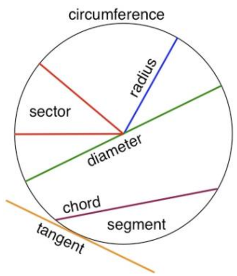
Year 9
PERIMETER AND CIRCUMFERENCE

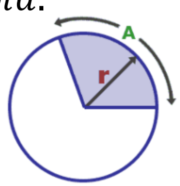
Key Concepts

Parts of a circle



Circumference of a circle is calculated by πd and is the distance around the circle.

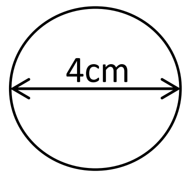
Arc length of a sector is calculated by $\frac{\theta}{360}\pi d$.



Examples

Calculate:

a) **Circumference**



C = $\pi \times 4$

= 4π

or = 12.57cm

b) **Diameter** when the circumference is 20cm

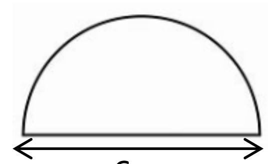
C = $\pi \times d$

20 = $\pi \times d$

$\frac{20}{\pi} = d$

Or $6.37cm$

c) **Perimeter**



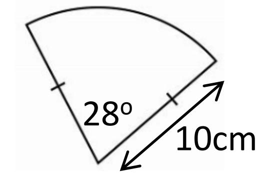
$$P = \frac{\pi \times d}{2} + d$$

$$P = \frac{\pi \times 6}{2} + 6$$

$$P = 3\pi + 6$$

Or = 15.42cm

d) **Arc length**



$$\text{Arc} = \frac{\theta}{360} \times \pi \times d$$

$$\text{Arc} = \frac{28}{360} \times \pi \times 2 \times 10$$

$$\text{Arc} = \frac{28}{360} \times \pi \times 20$$

$$\text{Arc} = \frac{14}{9}\pi$$

Or = 4.89cm

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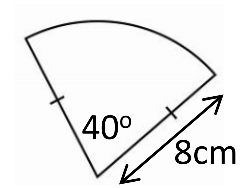
534, 535, 537, 538, 541, 544-545

Key Words

Circle
Perimeter
Circumference
Radius
Diameter
Pi
Arc

Calculate:

1) The circumference of a circle with a diameter of 12cm
2) The diameter of a circle with a circumference of 30cm
3) The perimeter of a semicircle with diameter 15cm
4) The arc length of the diagram



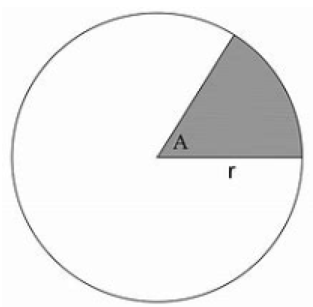
ANSWERS: 1) 12π or 37.7cm 2) $\frac{30}{\pi}$ or 9.54cm 3) 38.56cm 4) $\frac{16}{9}\pi$ or 5.59cm

Year 9
AREA OF CIRCLES AND PART CIRCLES

Key Concepts

The **area** of a circle is calculated by πr^2

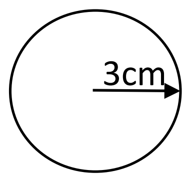
The **area of a sector** is calculated by $\frac{A}{360}\pi r^2$



Examples

Calculate:

a) **Area**



A = $\pi \times 3^2$
= 9π
or = 28.3cm^2

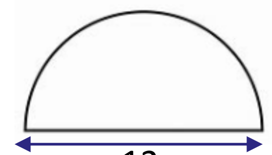
b) **Radius** when the area is 20cm^2

A = $\pi \times r^2$
20 = $\pi \times r^2$
$\frac{20}{\pi} = r^2$

$\sqrt{\frac{20}{\pi}} = r$

Or $2.52cm$

c) **Area**



$P = \frac{\pi \times r^2}{2}$

$P = \frac{\pi \times 6^2}{2}$

$P = 18\pi$

Or = 56.55cm^2

d) **Area of a sector**

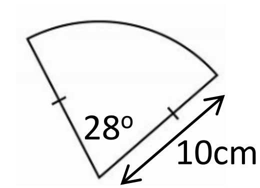
Arc $= \frac{\theta}{360} \times \pi \times r^2$

