

Section A - Revision

This section will help you revise previous learning which is required in this topic.

R1 I can substitute into a formula

In each of the following give your answer to 2 decimal places where necessary.

1. Given $A = \pi r^2$, calculate A when $\pi = 3 \cdot 14$ and $r = 10$.
2. Given $C = \pi d$, calculate C when $\pi = 3 \cdot 14$ and $d = 33$.
3. Given $V = \pi r^2 h$, calculate A when $\pi = 3 \cdot 14$, $r = 3 \cdot 2$ and $h = 5$.
4. Given $m = \frac{y_2 - y_1}{x_2 - x_1}$, calculate m when $y_2 = 3$, $y_1 = 7$, $x_2 = 6$ and $x_1 = 2$.
5. Given $V = \frac{4}{3} \pi r^3$, calculate V when $\pi = 3 \cdot 14$ and $r = 5 \cdot 7$.
6. Given $V = \frac{1}{3} \pi r^2 h$, calculate V when $\pi = 3 \cdot 14$ and $r = 0 \cdot 2$ and $h = 0 \cdot 7$.
7. Given $m = \frac{y_b - y_a}{x_b - x_a}$, calculate m when $y_a = 12$, $y_b = 3$, $x_a = 1$ and $x_b = 4$.
8. Given $A = \frac{1}{2} b h$, calculate A when $b = 7 \cdot 2$ and $h = 5$.
9. Given $A = \pi r^2$, calculate A when $\pi = 3 \cdot 14$ and $r = 2 \cdot 3$.
10. Given $C = \pi d$, calculate D when $\pi = 3 \cdot 14$ and $d = 12$.
11. Given $V = \pi r^2 h$, calculate A when $\pi = 3 \cdot 14$, $r = 0 \cdot 77$ and $h = 3$.
12. Given $m = \frac{y_2 - y_1}{x_2 - x_1}$, calculate m when $y_2 = 8$, $y_1 = 4$, $x_2 = 12$ and $x_1 = 10$.
13. Given $V = \frac{4}{3} \pi r^3$, calculate V when $\pi = 3 \cdot 14$ and $r = 10$.
14. Given $V = \frac{1}{3} \pi r^2 h$, calculate V when $\pi = 3 \cdot 14$ and $r = 0 \cdot 01$ and $h = 0 \cdot 5$.
15. Given $m = \frac{y_b - y_a}{x_b - x_a}$, calculate m when $y_a = 4$, $y_b = 1$, $x_a = 7$ and $x_b = 10$.
16. Given $A = \frac{1}{2} b h$, calculate A when $b = 0 \cdot 08$ and $h = 0 \cdot 53$.

Gradient, Sectors, Volumes and Sig Figs

Section B - Assessment Standard Section

This section will help you practise for your Assessment Standard Test for Gradient, Sectors and Volume (Expressions and Formulae 1.4)

Practice Assessment Standard Questions

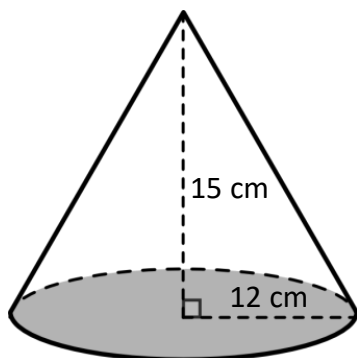
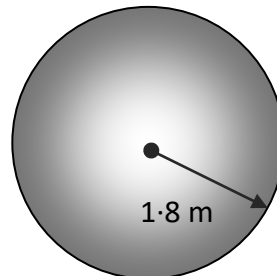
1. Find the gradient of the straight line between the two given points

- | | |
|----------------------------|-----------------------------|
| (a) T(3, 2) and R(4, 4) | (b) A(-1, 3) and Q(4, 8) |
| (c) C(-3, -2) and S(7, 3) | (d) V(0, 3) and L(-3, 9) |
| (e) B(1, 4) and H(-1, -2) | (f) G(-3, 4) and W(-1, 8) |
| (g) K(9, -2) and N(5, -12) | (h) X(-7, -4) and E(-3, -2) |

2. Find the volume of the following shapes and round your answer to the given number of significant figures

- (a) Find the volume of a sphere of radius 1.8 metres.

Give your answer to 2 significant figures.



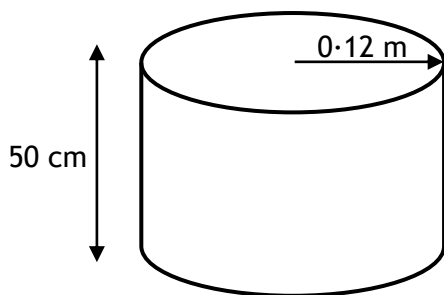
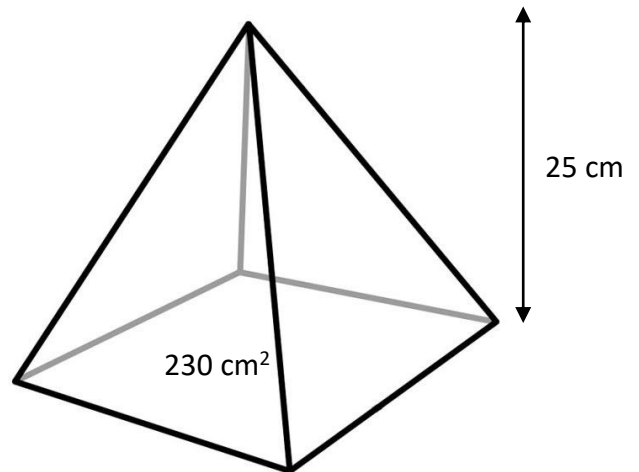
- (b) Find the volume of a cone of radius 12 centimetres and height 15 centimetres.

Give your answer to 2 significant figures.

