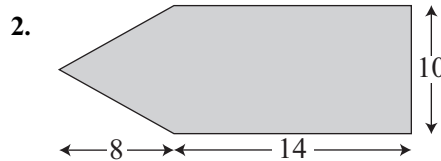# 3 MENSURATION
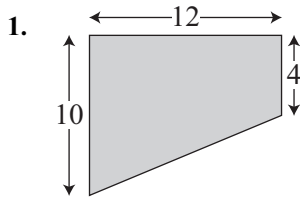
TASK **3.1**
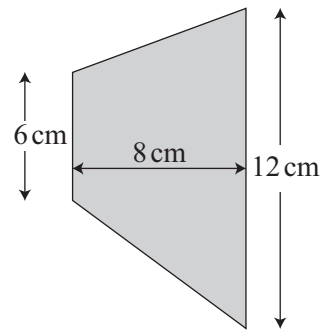
Give answers to one decimal place if necessary.
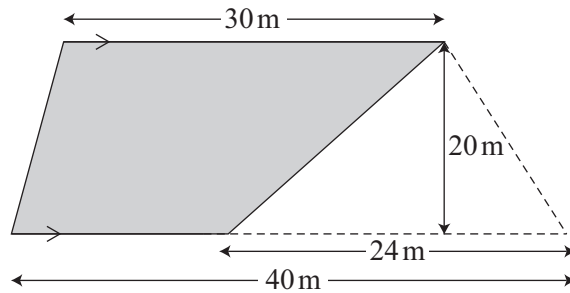
Find the area of each shape below. All lengths are in cm.
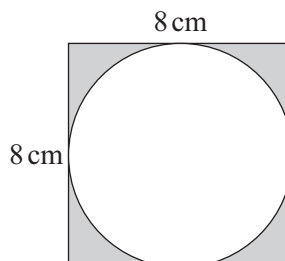
1.

2.

3.
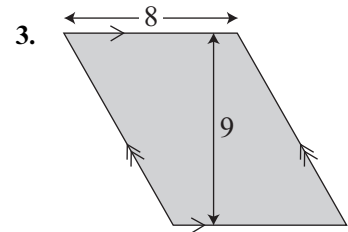
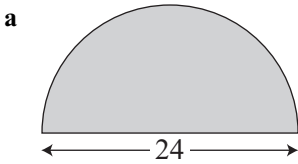**4.** The area of the parallelogram is equal to the area of the trapezium. Find the value of x.
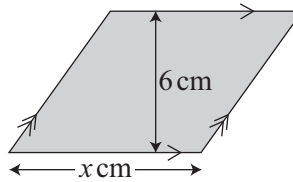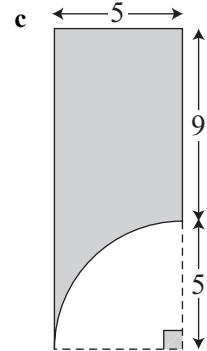
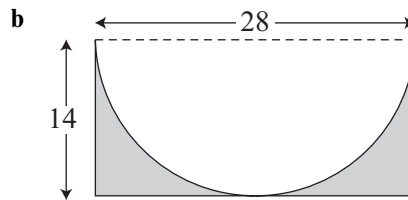**5.** Find the shaded area.

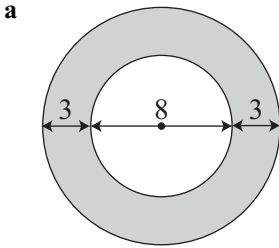**6.** Find the shaded area.

7. Find the area of each shape. All arcs are either semi-circles or quarter circles and the units are cm.

a

b

5·4

5·4

c

68

16
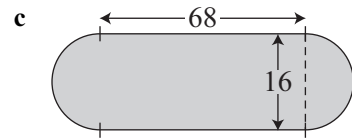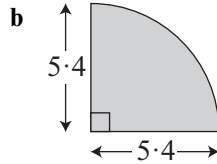
8. Find each shaded area below. All lengths are in cm.

a

3   8   3

b

28

14

c

5

9

5

9. A circular pond has a radius of 13 m. A path goes all the way round the circumference of the pond. The path is 1·2 m wide throughout. Find the area of the path.

