(c)



This pyramid has a square base

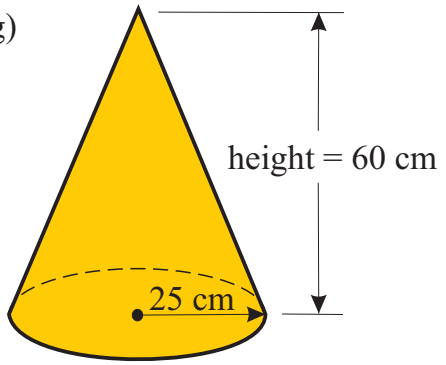
(d) A square-based pyramid with base length of 48 cm and vertical height of 32 cm.

(e)

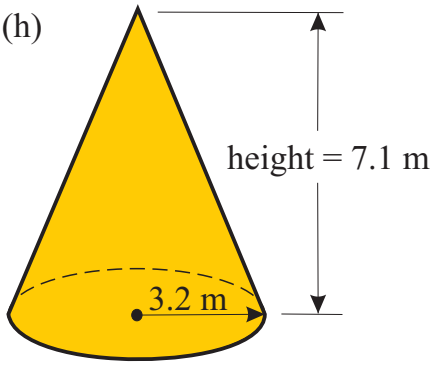


(f) A pyramid with base dimensions of 8.2 m × 6.4 m and vertical height of 5.6 m.

(g)

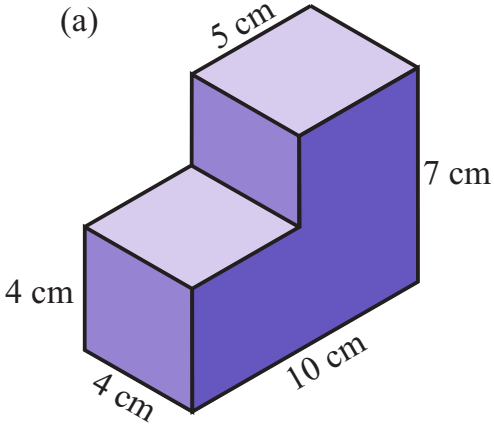


(h)

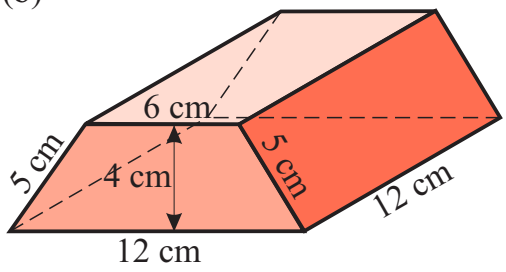


4. Find the surface area of the following objects.
Give answers to one decimal place where necessary.

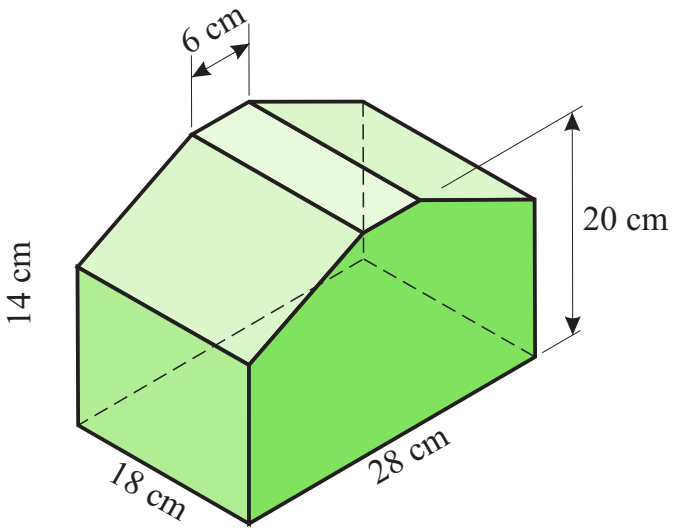
(a)



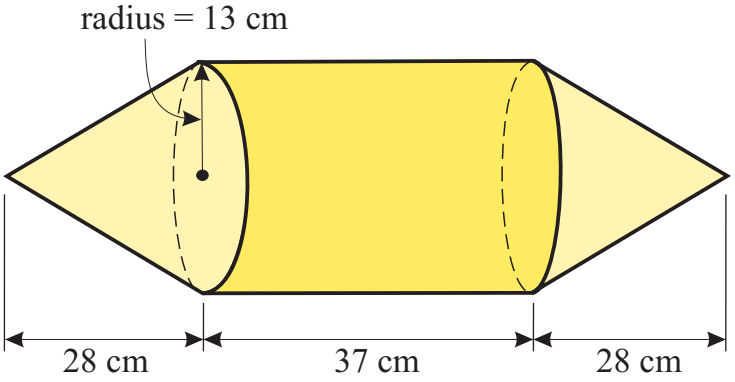
(b)



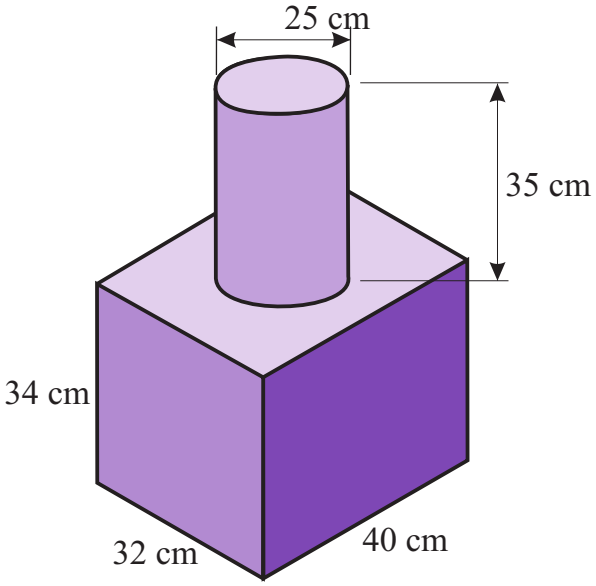
(c) This object is symmetrical.



