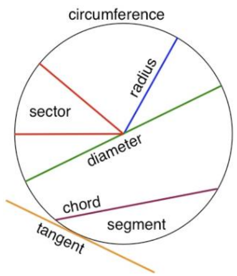
Year 9
PERIMETER AND CIRCUMFERENCE

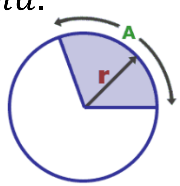
Key Concepts

Parts of a circle



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

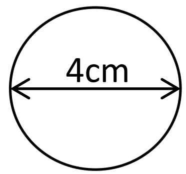
Arc length of a sector is calculated by $\frac{\theta}{360}\pi d$.



Examples

Calculate:

a) **Circumference**



C = $\pi \times 4$

= 4π

or = 12.57cm

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

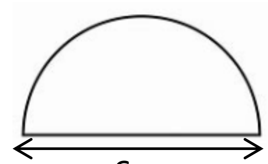
C = $\pi \times d$

20 = $\pi \times d$

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

Or $6.37cm$

c) **Perimeter**



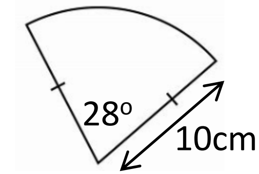
$$P = \frac{\pi \times d}{2} + d$$

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

$$P = 3\pi + 6$$

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

hegartymaths

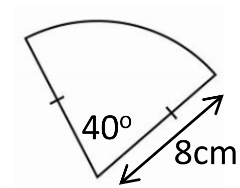
534, 535, 537, 538, 541, 544-545

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



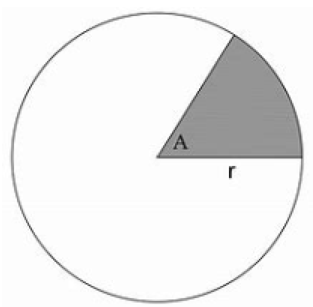
ANSWERS: 1) 12π or 37.7cm 2) $\frac{30}{\pi}$ or 9.54cm 3) 38.56cm 4) $\frac{16}{9}\pi$ or 5.59cm

Year 9
AREA OF CIRCLES AND PART CIRCLES

Key Concepts

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

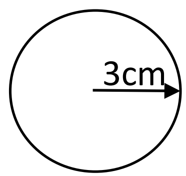
The **area of a sector** is calculated by $\frac{A}{360}\pi r^2$



Examples

Calculate:

a) **Area**



A = $\pi \times 3^2$

= 9π

or = 28.3cm^2

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

A = $\pi \times r^2$

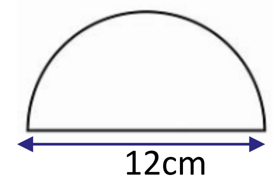
20 = $\pi \times r^2$

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

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

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**

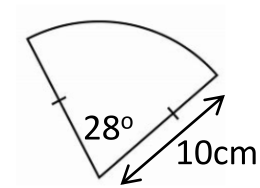
Arc $= \frac{\theta}{360} \times \pi \times r^2$

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



hegartymaths

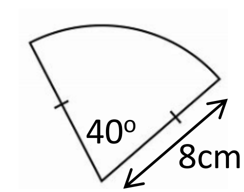
539, 540, 542-543, 546-547

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
PYTHAGORAS AND TRIGONOMETRY

Key Concepts

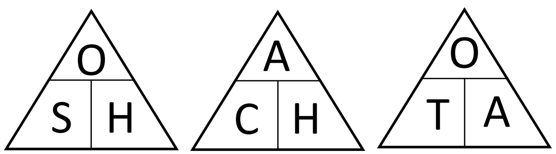
Pythagoras' theorem and basic trigonometry both only work with **right angled triangles**.

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

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

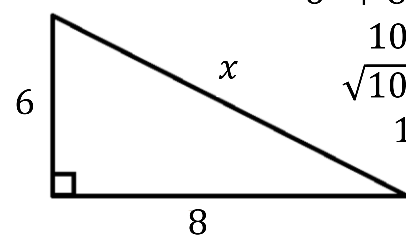
c is always the hypotenuse (longest side)

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



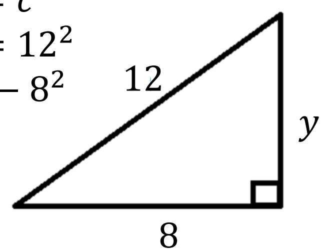
Examples

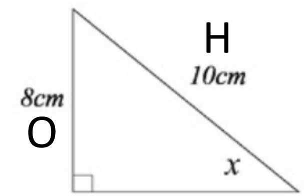
Pythagoras' Theorem

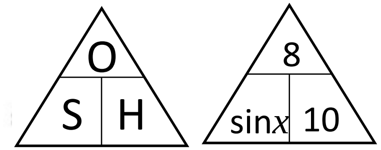


$$a^2 + b^2 = c^2$$
$$6^2 + 8^2 = x^2$$
$$100 = x^2$$
$$\sqrt{100} = x$$
$$10 = x$$