10. Calculate the radius of a circle of area 68 cm².

11. The area of this parallelogram is 112·5 cm². Calculate the value of x.

x

34°

9 cm
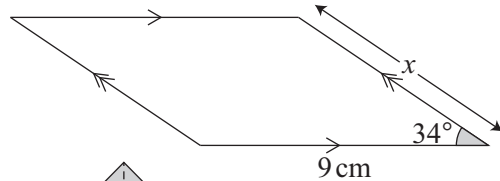
12. Find the area of this regular pentagon.

7 cm
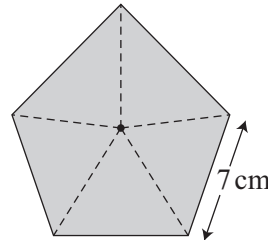
TASK **3.2**

Find the area of each triangle below, giving the answer to one decimal place.

1.

12 cm

49°

16 cm

2.

74°   8 cm

23 cm

3.

78°

59°

13 cm

9 cm

Find the value of the letter in each triangle below.

4.

6 cm

a

8·5 cm

area = 13·5 cm^2

5.

9 cm

82°

b

area = 75 cm^2

6.

14·3 cm

c

8·7 cm

area = 55 cm^2
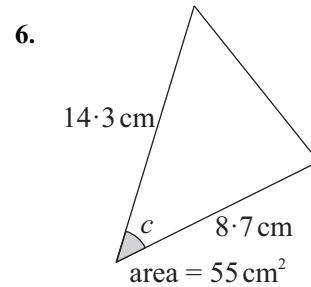
7. area triangle ABC = 48 cm^2
area triangle ABD = 120 cm^2
Calculate the length of CD.

A

17 cm

23°

D   C   B

8.

18 cm

38°

x
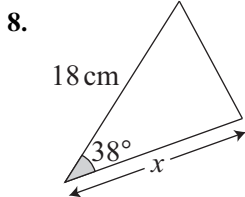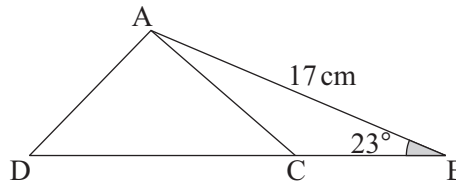
The area of this triangle is equal to the area of this trapezium. Calculate the value of x.

12 cm

6 cm

5 cm
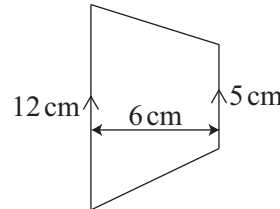
TASK **3.3**

1. What is the radius of a circle if the diameter is 46 cm?

2. What is the diameter of a circle if the radius is 19 mm?

3. *Use a calculator* to find the circumference of each circle below (give answers to 1 d.p.)

a

12 cm

b

3 m

c

9 cm

d

17 m
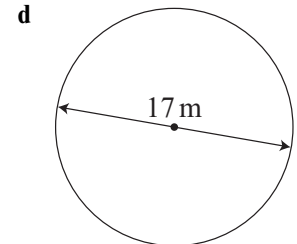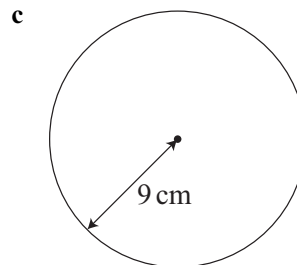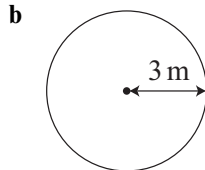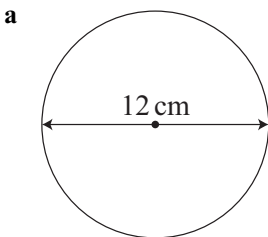
4. Which shape has the larger perimeter – the triangle or the circle?

5 cm

8 cm

9 cm

6 cm
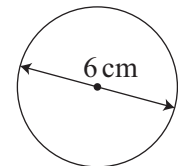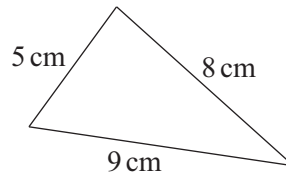
5. Which circle has the larger perimeter?