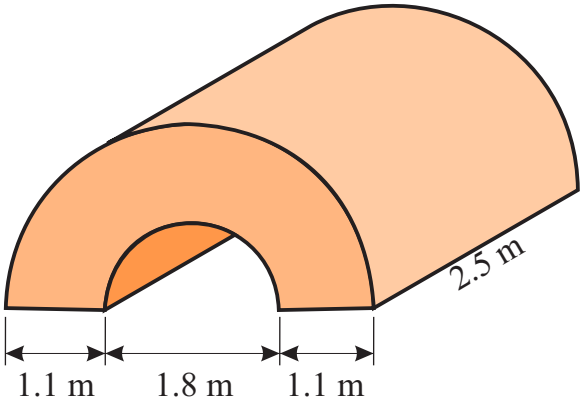
(d)


radius = 13 cm
28 cm
37 cm
28 cm

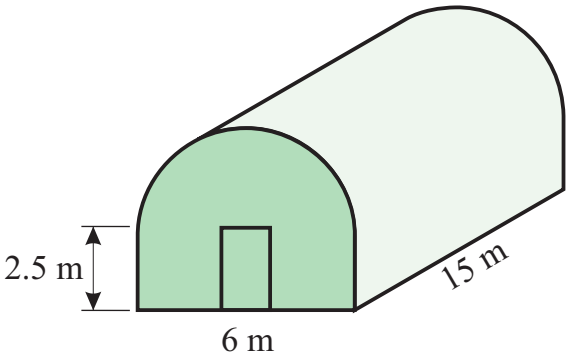
(e)


25 cm
35 cm
34 cm
32 cm
40 cm

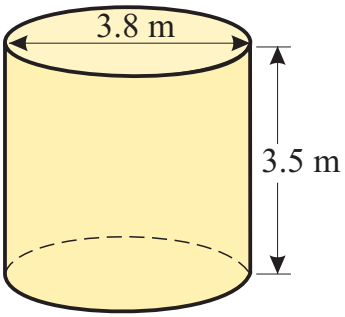
(f)


2.5 m
1.1 m
1.8 m
1.1 m

5. Conrad wants to construct the greenhouse shown here. The plastic he is going to use to cover the frame costs $8.00 per square metre. Calculate the cost to buy the plastic.



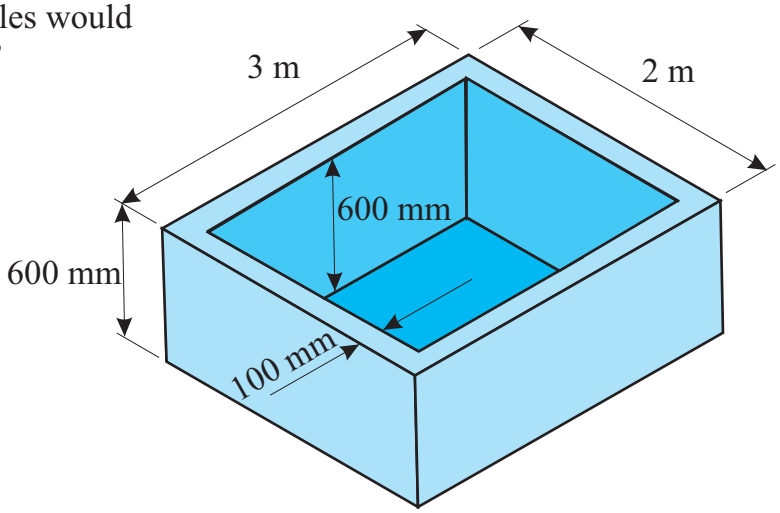
6. Rhonda has a cylindrical water tank that is 3.5 m high and has a diameter of 3.8 m. It is leaking so she is going to cover the inside of the tank with fibreglass (not the lid). The fibreglass costs $60 per square metre.
What is the total cost to fibreglass the curved surface and base of the tank?



7. Quinton is making the rectangular spa shown below. The outside dimensions are 3 m × 2 m and it is 600 mm deep. The wall thickness is 100 mm. Quinton wants to cover all surfaces with tiles (except underneath the spa). He has two tile sizes to choose from:
- 100 mm square tiles or 50 mm square tiles.

(a) How many 100 mm square tiles would he need?

(b) How many 50 mm square tiles would he need?



Volume

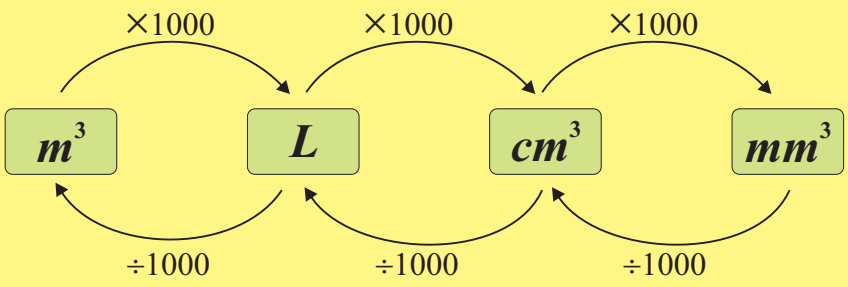
Common units of volume are ***mm***^{3}, ***cm***^{3} ,***litres*** and ***m***^{3}.

1 mm^3 is a volume equal to the volume of a cube with side length 1 mm.
1 cm^3 is a volume equal to the volume of a cube with side length 1 cm.
1 litre is a volume equal to the volume of a cube with side length 10 cm.
1 m^3 is a volume equal to the volume of a cube with side length 1 m.

1 cm^3 = 1000 mm^3
1 litre (L) = 1000 cm^3
1 m^3 = 1000 000 cm^3
1 m^3 = 1000 litres
1 cm^3 = 1 mL

The millilitre (mL) is often used as a unit of volume.
1 millilitre (mL) is equal to 1 cubic centimetre (cm^3).
Cubic centimetre is often abbreviated to c.c.

This diagram can be used to find the conversion factor when converting from one unit to another.