Gradient, Sectors, Volumes and Sig Figs

- (c) Find the volume of a pyramid with a base of 230 square centimetres and a height of 25 centimetres.

Give your answer to 2 significant figures.

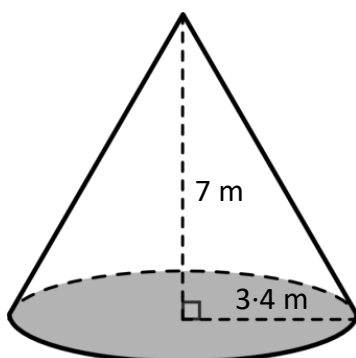
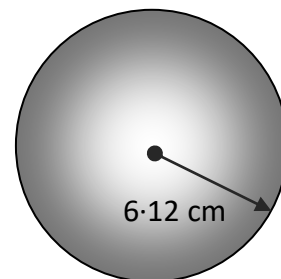


- (d) Find the volume of a cylinder of radius 0.12 metres and height 50 centimetres.

Give your answer to 2 significant figures.

- (e) Find the volume of a sphere of radius 6.12 centimetres.

Give your answer to 3 significant figures.



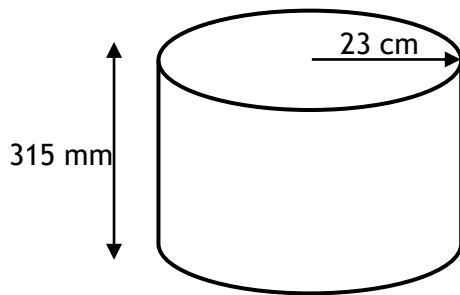
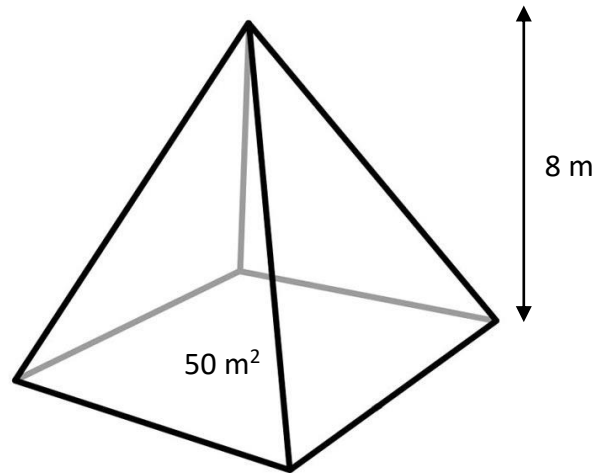
- (f) Find the volume of a cone of radius 3.4 metres and height 7 metres.

Give your answer to 3 significant figures.

Gradient, Sectors, Volumes and Sig Figs

- (g) Find the volume of a pyramid with a base of 50 square metres and a height of 8 metres.

Give your answer to 2 significant figures.

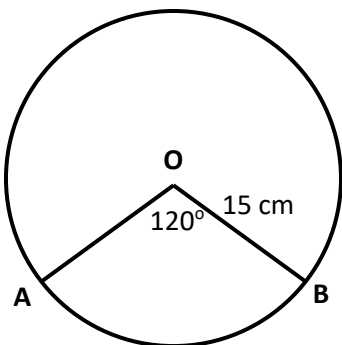


- (h) A cylinder of radius 23 centimetres and a height of 315 millimetres.

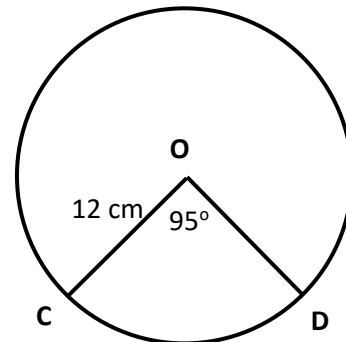
Give your answer to 3 significant figures.

3. Calculate the length of the minor arc giving your answer to one decimal place.

(a)



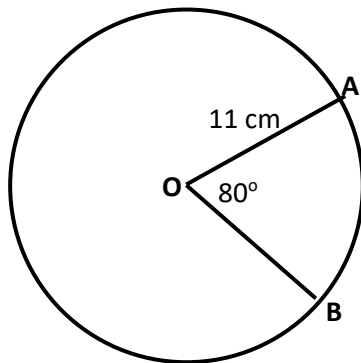
(b)



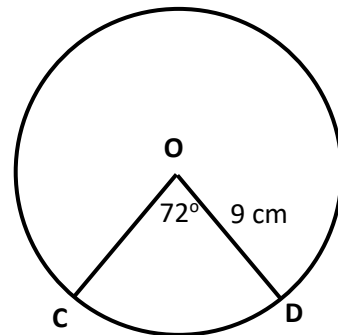
Gradient, Sectors, Volumes and Sig Figs

4. Calculate the area of the minor sector giving your answer to one decimal place.

(a)



(b)



Gradient, Sectors, Volumes and Sig Figs

Section C - Operational Skills Section

This section provides problems with the operational skills associated with Gradient, Sectors, Volumes and Significant Figures.

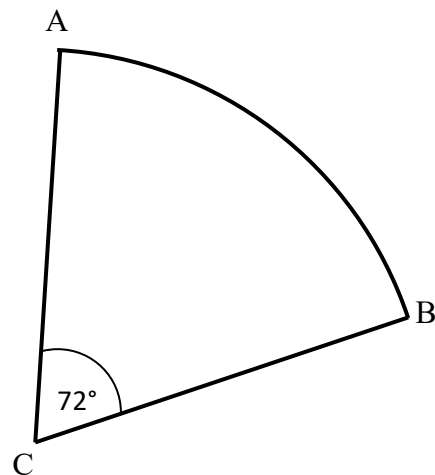
01 I can round to a given number of significant figures.