4 cm

A

7 cm
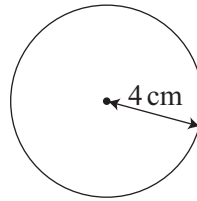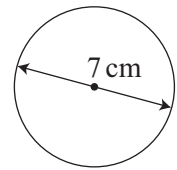
B

Calculate the perimeter of each shape. All arcs are either semi-circles or quarter circles. Give answers correct to 1 d.p.

6.

16 cm

7.

31 cm

8.
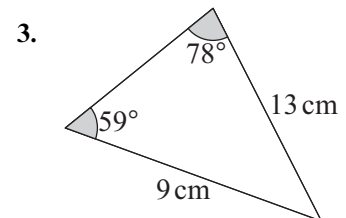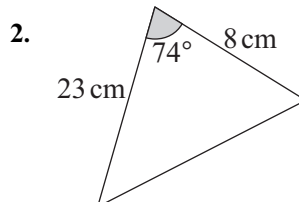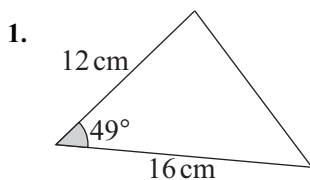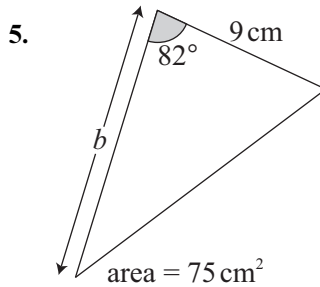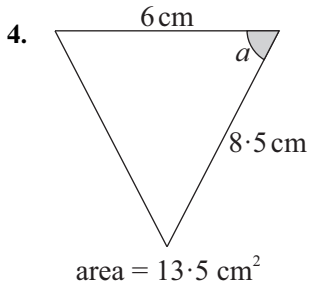
5 cm

5 cm

9.

12 cm

4 cm

10.

100 m

32 m

11.

3 m

6 m

3 m
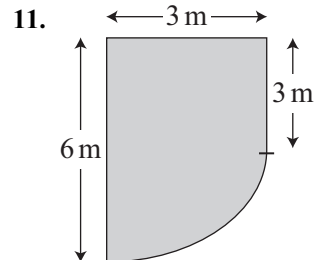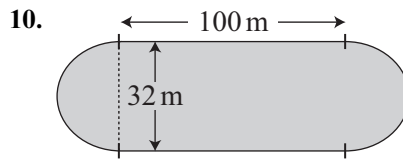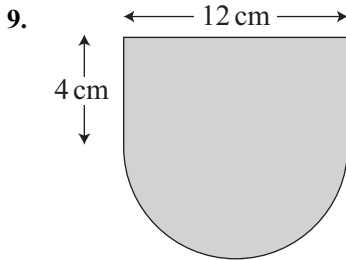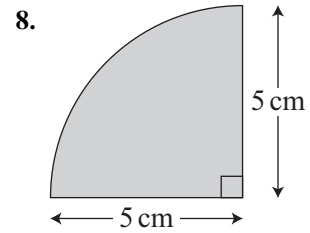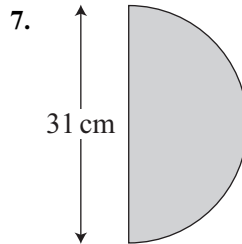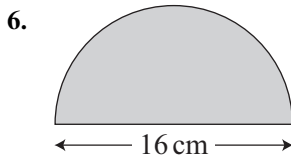
12. A circular log of diameter 30 cm is rolled down a hill. It rolls 48 metres. How many *complete* revolutions did the log make before it stopped?

13. Sanaa has a bike with wheels of radius 31·5 cm. She cycles 3 km. How many times do the wheels of her bike go round completely?

TASK **3.4**

Calculate the area of each circle below, correct to 1 d.p.

1. 5 cm

2. 9 cm

3. 12 cm

4. 32 cm
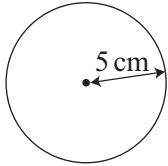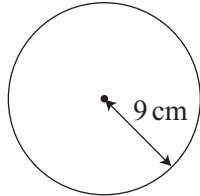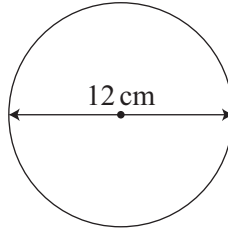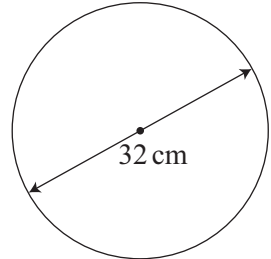
5. A circular pond has a radius of 11 m. What is the area of this pond in m^2?