Arc $= \frac{28}{360} \times \pi \times 10^2$

Arc $= \frac{28}{360} \times \pi \times 100$

Arc $= \frac{70}{9}\pi$

Or = 24.43cm



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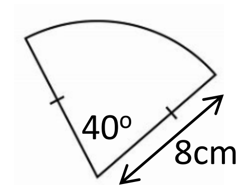
539, 540, 542-543, 546-547

Key Words

Circle
Area
Radius
Diameter
Pi
Sector

Calculate:

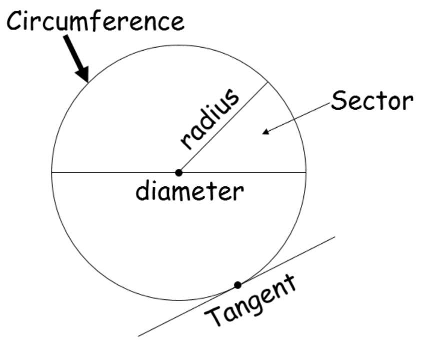
1) The area of a circle with a radius of 9cm
2) The radius of a circle with an area of 45cm^2
3) The area of a semicircle with diameter of 16cm
4) The area of the sector in the diagram

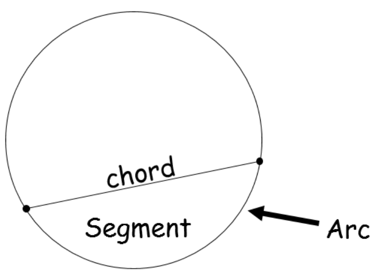


ANSWERS: 1) 81π or 254.47cm^2 2) $\sqrt{\frac{45}{\pi}}$ or 3.78cm^2 3) 32π or 100.53cm 4) $\frac{64}{9}\pi$ or 22.34cm

Year 9
CIRCLES AND COMPOUND AREA

Key Concepts





Key Words

Diameter: Distance from one side of the circle to the other, going through the centre.

Radius: Distance from the centre of a circle to the circumference.

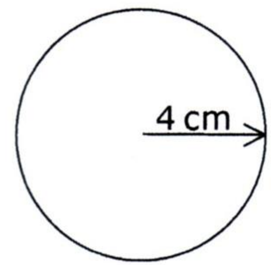
Chord: A line that intersects the circle at two points.

Tangent: A line that touches the circle at only one point.

Compound (shape): More than one shape joined to make a different shape.

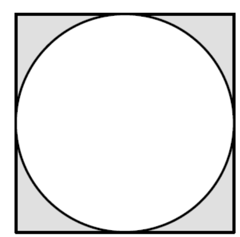
Examples

Find the area and circumference to 2dp.



$$Circumference = \pi \times d$$
$$= \pi \times 8 = 25.13cm$$
$$Area = \pi \times r^2$$
$$= \pi \times 4^2 = 50.27cm^2$$

Find shaded area to 2dp.



$$Square\ area = 10 \times 10$$
$$= 100m^2$$
$$Circle\ area = \pi \times r^2$$
$$= \pi \times 5^2$$
$$= 78.54\ m^2$$
$$Shaded\ area = 100 - 78.54 = 21.46m^2$$

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Clip Numbers

534-547, 556, 592

Tip

If you don't have a calculator you can leave your answer in terms of π.

Formula

$$Circle\ Area = \pi \times r^2$$
$$Circumference = \pi \times d$$

Questions

1) Find to 1dp the area and circumference of a circle with:

a) Radius = 5cm   b) Diameter = 12mm   c) Radius = 9m

2) Find the area & perimeter of a semi-circle with diameter of 15cm.