- Evaluate the following giving you answer to the stated number of significant figures.
 - 325×23 correct to 3 significant figures.
 - $\frac{1}{3} \times 0.23 \times 1.44$ correct to 2 significant figures.
 - $\frac{4}{3} \times 423 \times 1.8^2$ correct to 3 significant figures.
 - $\frac{47 \times 6}{355}$ correct to 4 significant figures.
 - 91.3×534 correct to 3 significant figures.
 - $\frac{1}{3} \times 1.77 \times 0.3^3$ correct to 2 significant figures.
 - $\frac{73}{3 \times 7}$ correct to 4 significant figures.
 - $\frac{1}{5} \times 0.95 \times 0.67^2$ correct to 3 significant figures.
 - 9999×99 correct to 3 significant figures.

02 I can calculate the perimeter and area of a sector of a circle.

- The diagram shows a sector of a circle, centre C.
The radius of the circle is 5.4 metres and the angle ACB is 72° .

- Calculate the length of arc AB, hence find the perimeter of the sector ABC to 3 significant figures.
- Calculate the area of the sector to 4 significant figures.

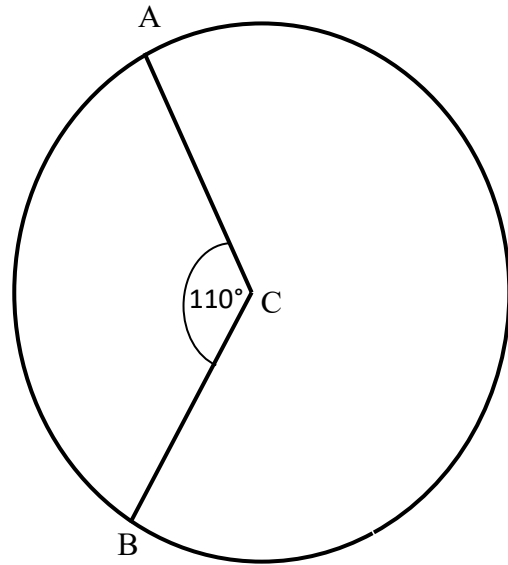


Gradient, Sectors, Volumes and Sig Figs

2. The diagram shows a circle, centre C.

The circumference of the circle is 40.8 centimetres.

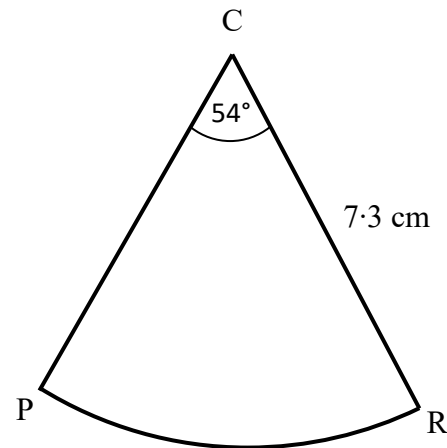
- (a) Calculate the length of the minor arc AB to 4 significant figures.
- (b) Calculate the radius of the circle to 2 significant figures.
- (c) Calculate the area of the circle to 2 significant figures.



3. The diagram shows a sector of a circle, centre C.

The radius of the circle is 7.3 centimetres and angle PCR is 54° .

- (a) Calculate the area of the sector PCR to 3 significant figures.
- (b) Find the perimeter of the sector PCR to nearest centimetre.

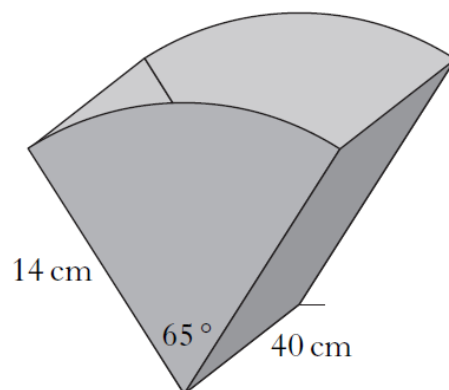


4. The ends of a magazine rack are identical.

Each end is a sector of a circle with radius 14 centimetres. The angle of each sector is 65° .

The sectors are joined by two rectangles, each with length 40 centimetres.

The exterior is covered by material. What area of material is required?



Gradient, Sectors, Volumes and Sig Figs

5.



A pet shop manufactures protective dog collars.

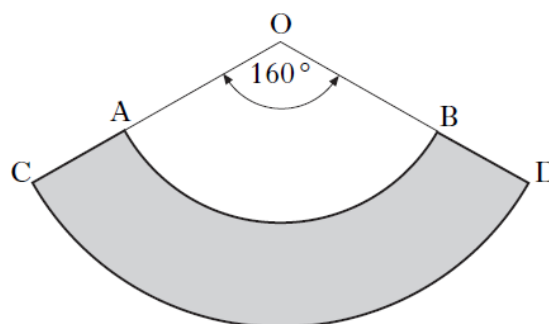
In the diagram below the shaded area represents one of these collars.

AB and CD are the arcs of the circles with centres at O.

The radius, OA, is 25 centimetres and the radius, OC, is 45 centimetres.

Angle AOB is 160° .

Calculate the area of a collar to 3 significant figures.



6. A sector of a circle, centre O, is shown.

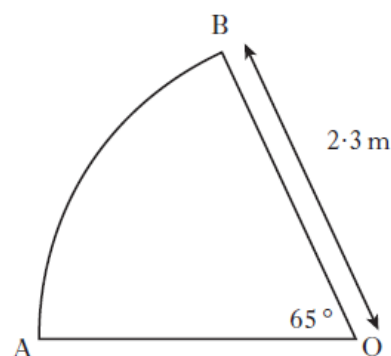
The radius of the circle is 2.3 metres.

Angle AOB is 65° .

(a) Find the length of the arc AB.

(b) Find the perimeter of the sector.

(c) Find the area of the sector to 2 significant figures.