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

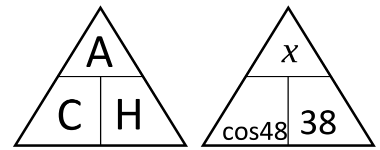






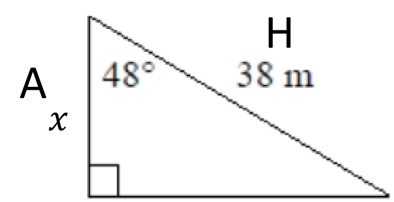
$$\sin x = \frac{8}{10}$$

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



$$\cos 48 = \frac{x}{38}$$

$$x = 38 \times \cos 48 = 25.4m$$



hegartymaths

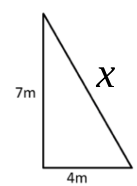
498-499,
509-515

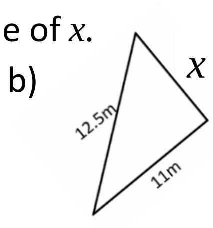
Key Words

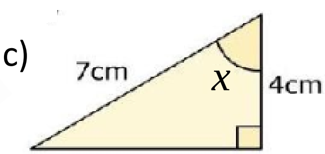
Right angled triangle
Hypotenuse
Opposite
Adjacent
Sine
Cosine
Tangent

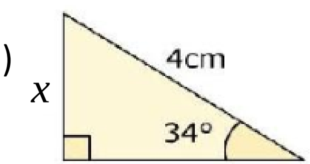
Questions

Find the value of x.

a) 

b) 

c) 

d) 

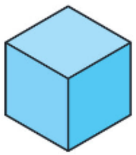
ANSWERS: a) 8.06m b) 5.94m c) 55.15° d) 2.34cm

Year 9

3D SHAPES, CAPACITY AND VOLUME

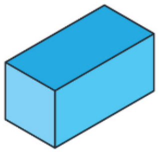
Key Concept

Cube



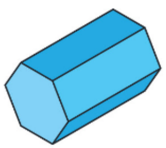
Faces – 6
Edges – 12
Vertices – 8

Cuboid



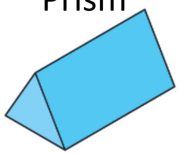
Faces – 6
Edges – 12
Vertices – 8

Hexagonal Prism



Faces – 8
Edges – 18
Vertices – 12

Triangular Prism

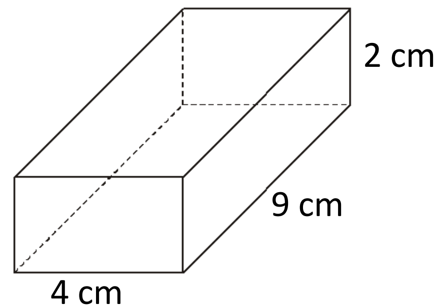


Faces – 5
Edges – 9
Vertices – 6

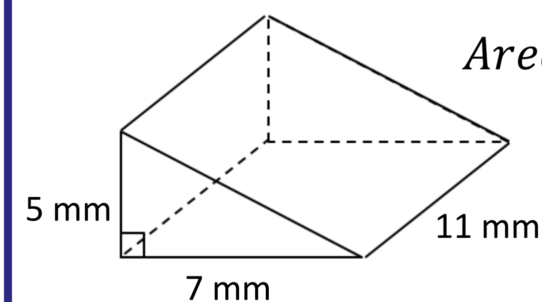
Key Words

Volume: The amount of space that an object occupies.
Capacity: The amount of space that a liquid occupies.
Cuboid: 3D shape with 6 square/rectangular faces.
Vertices: Angular points of shapes.
Face: A surface of a 3D shape.
Edge: A line which connects two faces on a 3D shape.

Examples



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



$$Area\ of\ triangle = \frac{5 \times 7}{2}$$
$$= 17.5mm^2$$
$$Volume = 17.5 \times 11$$
$$= 192.5mm^3$$

hegartymaths

Clip Numbers

568-571, 698,699

Tip

Remember the units are cubed for volume.

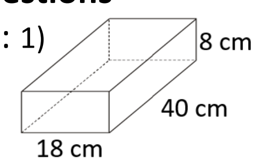
Formula

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

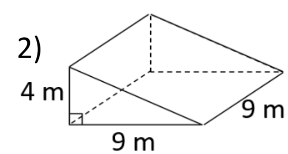
$Prism\ Volume = area\ of\ cross\ section\ \times length$

Questions

Find the volume of these shapes: 1)



2)

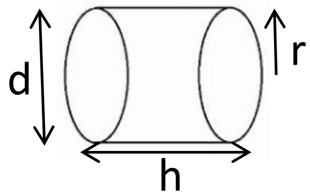


ANSWERS: 1) 5760 cm^3 2) 162 m^3

Year 9
VOLUME AND SURFACE AREAS OF CYLINDERS

Key Concepts

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

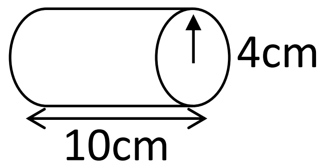


The **volume** of a cylinder is calculated by $\pi r^2 h$ and is the space inside the 3D shape

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

Area of two circles

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

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

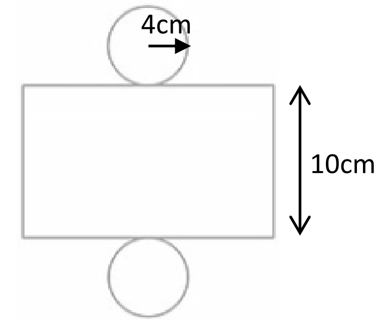
$= 32\pi$

Area of rectangle

$= \pi \times d \times h$

$= \pi \times 8 \times 10$

$= 80\pi$



$Surface\ Area = 32\pi + 80\pi$

$= 112\pi$

or $= 351.86cm^3$

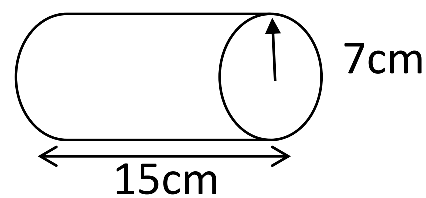
hegartymaths

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.

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

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

hegartymaths

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