EXERCISE 11I

1. Convert the following volumes to the units shown in the brackets.

(a) 50 000 cm^3 (L)
(b) 0.02 cm^3 (mm^3)
(c) 600 mL (L)
(d) 8.1 m^3 (L)
(e) 0.25 L (mL)
(f) 890 000 mm^3 (cm^3)
(g) 300 L (m^3)
(h) 7 mL (mm^3)
(i) 8 cm^3 (mL)
(j) 100 000 mm^3 (L)
(k) 2.4 L (cm^3)
(l) 0.75 mL (cm^3)

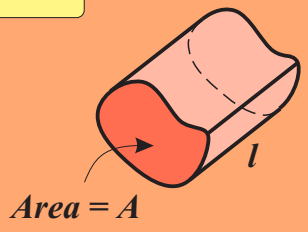
2. Rani bought 14 bottles of drink for a party she was organising. Each bottle contained 750 mL.
How many ***litres*** of drink did she have?

3. Jasmin bought a 2 litre bottle of concentrated fruit juice. She mixed 50 mL of the juice into a glass of water each day. How many days will the 2 litre bottle last?

4. Giaan bought 3 m^3 of soil for her garden. Her wheelbarrow holds 100 litres and she could fill the wheelbarrow five times an hour. How many hours will it take her to move all the soil?

Volume of Regular Objects

Prism

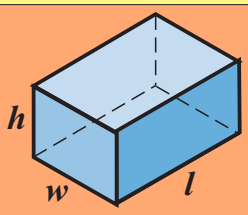


Volume = area of end × length

$V = A \times l$

$V = Al$

Rectangular Prism (Cuboid)

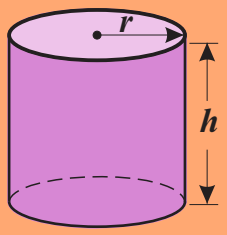


Volume = length × width × height

$V = l \times w \times h$

$V = lwh$

Cylinder

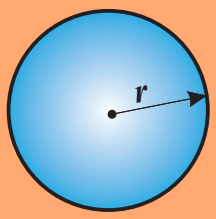


Volume = $\pi r^2 \times$ height

$V = \pi r^2 \times h$

$V = \pi r^2 h$

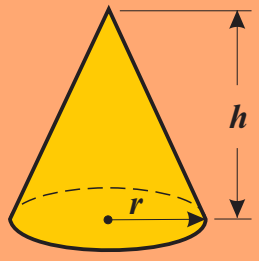
Sphere



Volume = $\frac{4}{3}\pi r^3$

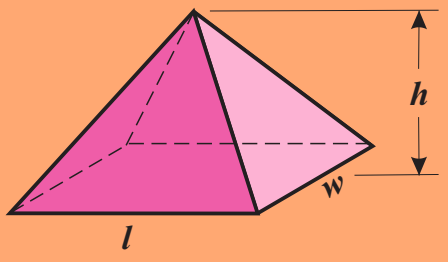
$V = \frac{4}{3}\pi r^3$

Cone



$V = \frac{1}{3}\pi r^2 h$

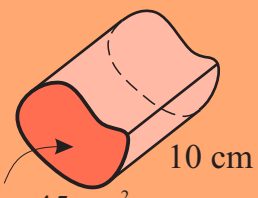
Pyramid



$V = \frac{1}{3}lwh$

Examples

1.



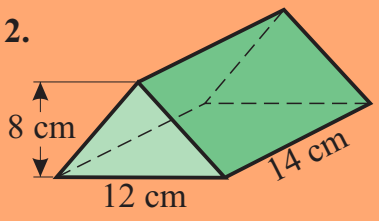
Area = 45 cm^2

Volume = area of end × length

V = 45 × 10

V = **450 cm^3**

2.



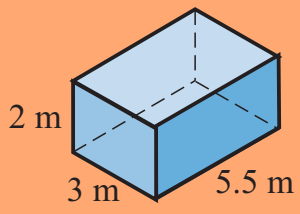
Volume = area of end × length

V = area of triangle × length

= $\frac{1}{2}$ × 12 × 8 × 14

V = **672 cm^3**

3.

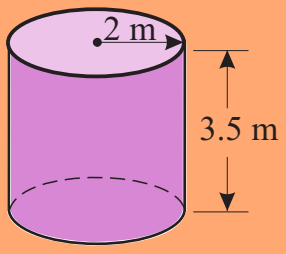


Volume = length × width × height

V = 5.5 × 3 × 2

V = **33 m^3**

4.

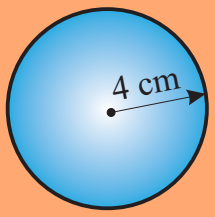


Volume = πr^2 × height

V = π × 2^2 × 3.5

V = **44.0 m^3** (one dec. pl.)

5.

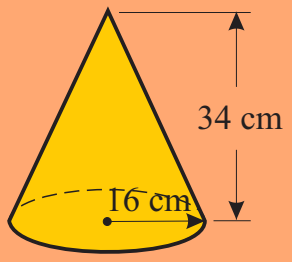


Volume = $\frac{4}{3}\pi r^3$

V = $\frac{4}{3}$ × π × 4^3

V = **268.1 cm^3** (one dec. pl.)

6.



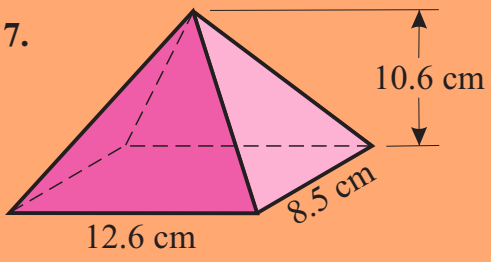
Volume = $\frac{1}{3}\pi r^2 h$

V = $\frac{1}{3}$ × π × 16^2 × 34

V = **9114.8 cm^3** (one dec. pl.)

Examples continued

7.



Volume = $\frac{1}{3}$ *lwh*

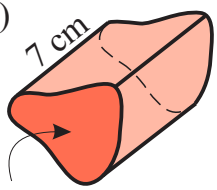
$V = \frac{1}{3} \times 12.6 \times 8.5 \times 10.6$

$V =$ **378.42 cm^3**

EXERCISE 11J

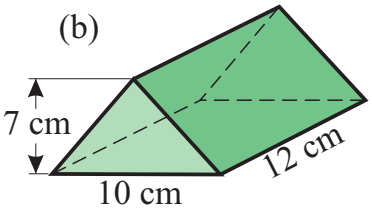
1. Find the volume of each of the following objects.