ANSWERS: 1) a) A = 78.5cm^2, C = 31.4cm b) A = 113.1mm^2, C = 37.7mm

c) A = 254.5m^2, C = 56.5m   2) A = 88.4cm^2, P = 38.6cm

Year 9
PYTHAGORAS AND TRIGONOMETRY

Key Concepts

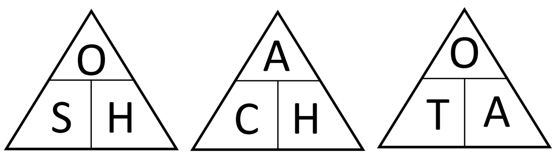
Pythagoras' theorem and basic trigonometry both only work with **right angled triangles**.

Pythagoras' Theorem – used to find a missing length when two sides are known

$$a^2 + b^2 = c^2$$

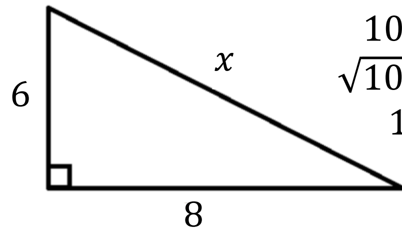
c is always the hypotenuse (longest side)

Basic trigonometry SOHCAHTOA –
used to find a missing side or an angle



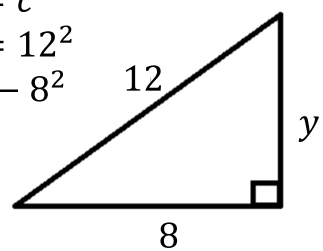
Examples

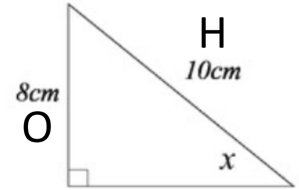
Pythagoras' Theorem

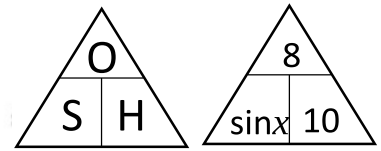


$$a^2 + b^2 = c^2$$
$$6^2 + 8^2 = x^2$$
$$100 = x^2$$
$$\sqrt{100} = x$$
$$10 = x$$

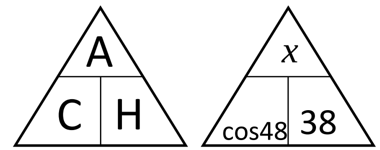
$$a^2 + b^2 = c^2$$
$$y^2 + 8^2 = 12^2$$
$$y^2 = 12^2 - 8^2$$
$$y^2 = 80$$
$$y = \sqrt{80}$$
$$y = 8.9$$



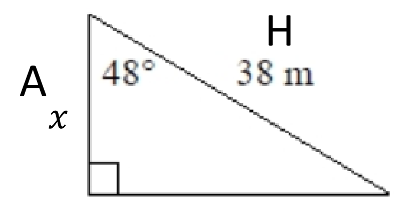




$$\sin x = \frac{8}{10}$$
$$x = \sin^{-1}\left(\frac{8}{10}\right) = 53.1^o$$



$$\cos 48 = \frac{x}{38}$$
$$x = 38 \times \cos 48 = 25.4m$$



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509-515

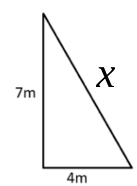
Key Words

Right angled triangle
Hypotenuse
Opposite
Adjacent
Sine
Cosine
Tangent

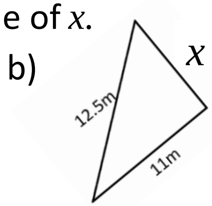
Questions

Find the value of x.

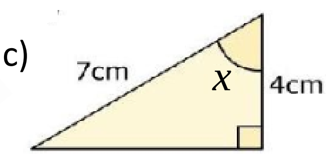
a)



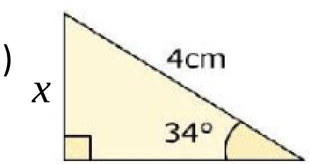
b)



c)



d)



ANSWERS: a) 8.06m b) 5.94m c) 55.15° d) 2.34cm

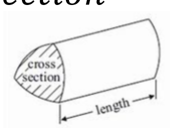
Year 9
VOLUME AND SURFACE AREA OF PRISMS

Key Concept

The **volume** of an object is the amount of space that it occupies. It is measured in units cubed e.g. cm^3.