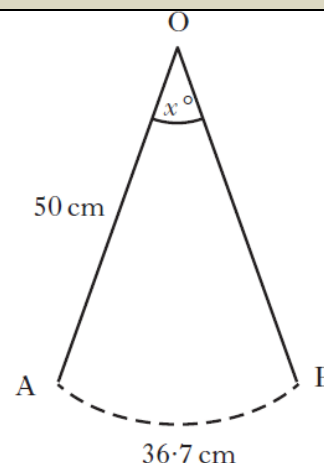
03 I can find the angle in a sector given the arc length or area of the sector.

1. As the pendulum of a clock swings, its tip moves through an arc of a circle, AB.

The length of the pendulum is OA = 50 centimetres.

The length of the arc is 36.7 centimetres.

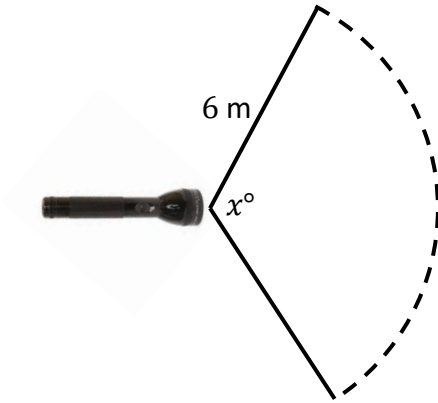
Calculate x° , the angle through which the pendulum swings.



Gradient, Sectors, Volumes and Sig Figs

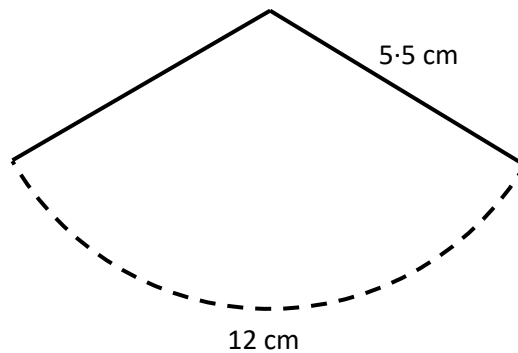
2. The beam from a torch lights up an area of ground in the shape of a sector of a circle as shown.

The area lit up by the torch is 40 square metres and the radius of the sector is 6 metres.



Find the size of the angle, x° , the angle of coverage of the beam.

3. The sector of the circle, shown below, has an arc length 12 cm and a radius of 5.5 centimetres.



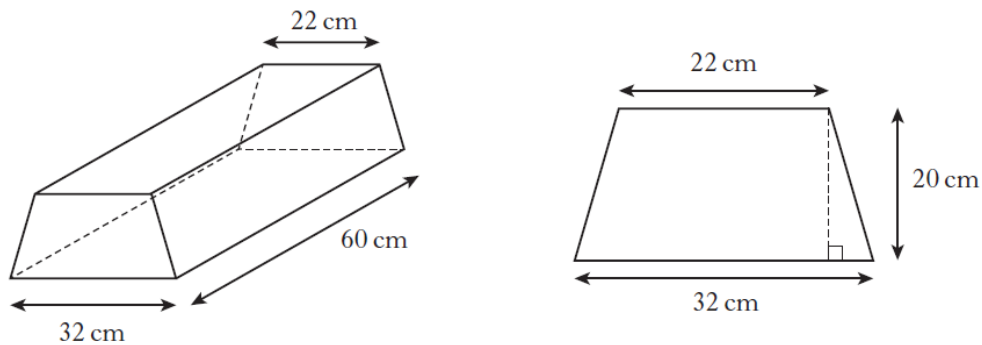
Find the area of the sector.

Gradient, Sectors, Volumes and Sig Figs

04 I can find the volume of cuboids, prisms (including cylinders), cones and spheres.

1. A concrete block is in the shape of a prism.

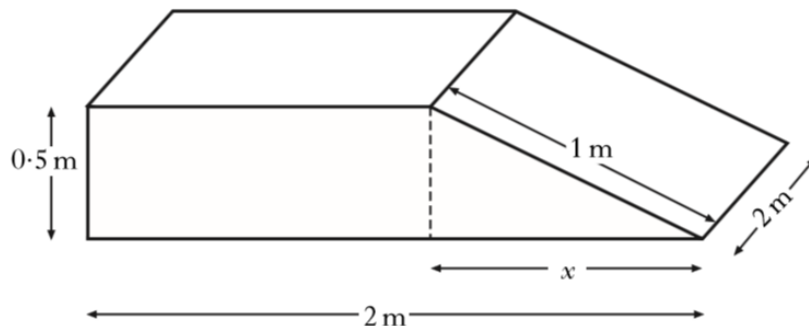
The cross section of the prism is a trapezium with dimensions shown.



- (a) Calculate the area of the cross section.
(b) Calculate the volume of the concrete block.

2. A concrete ramp is to be built.

The ramp is in the shape of a cuboid and a triangle prism with dimensions as shown.

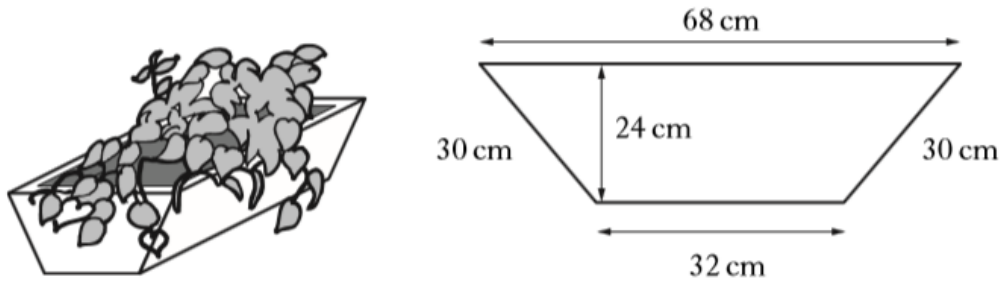


- (a) Calculate the value of x .
(b) Calculate the volume of concrete required to build the ramp.