6. Which shape has the larger area – the triangle or the circle?

4 cm   5 cm

3 cm

1·5 cm
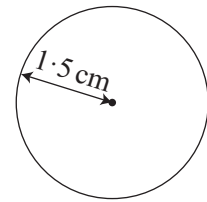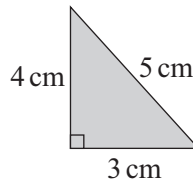
7. Find the shaded area.

8 cm

8 cm
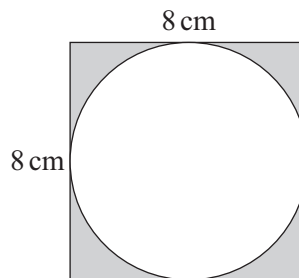
In Questions **8** to **10** find the area of each shape. All arcs are either semi-circles or quarter circles and the units are cm.
Give answers correct to 1 d.p.

8. 24

9. 5·4   5·4

10. 68   16
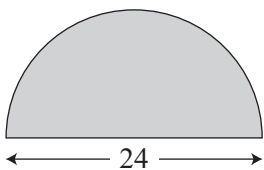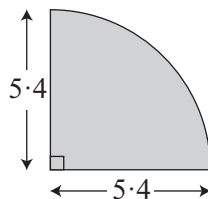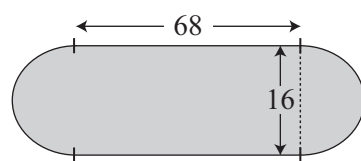
In Questions **11** to **13** find the shaded area. Lengths are in cm. Give answers correct to 1 d.p.

11.
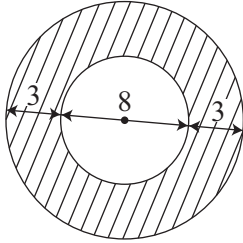
12.
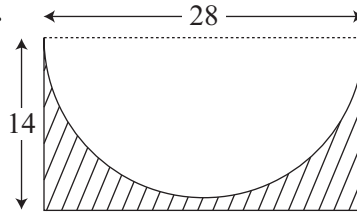
13.
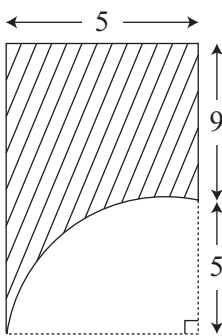
14. A circular pond has a radius of 13 m. A path goes all the way round the circumference of the pond. The path is 1·2 m wide throughout. Find the area of the path.

TASK **3.5**

In this task, O is always the centre of the circle. Give answers to 1 d.p.

1. Find the length of arc AB.
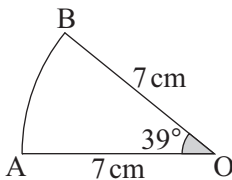
2. Find the length of arc AB.
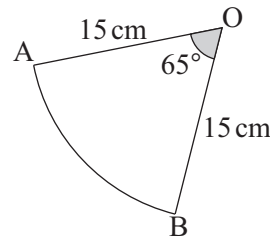
3. The arc PQ = 9 cm. Find angle POQ.
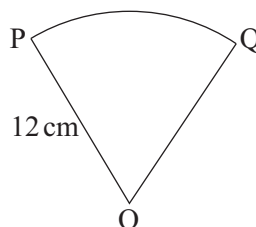
In Questions **4** to **6**, find the perimeter of each shape, leaving answers in terms of π.

4.

O

4 cm / 30°

A   B

5.

B

A

40°

18 cm

O

6.