To calculate the volume of any prism we use:

$$\begin{matrix} area\ of \\ cross\ section \end{matrix} \times length$$

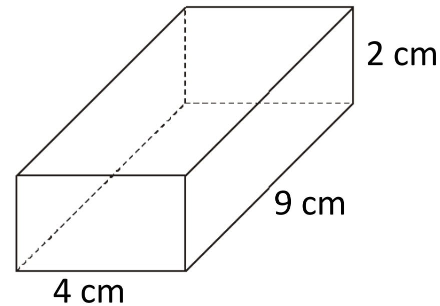


A **prism** is a 3D shape which has a continuous cross-section.

The **surface area** of an object is the sum of the area of all of its faces. It is measured in units squared e.g. cm^2.

Examples

$$\boldsymbol{Volume} = 4 \times 9 \times 2$$
$$= \boldsymbol{72cm^3}$$

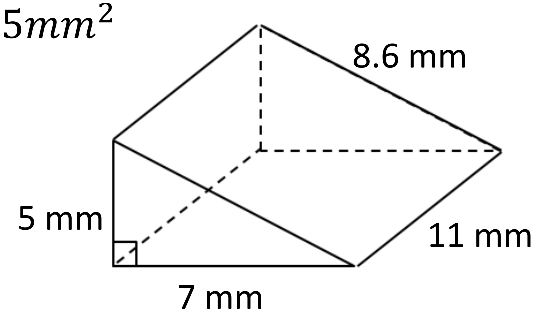


$\boldsymbol{Surface\ area}$:

$$Front = 4 \times 2 = 8$$
$$Back = 4 \times 2 = 8$$
$$Side\ 1 = 9 \times 2 = 18$$
$$Side\ 2 = 9 \times 2 = 18$$
$$Bottom = 4 \times 9 = 36$$
$$Top = 4 \times 9 = 36$$
$$Total = \boldsymbol{124cm^2}$$

$$Area\ of\ triangle = \frac{5 \times 7}{2}$$
$$= 17.5mm^2$$

$$\boldsymbol{Volume} = 17.5 \times 11$$
$$= \boldsymbol{192.5mm^3}$$



$\boldsymbol{Surface\ area}$:

$$Front = \frac{7 \times 5}{2} = 17.5$$
$$Back = \frac{7 \times 5}{2} = 17.5$$
$$Side = 5 \times 11 = 55$$
$$Bottom = 7 \times 11 = 77$$
$$Top = 11 \times 8.6 = 94.6$$
$$Total = \boldsymbol{261.6cm^2}$$

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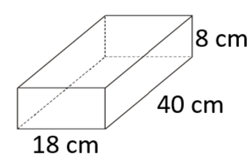
568-571, 584-586

Key Words

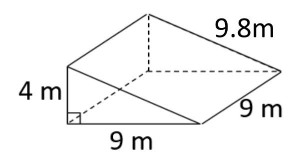
Volume
Capacity
Prism
Surface area
Face

Find the volume and surface area of each of these prisms:

1)



2)

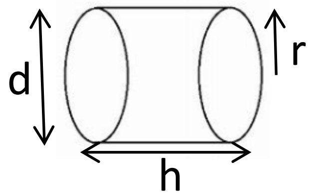


ANSWERS: 1)Volume = 5760 cm^3 Surface area = 2368 cm^2 2) Volume = 162 m^3 Surface area = 241.2m^2

Year 9
VOLUME AND SURFACE AREAS OF CYLINDERS

Key Concepts

A **cylinder** is a **prism** with the cross section of a circle.

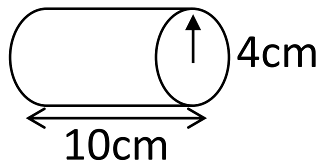


The **volume** of a cylinder is calculated by $\pi r^2 h$ and is the space inside the 3D shape

The **surface area** of a cylinder is calculated by $2\pi r^2 + \pi d h$ and is the total of the areas of all the faces on the shape.