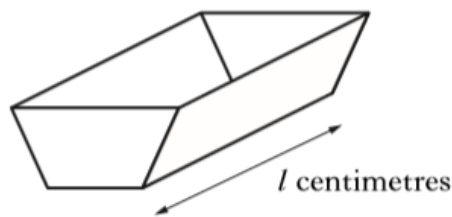
Gradient, Sectors, Volumes and Sig Figs

3. A flower planter is in the shape of a prism.

The cross-section is a trapezium with dimensions as shown.



- (a) Calculate the area of the cross-section of the planter.
(b) The volume of the planter is 156 litres.

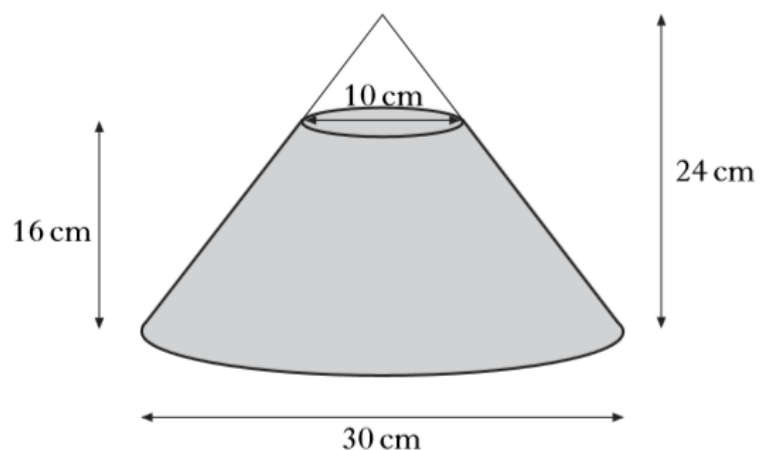


Calculate the length, l centimetres, of the planter.

4. A glass ornament in the shape of a cone is partly filled with coloured water.

The cone is 24 centimetres high and has a base of diameter 30 centimetres.

The water is 16 centimetres deep and measures 10 centimetres across the top.

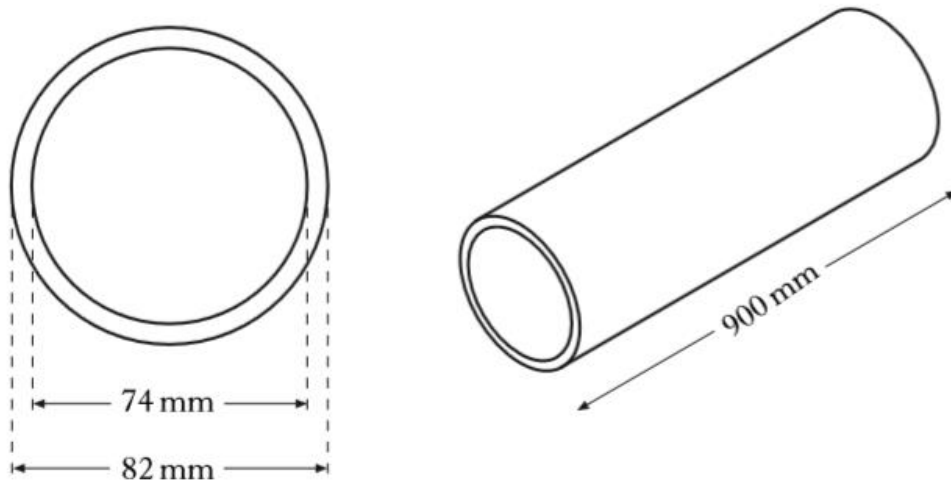


What is the volume of water correct to 2 significant figures?

Gradient, Sectors, Volumes and Sig Figs

5. A company manufactures aluminium tubes.

The cross-section of one of the tubes is shown in the diagram below.



The inner diameter is 74 millimetres.

The outside diameter is 82 millimetres.

The tube is 900 millimetres long.

Calculate the volume of aluminium used to make the tube.

Give your answer correct to 3 significant figures.

6. A cylindrical container has a volume of 3260 cubic centimetres.

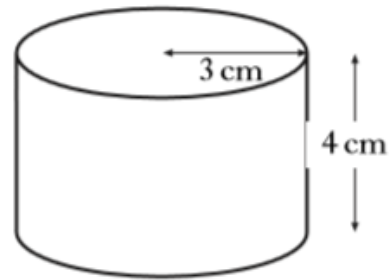
The radius of the cross section is 6.4 centimetres.

Calculate the height of the cylinder.



Gradient, Sectors, Volumes and Sig Figs

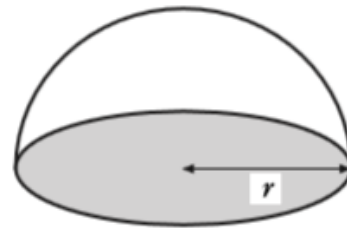
7. (a) A cylindrical paperweight of radius 3 centimetres and height 4 centimetres is filled with sand.



Calculate the volume of sand in the paperweight.

- (b) Another paperweight, in the shape of a hemisphere, is filled with sand.

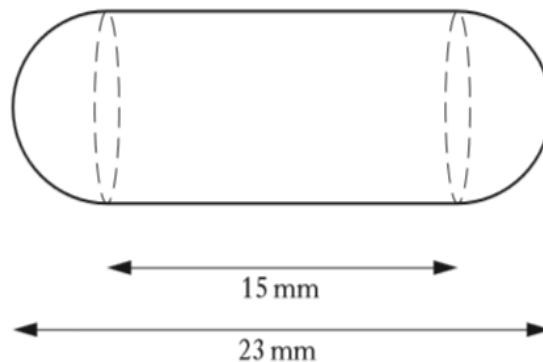
It contains the same volume of sand as the first paperweight.