120°

4 cm   4 cm

3 cm   3 cm

7. Use a calculator to find the perimeter of the shaded area.

B

A

O

29°

D   C

←——— 8 cm ———→←— 5 cm —→
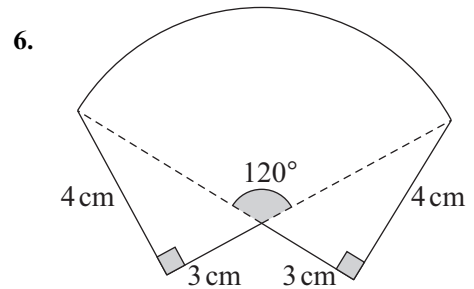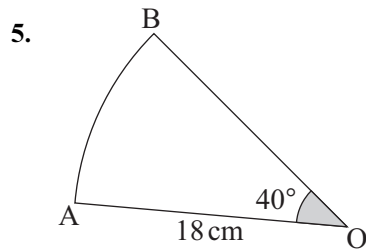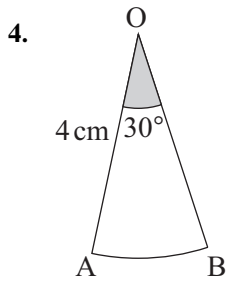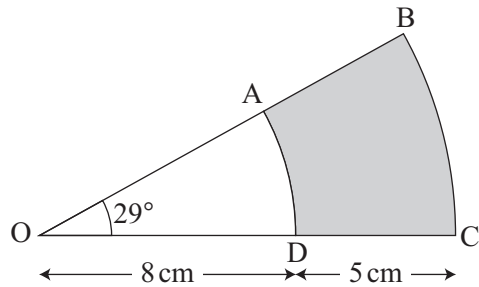
8. Use a calculator to find the perimeter of the shaded area.

O

70°

18 cm   18 cm

B   A
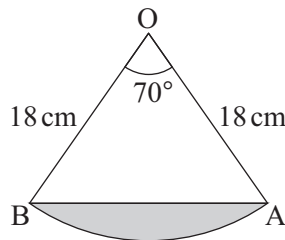
TASK **3.6**

In this task, O is always the centre of the circle. Give answers to 1 d.p.

In Questions **1** to **3**, find each shaded area.

1.

6 cm

O   150°

2.

O

12 cm   41°

3.

78°

←3 cm→←—— 7 cm ——→O
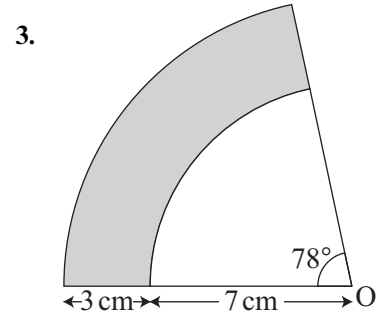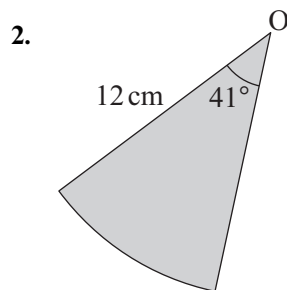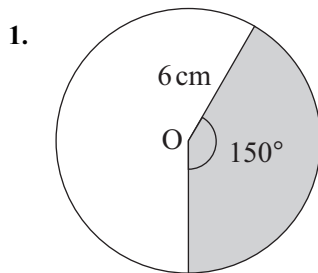
4. Show that the area of this sector is exactly $\frac{16\pi}{9}$ cm^2.
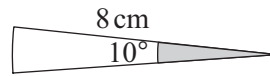
5. ODC is a sector of radius 4 cm.
Find the shaded area, leaving your answer in terms of π.
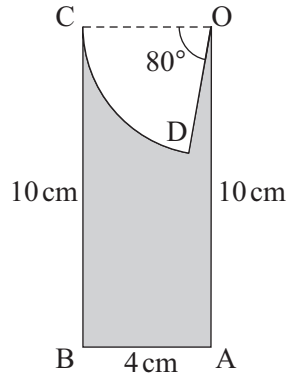
6. Find the value of A if the area of the sector is 90 cm^2.
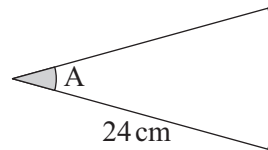
7. Find the area of the shaded segment.
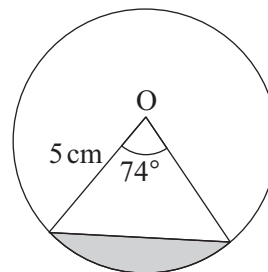
8. If AB $=$ 13 cm, find the area of the shaded segment.
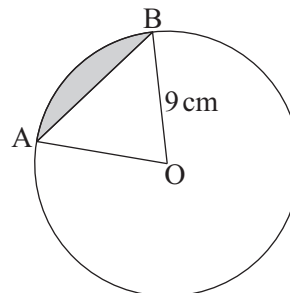
TASK **3.7**