(a)

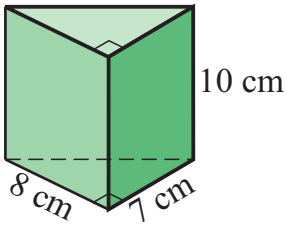


Area = 30 cm^2

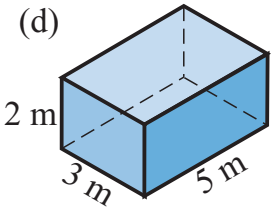
(b)



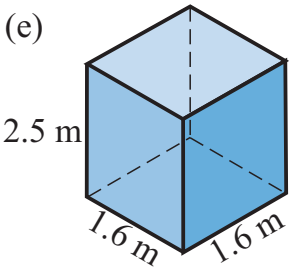
(c)



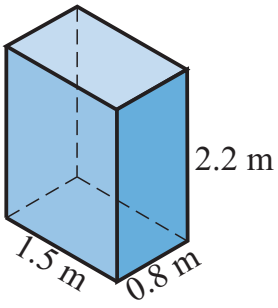
(d)



(e)

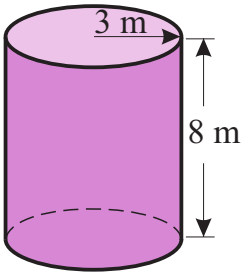


(f)

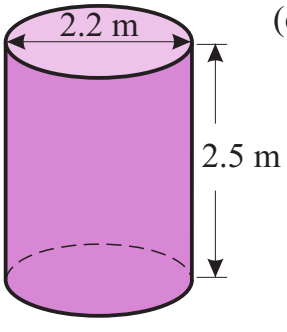


2. Find the volume of each of the following cylinders.
Give answers correct to one decimal place.

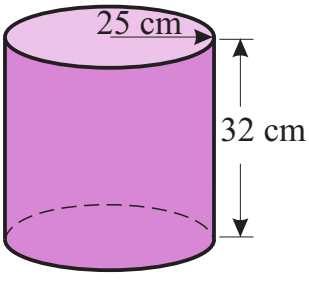
(a)



(b)

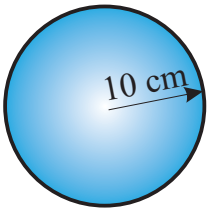


(c)

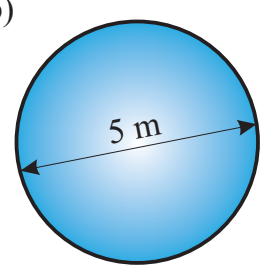


3. Find the volume of each of the following spheres.
Give answers correct to one decimal place.

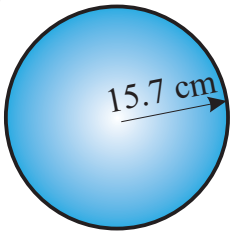
(a)



(b)

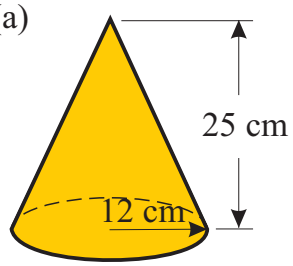


(c)

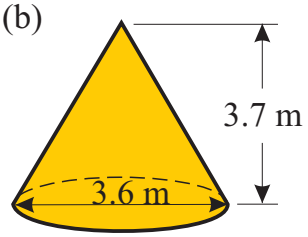


4. Find the volume of each of the following cones.
Give answers correct to one decimal place.

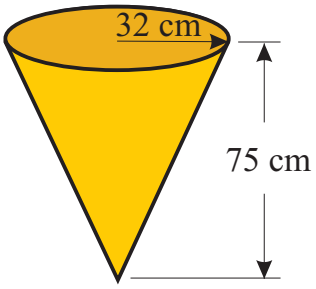
(a)



(b)

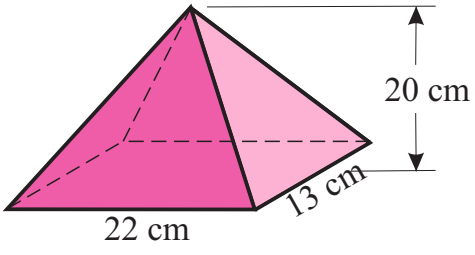


(c)

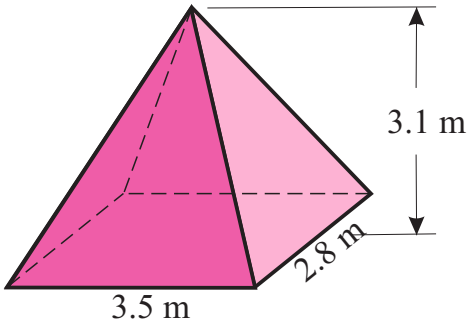


5. Find the volume of each of the following pyramids.
Give answers correct to one decimal place.

(a)

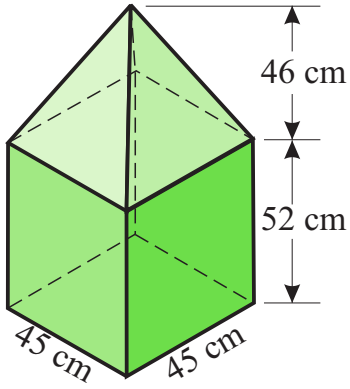


(b)