Calculate the radius of the hemisphere.

8. A painkiller is dispensed in capsules.

Each capsule is in the shape of a cylinder with hemispherical ends as shown in the diagram.



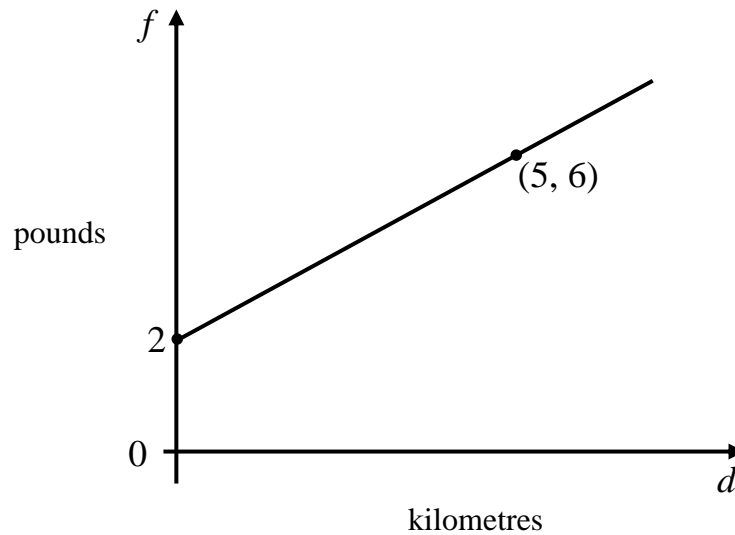
The total length of the capsule is 23 millimetres and the length of the cylinder is 15 millimetres.

Calculate the volume of the capsule.

Gradient, Sectors, Volumes and Sig Figs

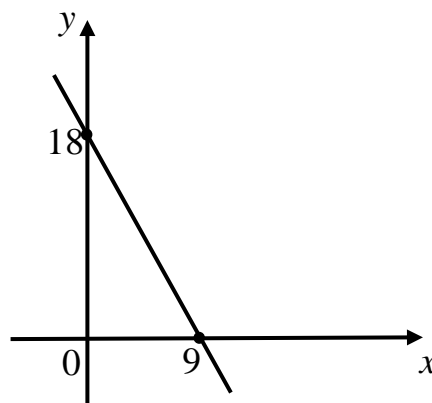
05 *I can calculate the gradient of a straight line given two points which lie on the line.*

1. The graph shows the fare, f pounds for a journey of d kilometres.



Calculate the gradient of the line.

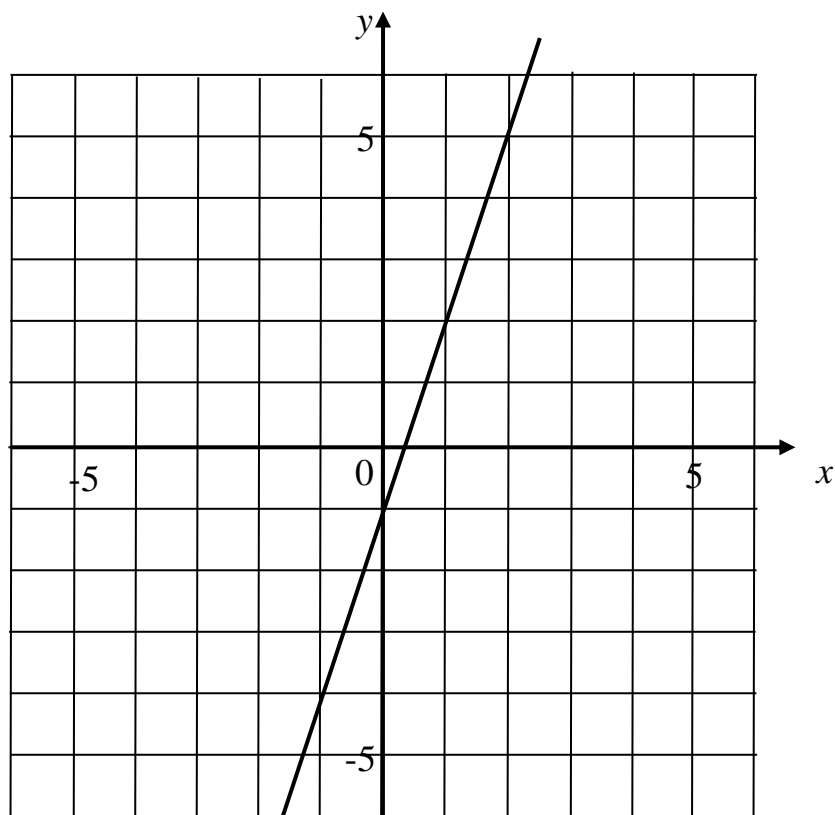
2. A straight line cuts the x -axis at the point $(9, 0)$ and the y -axis at the point $(0, 18)$ as shown



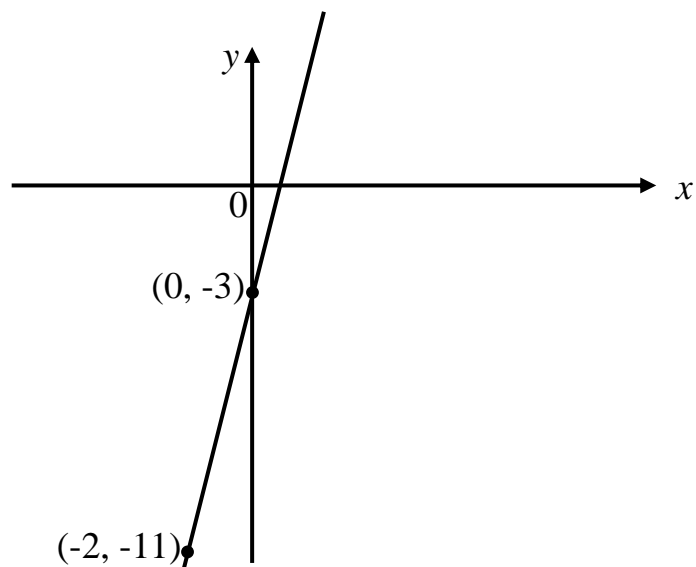
Calculate the gradient of the line.