> **Remember** $1 \text{ m}^3 = 1000 \text{ l} = 1000\,000 \text{ cm}^3$
> $1 \text{ m}^2 = 10\,000 \text{ cm}^2$

1. Find the volume of each prism below:

   a

   6 m
   4 m
   9 m
   3 m
   12 m

   b

   3 cm
   4 cm
   13 cm
   25 cm
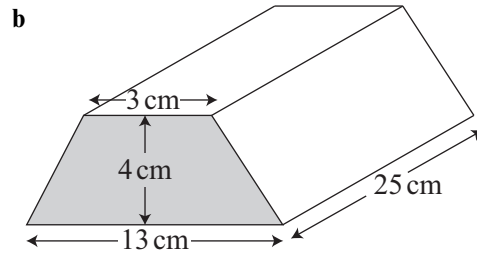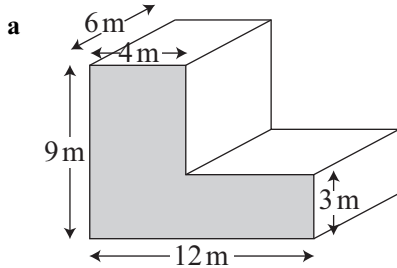
2. Which is the greater amount? $7 \cdot 2 \text{ m}^3$ or $7\,090\,000 \text{ cm}^3$

3. True or false? $6 \cdot 3 \text{ m}^2 = 630 \text{ cm}^2$

4. A rectangular tank has a length of 8 m and a width of 6 m. How high is the tank if it can hold 240 000 litres of water when full?

5. Copy and complete

   a $4 \text{ m}^3 = \boxed{} \text{ cm}^3$

   b $2 \cdot 9 \text{ m}^3 = \boxed{} \text{ cm}^3$

   c $8 \text{ m}^2 = \boxed{} \text{ cm}^2$

   d $7 \cdot 48 \text{ m}^2 = \boxed{} \text{ cm}^2$

   e $6\,000\,000 \text{ cm}^3 = \boxed{} \text{ m}^3$

   f $6 \text{ m}^3 = \boxed{} \text{ litres}$

   g $6\,000\,000 \text{ cm}^2 = \boxed{} \text{ m}^2$

   h $5 \cdot 16 \text{ m}^3 = \boxed{} \text{ litres}$

   i $38\,000 \text{ cm}^2 = \boxed{} \text{ m}^2$

6. Find the 'exact' volume of each prism below, leaving your answers in terms of π.

   a

   3 cm
   10 cm

   b

   12 cm
   4 cm
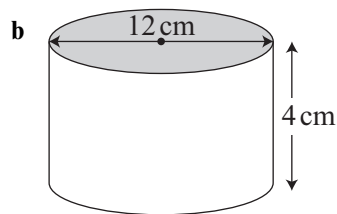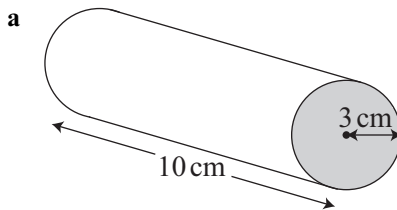
7. A pipe of diameter 8 cm and length 3 m is half full of water. How many litres of water are in the pipe?
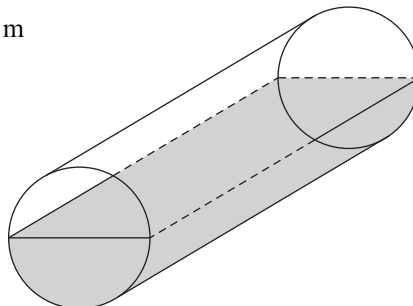
8. Find the volume of this prism.
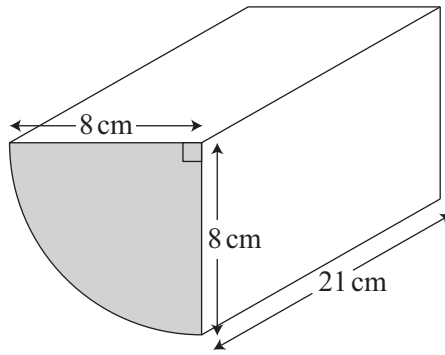
9. A cylindrical bucket has a diameter of
30 cm and a height of 35 cm.
How many full bucket loads of water
are needed to fill up the tank
opposite?
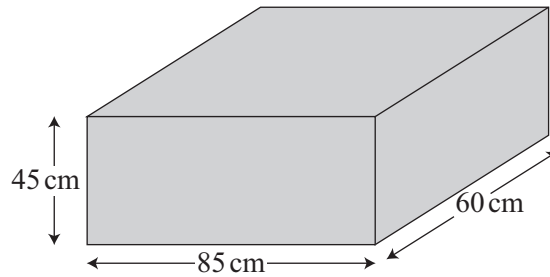
10. The height of a cylinder of capacity 3·5 litres is twice
its radius. Calculate the radius of the cylinder.