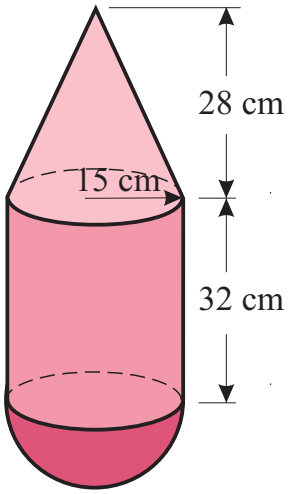


6. Calculate the volume of the following objects.
Give answers correct to one decimal place.

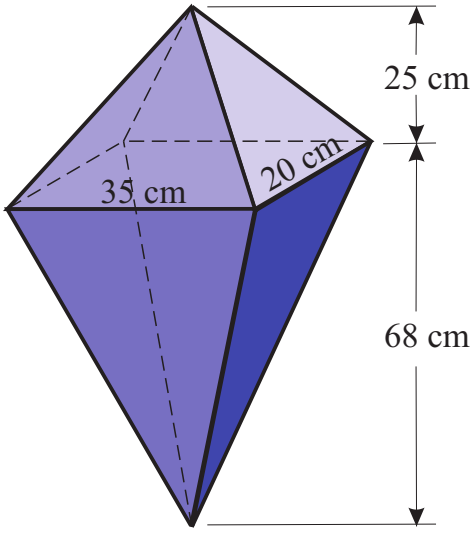
(a)



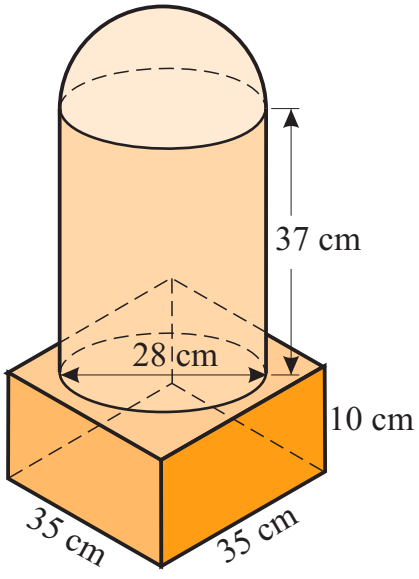
(b)



(c)



(d)

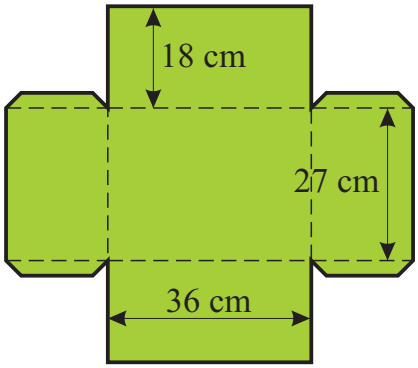


7. (a) Choose which of the following alternatives is the best estimate of the volume of a basketball.

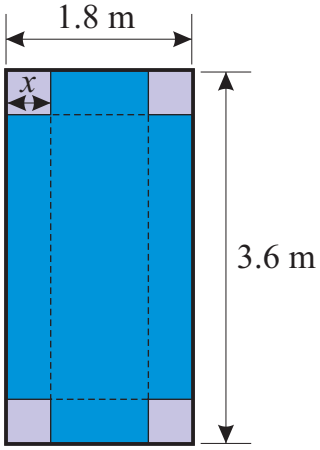
A 2 litres **B** 7 litres **C** 15 litres **D** 27 litres

(b) The ***diameter*** of a basketball is 24 cm. Calculate the volume of a basketball (in ***litres***) correct to one decimal place.

8. The net shown here is of cardboard that is folded to form a box without a lid.
What is the volume of the box?



9. Andrew is going to make a rectangular feeding box for his horses by cutting square corners out of a rectangular sheet of metal and folding. The sheet of metal is 3.6 m × 1.8 m.
He wants to investigate the effect that the side length, x, of the square cut out, will have on the capacity of the box.
Calculate the capacity, in litres, of the box for the following values of x.



(a) 100 mm (b) 200 mm (c) 300 mm (d) 400 mm (e) 500 mm

10. Emily wanted to move a large stone block in her garden. The stone was 1.5 m long, 800 mm wide and 400 mm high. She needed to calculate how much it weighed to organise a mechanical lifting device. She found a block of the same type of stone that was 200 mm × 100 mm × 60 mm and it weighed 3 kg.
What would the large block weigh?

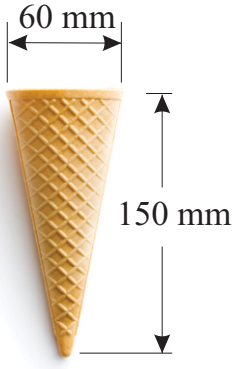
11. The Moozly breakfast food company want to change the size of their 2 kg box of cereal. The dimensions of the existing box are 300 mm × 250 mm × 80 mm. They want the new box to be 150 mm wide and 320 mm high. Calculate the width of the new box so the volume is the same as the existing box.

12. A producer of nuts and bolts has found that the size of the boxes they use to pack their products is too large. They decide to reduce the length, width and height of the boxes by 10%. What will be the percentage reduction in the volume of the boxes?

13. The I-Scream shop sells ice-creams in cones. They buy cylindrical tubs of ice-cream that have a diameter of 500 mm and are 1.5 m deep.

(a) How many spherical scoops of ice-cream, 60 mm in diameter, could they get from each tub?

(b) The I-Scream shop also sells soft ice-cream in cones. The cones have a diameter of 60 mm and are 150 mm deep. The cone is filled with ice-cream till it is level. How many cones could be filled from a 20 litre tub of soft ice-cream?



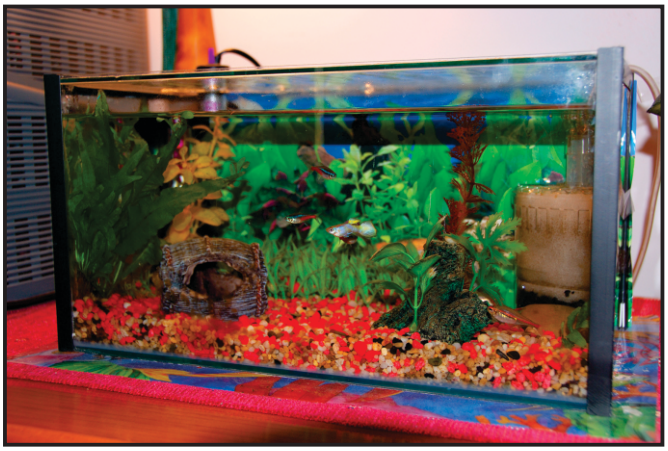
14. Mulder is a sculptor who is fascinated with pyramids. He buys a block of clay that is in the shape of a cube with side length 1.2 m. He wants to make as many clay pyramids as he can from this block. The pyramids are to be square-based with base length of 400 mm and be 270 mm high. How many of these pyramids could Mulder sculpt from the block?