Gradient, Sectors, Volumes and Sig Figs

3. Find the gradient of the straight line.

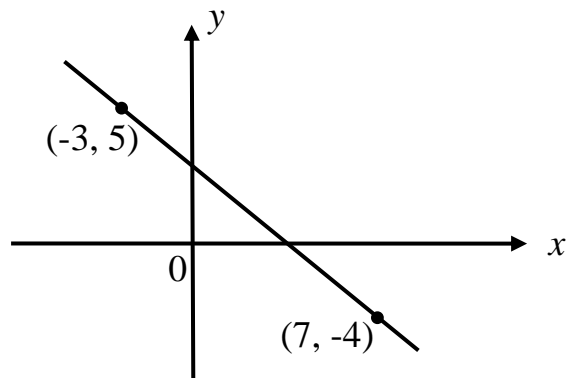


4. Find the gradient of the straight line.

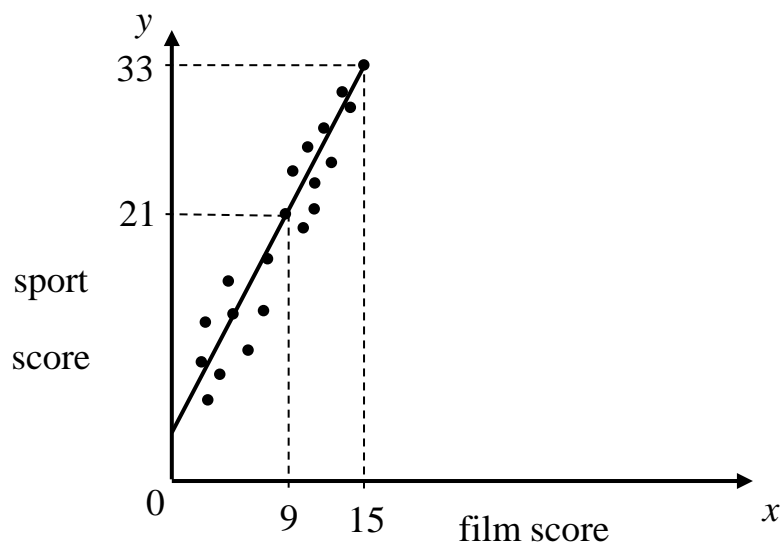


Gradient, Sectors, Volumes and Sig Figs

5. Calculate the gradient of the straight line.



6. A line of best fit is drawn in the scattergraph below.



Calculate the gradient of this line of best fit.

Gradient, Sectors, Volumes and Sig Figs

Section D - Reasoning Skills Section

This section provides problems with Reasoning Skills in the context of Gradient, Sectors and volumes.

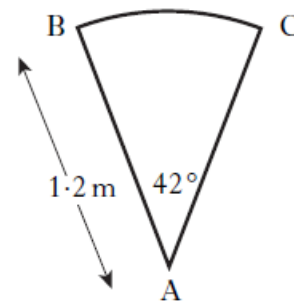


A spiral staircase is being designed.

Each step is made from a sector of a circle as shown.

The radius is 1.2 metres.

Angle BAC is 42° .

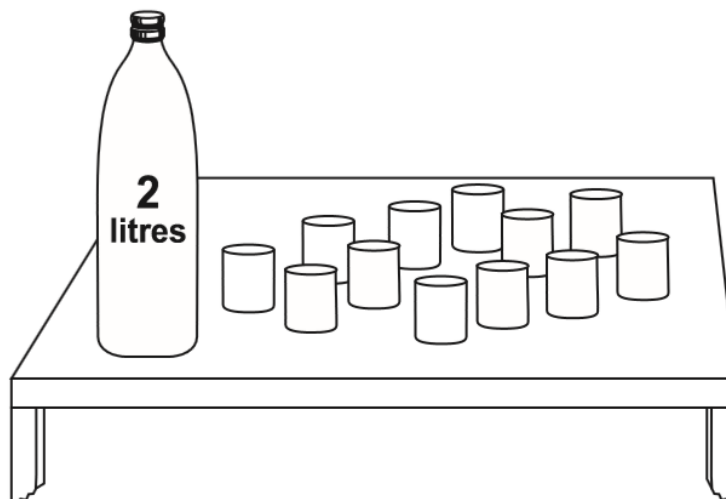


For the staircase to pass safety regulations, the arc BC must be at least 0.9 metres.

Will the staircase pass safety regulations?

2. Lemonade is to be poured from a 2 litre bottle into glasses.

Each glass is in the shape of a cylinder of radius 3 centimetres and height 8 centimetres.

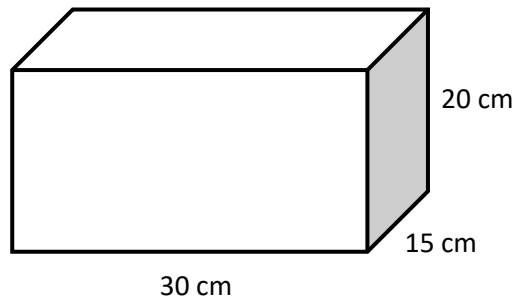


How many full glasses can be poured from the bottle?