TASK **3.8**

Remember	sphere	pyramid	cone
	volume $= \frac{4}{3}\pi r^3$	volume $= \frac{1}{3} \times$ (base area) $\times h$	volume $= \frac{1}{3}\pi r^2 h$

In this task, give answers to 3 significant figures where necessary.

1. Find the volume of each solid.

a

b

c
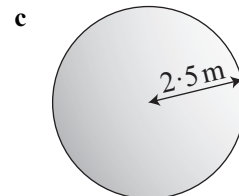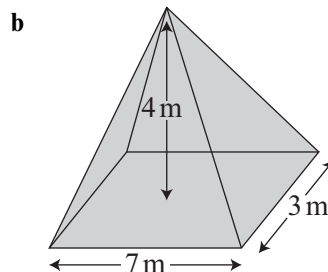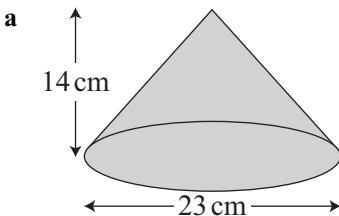
2. A hemisphere and a cone are both made from the same material. The
cone has a base diameter of 8 cm and a perpendicular height of 6 cm. The
hemisphere has a diameter of 7 cm. Which solid weighs more?

3. A sphere has a volume of 80 cm^3. Find the radius of the sphere.

4. Find the 'exact' volume of each solid, leaving your answers in terms of π.

a

4 cm

3 cm

16 cm

15 cm

b

9 cm

25 cm
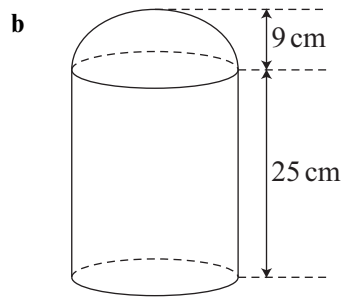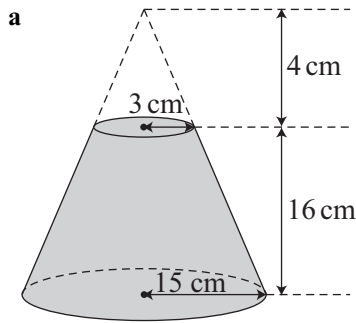
(hemisphere on a cylinder)

5. A bowl is in the shape of a hemisphere with diameter 18 cm. Water is poured into the bowl at a rate of 12 cm^3/s. How long will it take to fill the bowl completely?
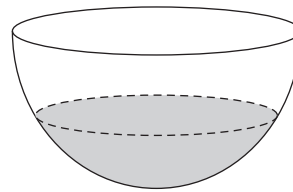
6. A pyramid has a square base of side length 8 cm and a perpendicular height of 17 cm. The pyramid has the same volume as a cone of base radius 6·5 cm. Find the perpendicular height of the cone.

7. A metal cylinder has diameter 4·8 cm and a height of 8·3 cm. 75 identical cylinders are melted down to make a single sphere. Calculate the diameter of the sphere.