PROBLEM SOLVING

Layla wants to make a fish tank. She has a sheet of glass 2.4 m × 1.2 m that she is going to cut to make the four sides, base and lid of her fish tank.
She wants to choose dimensions that will give the largest volume of water in the tank.

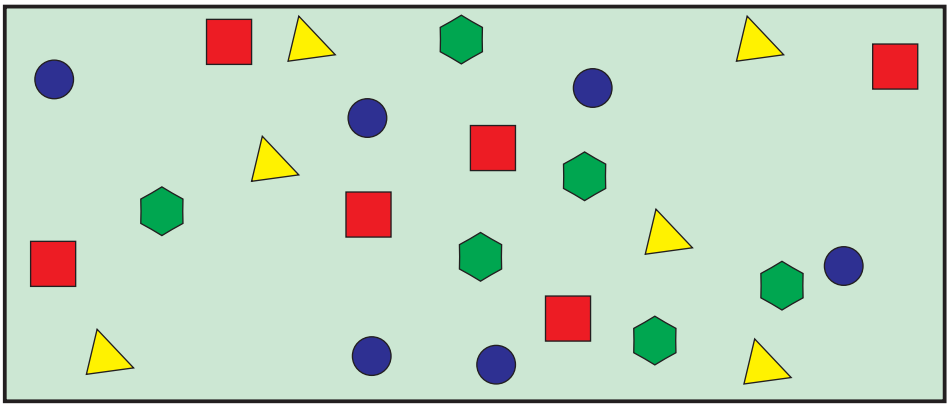
1. Find three different ways that this sheet of glass could be cut, with as little wastage as possible, to make a fish tank with rectangular sides, base and lid. There is one solution that uses all the glass.

2. Calculate how many litres of water each tank would hold.



PUZZLE

Divide this diagram by drawing three straight lines to produce six sections with each section containing a circle, square, triangle and hexagon.



CHAPTER REVIEW

1. Change the following lengths to the units shown in the brackets.

(a) 14 cm (mm)	(b) 8.3 m (cm)	(c) 4 km (m)
(d) 0.56 m (mm)	(e) 9.75 cm (mm)	(f) 1.26 km (m)
(g) 83 mm (cm)	(h) 450 cm (m)	(i) 3450 m (km)
(j) 2.9 cm (m)	(k) 0.055 m (mm)	(l) 35 600 mm (m)

2. Change the following lengths to the units shown in the brackets.

(a) 2 m 11 cm (m)	(b) 3 cm 2 mm (cm)
(c) 6 m 6 cm (m)	(d) 8 m 75 mm (m)

3. Round the following lengths to the nearest metre.

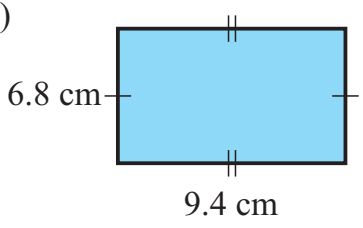
(a) 4.6 m	(b) 7 m 6 cm	(c) 3 m 350 mm
(d) 2 m 78 cm	(e) 0.7852 km	(f) 398 658 mm

4. At a timber yard, sheets of timber laminate, each 5 mm thick, are stacked to a height of 1.6 m. How many sheets of timber laminate are there?

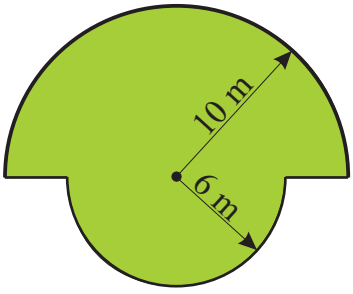
5. Give the following answers to one decimal place
(a) Find the circumference of the circle with a diameter of 6.8 m.
(b) Find the circumference of the circle with a radius of 23.6 cm.

6. Find the perimeter of the following shapes.
Give answers correct to one decimal place.

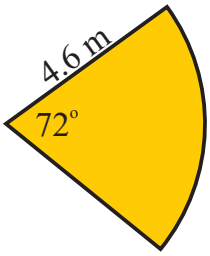
(a)



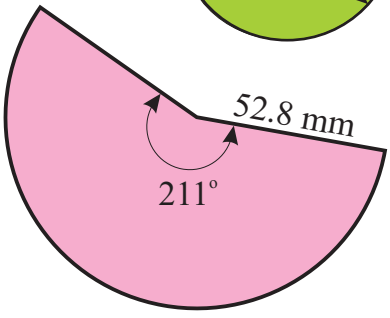
(b)



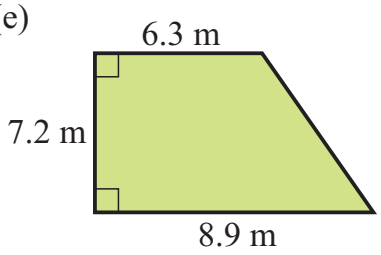
(c)



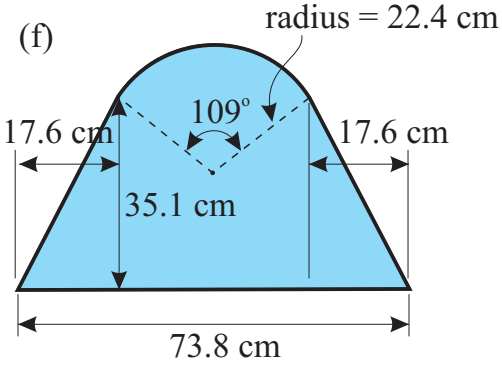
(d)



(e)



(f)



7. The diameter of the wheels on a bicycle is 750 mm. How many times will each wheel turn if the bicycle travels 25 km?
Give answer to the nearest revolution.