Examples

From the diagram calculate:



a) **Volume**

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

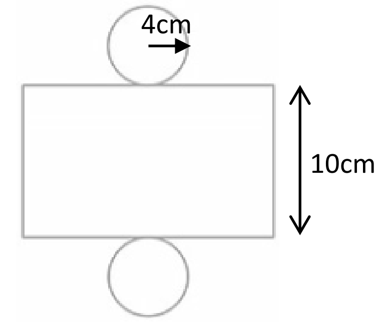
$V = \pi \times 4^2 \times 10$

$V = 160\pi$

Or $= 502.65cm^3$

b) **Surface Area –** You can use the net of the shape to help you

$\textit{Area of two circles}$
$= 2 \times \pi \times r^2$
$= 2 \times \pi \times 4^2$
$= 32\pi$



$\textit{Area of rectangle}$
$= \pi \times d \times h$
$= \pi \times 8 \times 10$
$= 80\pi$

$\textit{Surface Area} = 32\pi + 80\pi$
$= 112\pi$
or $= 351.86cm^3$

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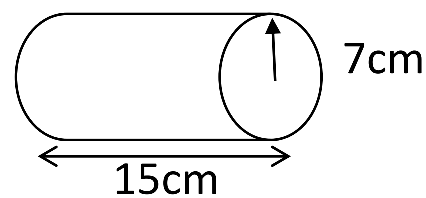
572, 586

Key Words

Cylinder
Surface Area
Radius
Diameter
Pi
Volume
Prism

Calculate the volume and surface area of this cylinder



ANSWERS: Volume = 735π or $2309.07cm^3$ Surface area = 308π or $967.61cm^3$

Year 9
BOUNDARIES

Key Concepts

The boundaries of a number derive from **rounding**.

E.g. State the boundaries of 360 when it has been rounded to 2 significant figures:

$$355 \leq x < 365$$

E.g. State the boundaries of 4.5 when it has been rounded to 2 decimal place:

$$4.45 \leq x < 4.55$$

These boundaries can also be called the **error interval** of a number.

Examples

	+	-	×	÷
Upper bound answer	$UB_1 + UB_2$	$UB_1 - LB_2$	$UB_1 \times UB_2$	$UB_1 \div LB_2$
Lower bound answer	$LB_1 + LB_2$	$LB_1 - UB_2$	$LB_1 \times LB_2$	$LB_1 \div UB_2$

When completing calculations involving boundaries we are aiming to find the greatest or smallest answer.

A restaurant provides a cuboid stick of butter to each table. The dimensions are 30mm by 30mm by 80mm, correct to the nearest 5mm. Calculate the upper and lower bounds of the volume of the butter.

$$Volume = l \times w \times h$$

$$\begin{aligned} Upper\ bound &= 32.5 \times 82.5 \times 32.5 \\ &= 87140.63mm^3 \end{aligned}$$

$$\begin{aligned} Lower\ bound &= 27.5 \times 77.5 \times 27.5 \\ &= 58609.38mm^3 \end{aligned}$$

$$D = \frac{x}{y}$$

x = 99.7 correct to 1 decimal place.
y = 67 correct to 2 significant figures.
Work out an upper and lower bounds for D.

$$Upper\ bound\ D = \frac{99.75}{66.5} = 1.5$$

$$Lower\ bound\ D = \frac{99.65}{67.5} = 1.48$$

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137-139, 411

Key Words

Bound
Upper
Lower
Accuracy
Rounding

1) Jada has 100 litres of oil, correct to the nearest litre.
The oil is poured into tins of volume 1.5 litres, correct to one decimal place.
Calculate the upper and lower bounds for the number of tins that can be filled.

2) There are 110 identical marbles in a bag. A marble is taken and weighed as 15.6 g to the nearest tenth of a gram. Find the upper and lower bounds for the weight of all the marbles.

ANSWERS: 1) LB = 69.3 ≈ 69 UB = 64.2 ≈ 64 2) LB = 1710.5 g UB = 1721.5 g