Gradient, Sectors, Volumes and Sig Figs

3. Marie makes candles from wax.

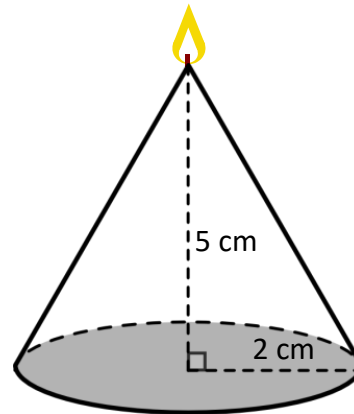
She buys the wax for the candle in large cuboid blocks with dimensions shown below.



One of the candles that Marie makes is a cone shaped candle with a radius of 2 centimetres and a height of 5 centimetres.

Marie says she will be able to make 43 complete candles from the block of wax.

Is she correct?



4. A container, in the shape of a cylinder, is full of fluid.

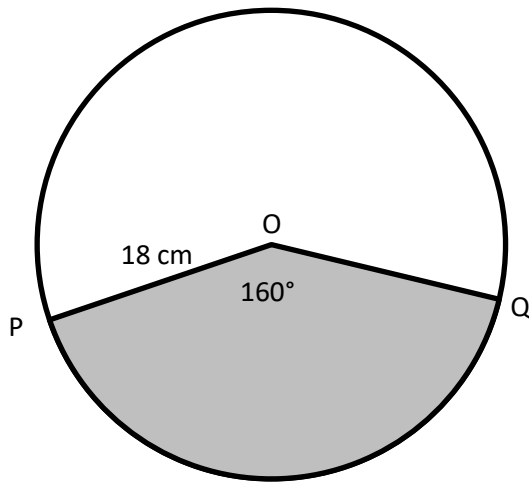
The container has a radius of 4 centimetres and a height of 6.5 centimetres.

The fluid in the container is poured into a hemispherical mould with a radius of 5.3 centimetres.

Will the mould hold the fluid or will it overflow?

Gradient, Sectors, Volumes and Sig Figs

5. The guard on a garden strimmer is in the shape of a circle with a piece, represented by the shaded sector in the diagram, cut out.



PQ is a minor arc of the circle with centre O.

The radius OP is 18 cm.

Angle POQ is 160° .

- (a) Calculate the length of minor arc PQ.
- (b) Calculate the area of the waste plastic, the shaded sector, in square metres.
- (c) The manufacturers of the guards also make magazine racks.

A magazine rack is designed which uses two pieces of waste plastic in each magazine rack. The cost of the plastic is £15.73 per square metre and the company claim to save over £140 every 100 magazine racks by recycling the plastic.

Is the company's claim true?

Gradient, Sectors, Volumes and Sig Figs

Answers for N5 Portfolio Gradient, Sectors and Volumes

Section A

R1

- | | | |
|-------------|---------------------------|-----------|
| 1. 314 | 2. 103.62 | 3. 160.77 |
| 4. -1 | 5. 775.34 | 6. 0.03 |
| 7. -3 | 8. 18 | 9. 16.61 |
| 10. 37.68 | 11. 5.59 | 12. 2 |
| 13. 4186.67 | 14. 5.23×10^{-5} | 15. -1 |
| 16. 0.02 | | |

Section B

- | | | |
|--|-----------------------|--|
| 1. (a) 2 | (b) 1 | (c) $\frac{1}{2}$ |
| (d) -2 | (e) 3 | (f) 2 |
| (g) $\frac{5}{2}$ | (h) $\frac{1}{2}$ | |
| 2. (a) 24m^3 | (b) 2300cm^3 | (c) 1900cm^3 |
| (d) $0.023\text{m}^3/23000\text{cm}^3$ | (e) 960cm^3 | |
| (f) 84.7m^3 | (g) 130m^3 | (h) $52300\text{cm}^3/52300000\text{mm}^3$ |
| 3. (a) 31.4cm | (b) 19.9cm | |
| 4. (a) 84.5cm^2 | (b) 50.9cm^2 | |

Section C

O1

- | | | | |
|-------------|-----------|-----------|------------|
| 1. (a) 7480 | (b) 0.11 | (c) 1830 | (d) 0.7944 |
| (e) 48800 | (f) 0.016 | (g) 3.476 | (h) 0.0853 |
| (i) 990000 | | | |

O2

- | | | | |
|--------------------------|-----------|------------------------|----------------------|
| 1. (a) Arc = 6.79m | P = 17.6m | (b) 18.32m^2 | |
| 2. (a) 12.47cm | (b) 6.5cm | (c) 130cm^2 | |
| 3. (a) 25.1cm^2 | (b) 21cm | 4. 1342.4cm^2 | 5. 1950cm^2 |
| 6. (a) 2.6m | (b) 7.2m | (c) 3.0m^2 | |

Gradient, Sectors, Volumes and Sig Figs

03

1. 42.1° 2. 127.3° 3. 33cm^2

04

1. (a) 540cm^2 (b) 32400cm^3 2. (a) 0.9m (b) 1.8m^3
3. (a) 1200cm^2 (b) 130cm 4. 5400cm^3
5. $882\,000\text{mm}^3$ 6. 25.3cm 7. (a) 113.1cm^3 (b) 3.8cm
8. 1022.1mm^3

05

1. $\frac{4}{5}$ 2. -2 3. 3 4. 4 5. $\frac{-9}{10}$ 6. 2

Section D

1. No it will not pass safety regulations as $0.88\text{m} < 0.9\text{m}$.
2. 8 full glasses can be filled.
3. Yes she can make 43 complete candles as $9000 \div 20.94 = 429$ complete candles can be made.

OR

Yes she can make 43 complete candles as $898.7\text{cm}^3 < 9000\text{cm}^3$.

4. The mould will overflow as 311.8cm^3 (mould) $<$ 326.7cm^3 (container)
5. (a) 50.3cm (b) 0.045m^2
(c) Yes the company's claim is true as they will save $\text{£}141.57$ which is greater than $\text{£}140$ for every 100 magazine racks.