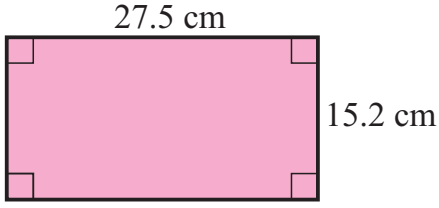
8. Convert the following areas to the units shown in the brackets.

(a) 800 mm^2 (cm^2)
(b) 0.26 cm^2 (mm^2)
(c) 150 000 cm^2 (m^2)
(d) 0.84 m^2 (cm^2)
(e) 70 000 000 m^2 (km^2)
(f) 0.0083 km^2 (m^2)

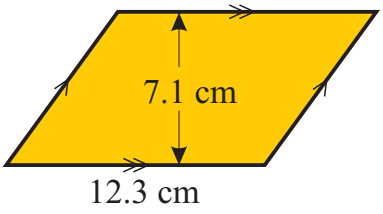
9. (a) How many hectares is a rectangular paddock 500 m × 300m?
(b) What is the side length of a square park that is 49 hectares?

10. Find the area of the following shapes.

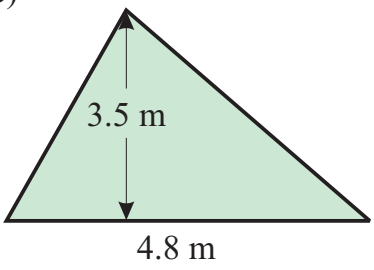
(a)



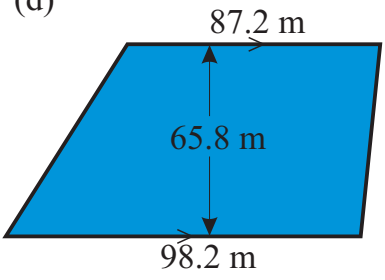
(b)



(c)

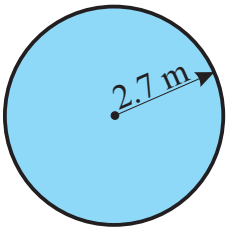


(d)

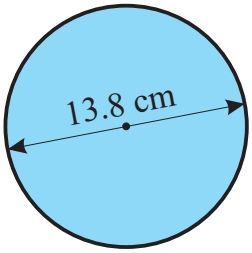


11. Find the area of these shapes correct to one decimal place.

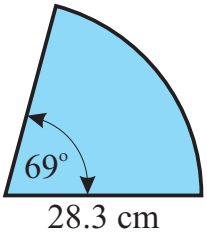
(a)



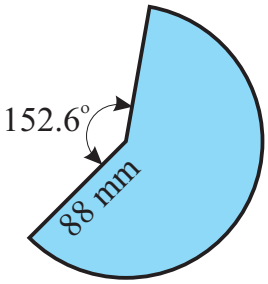
(b)



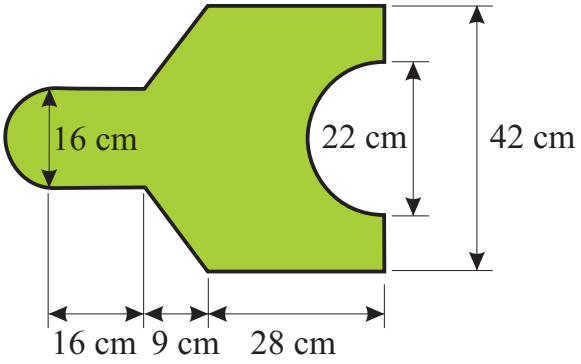
(c)



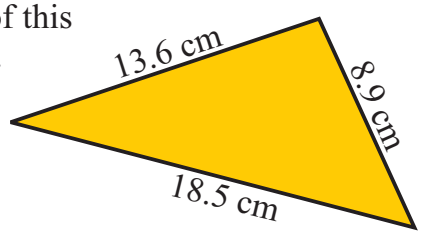
(d)



12. Find the area of the following symmetrical shape.
Give answer correct to one decimal place.



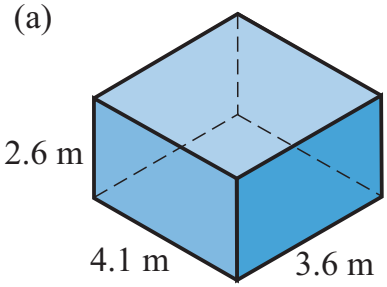
13. Use Hero's formula to find the area of this triangle correct to one decimal place.



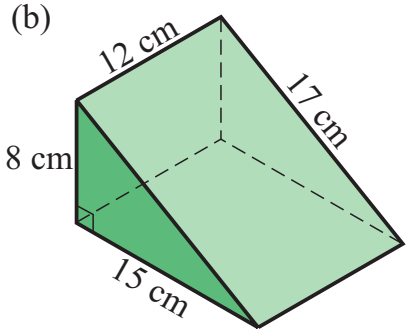
14. Find the side length of a square, correct to one decimal place, that has the same area as a circle with a diameter of 56.8 cm.

15. Find the surface area of the following objects.

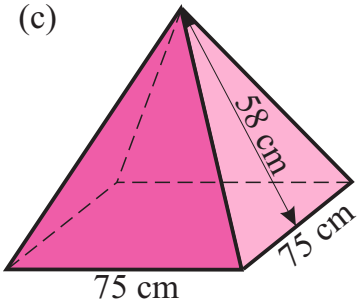
(a)



(b)

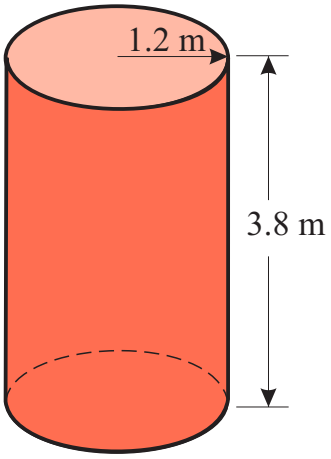


(c)

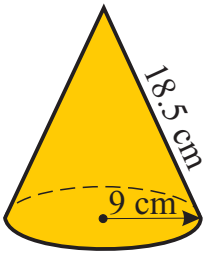


16. Find the surface area of the following objects correct to one decimal place.

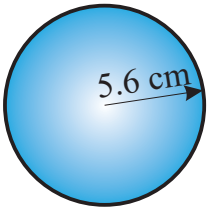
(a)