TASK **3.9**

> **Remember**   sphere   cylinder   cone
> surface area $= 4\pi r^2$ curved surface area $= 2\pi rh$ curved surface area $= \pi rl$
> where l is the slant height

In this task, give answers to 3 significant figures where necessary.

1. Find the *curved* surface area of each solid.

a

19 cm

4 cm

b

9 cm

c

23 cm

←14 cm→
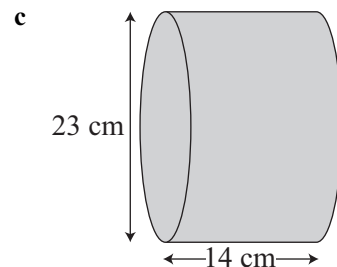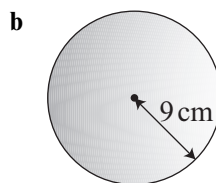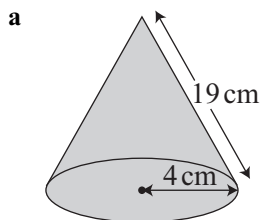
2. Find the *total* surface area of this cone, leaving your answer in terms of π.

10 cm

—12 cm—
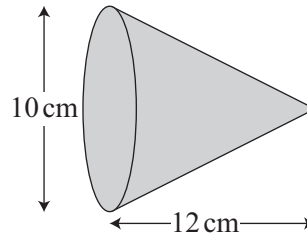
3. A sphere has a surface are of 480 cm². Calculate its diameter.

4. The curved surface area of a hemisphere is 72π cm². What is the *total* surface area of the hemisphere?

5. A cone is attached to a cylinder of diameter 15 cm as shown. The perpendicular heights of the cylinder and the cone are both equal to the diameter of the cylinder. Find the *total* surface area of the combined solid.

15 cm
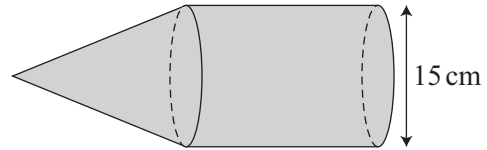
6. A cylinder has a radius of 2 cm and a height of 10 cm. A cone has a radius of 3 cm. The total surface area of the cone is equal to the total surface area of the cylinder. Show that the perpendicular height of the cone is $4\sqrt{10}$ cm.

TASK **3.10**

Use $\dfrac{M}{D\,|\,V}$ to help you work out the questions below.

1. A solid weighs 450 g and has a volume of 50 cm³. Find the density of this solid.

2. A liquid has a density of 2 g/cm². How much does the liquid weigh if its volume is 240 cm³?

3. A metal bar has a density of 12 g/cm³ and a mass of 360 g. Find the volume of the metal bar.

4. Copy and complete this table.

density (g/cm³)	mass (g)	volume (cm³)
7		90
	240	60
8	152	
	42	0·5
13	585	
1·5		140

5. Gold has a density of 19·3 g/cm^3. A gold ring has a volume of 1·1 cm^3.
   Find the mass of the gold ring.

6. A brass handle has a volume of 17 cm^3 and a mass of 139·4 g.
   Find the density of the brass.

7. Which has a greater volume — 102·6 g of lead with density 11·4 g/cm^3 or
   78·85 g of steel with density 8·3 g/cm^3? Write down by how much.

8. The density of this metal bar is 7·4 g/cm^3.
   Find the mass of this metal bar. Give your answer in kg.
   (Note the length is given in metres.)

   5 cm   8 cm   1·2 m
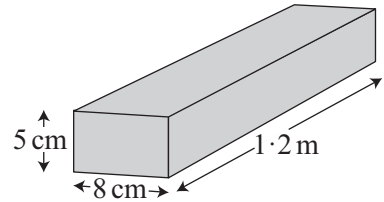
9. A metal cube of length 0·2 m has a density of 8·3 g/cm^3. A hole is bored
   through the cube with 485 cm^3 of metal being removed. What is the mass
   in kg of the remaining piece of metal?

10. A metal bar has 3 holes cut completely through its
    length. The cross-sectional area of each hole is y cm^2.
    The density of the metal is 9 g/cm^3.
    Find the mass of the remaining piece of metal,
    giving your answer in terms of x and y.

    7 cm x cm x cm