(b)

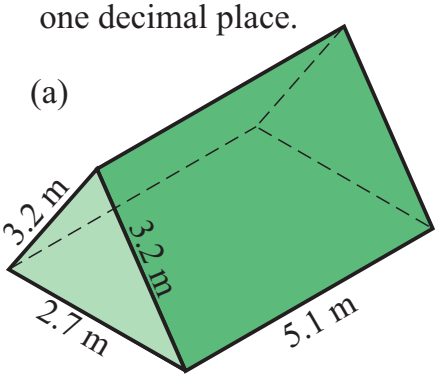


(c)

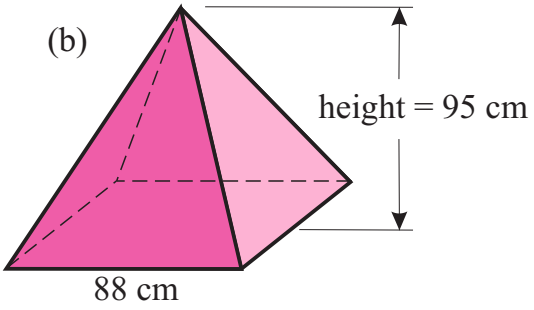


17. Find the surface area of the following objects correct to one decimal place.

(a)

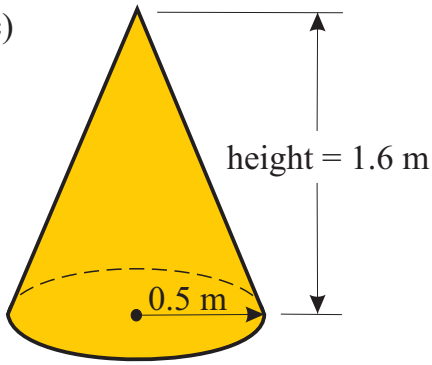


(b)

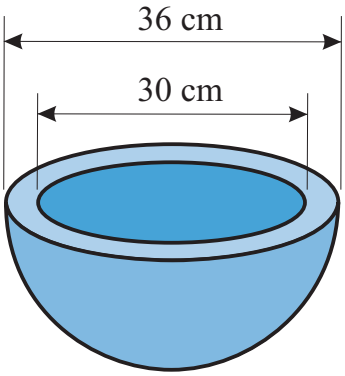


This pyramid has a square base

(c)



(d)



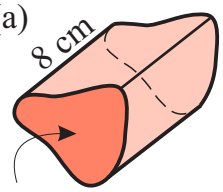
18. Convert the following volumes to the units shown in the brackets.

(a) 80 000 cm^3 (L)
(b) 0.035 cm^3 (mm^3)
(c) 700 mL (L)
(d) 3.2 m^3 (L)
(e) 0.035 L (mL)
(f) 90 000 mm^3 (cm^3)
(g) 800 L (m^3)
(h) 0.7 mL (mm^3)
(i) 8 cm^3 (mL)
(j) 100 000 mm^3 (L)
(k) 2.4 L (cm^3)
(l) 0.75 mL (cm^3)

19. A bucket holds 10 litres of water. How many buckets full of water would be needed to fill a fish tank that is 1.2 m long, 750 mm wide and 500 mm deep?

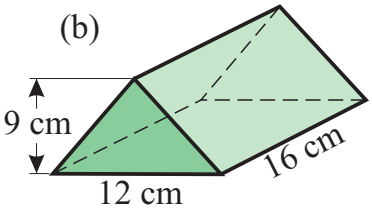
20. Find the volume of each of the following objects.

(a)

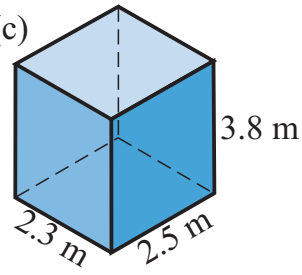


Area = 45 cm^2

(b)

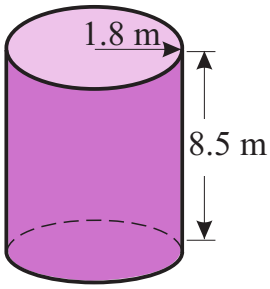


(c)

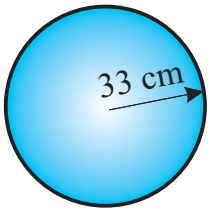


21. Find the volume of each of the following objects. Give answers correct to one decimal place.

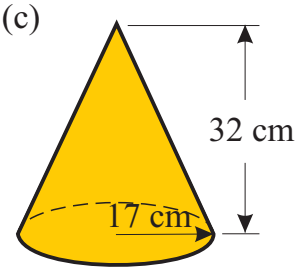
(a)



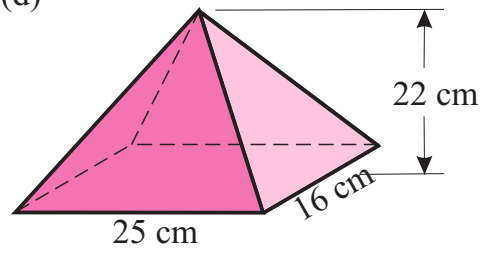
(b)



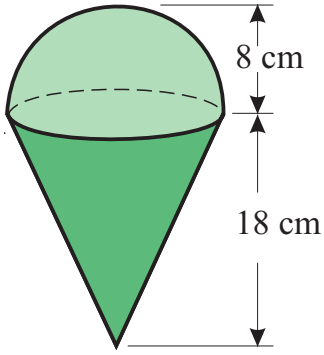
(c)



(d)



(e)



22. Find the volume of a box formed by cutting squares with side length 8 cm out of each corner of a rectangular board 50 cm long and 36 cm wide and folding.

23. Eight spherical balls with diameter 400 mm are dropped into a cylindrical container partially filled with water. The diameter of the cylindrical container is one metre. By how many millimetres will the water level rise? Give answer to nearest mm.