Year 9
PYTHAGORAS AND TRIGONOMETRY

Key Concepts

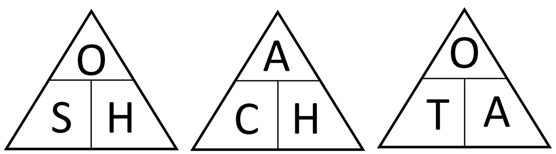
Pythagoras' theorem and basic trigonometry both only work with **right angled triangles**.

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

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

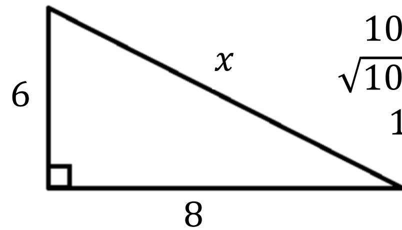
c is always the hypotenuse (longest side)

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



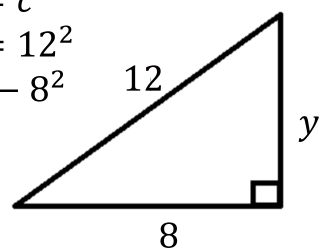
Examples

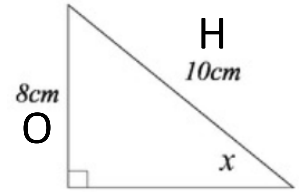
Pythagoras' Theorem

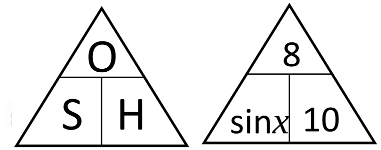


$$a^2 + b^2 = c^2$$
$$6^2 + 8^2 = x^2$$
$$100 = x^2$$
$$\sqrt{100} = x$$
$$10 = x$$

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

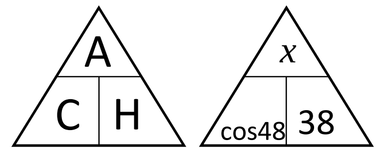






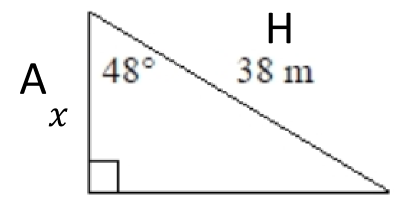
$$\sin x = \frac{8}{10}$$

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



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

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



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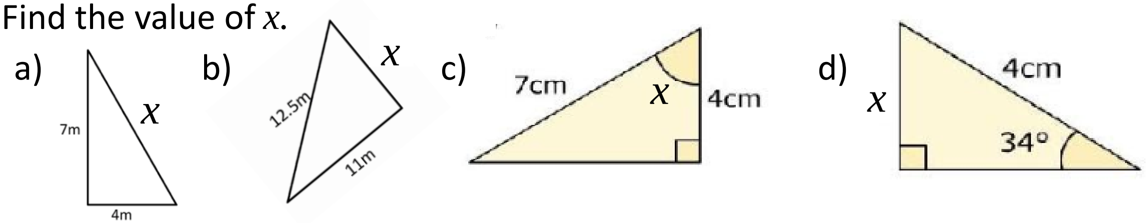
Key Words

Right angled triangle
Hypotenuse
Opposite
Adjacent
Sine
Cosine
Tangent

Questions

Find the value of x.

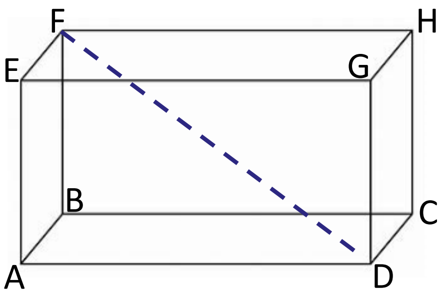
a) b) c) d)



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

Year 9
3D TRIGONOMETRY

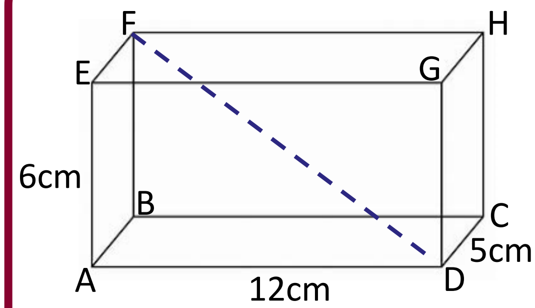
Key Concepts



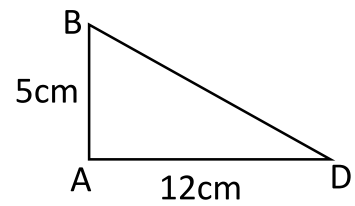
The **plane** of a cuboid is a flat 2 dimensional surface. An example of a plane is ABCD.

An example of a **diagonal** in a cuboid is FD.

Examples

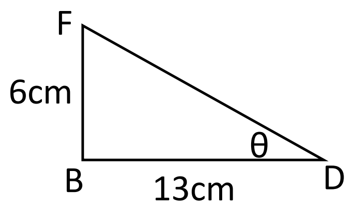


Calculate the length BD:



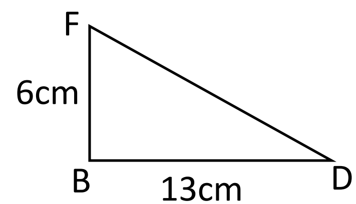
$$BD^2 = 12^2 + 5^2$$
$$BD = \sqrt{169}$$
$$BD = 13cm$$

Calculate the angle between FD and the plane ABCD:



$$tan\theta = \frac{6}{13}$$
$$\theta = tan^{-1}\left(\frac{6}{13}\right)$$
$$\theta = 24.78^o$$

Calculate the length FD:



$$FD^2 = 13^2 + 6^2$$
$$FD = \sqrt{205}$$
$$FD = 14.32cm$$

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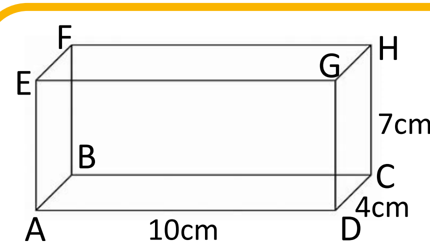
Key Words
Sine
Cosine
Tangent
3D
Plane
Diagonal



1) Calculate the length AC
2) Calculate the length AH
3) Calculate the angle between AH and the plane ABCD.

ANSWERS 1) 10.77cm 2) 12.84cm 3) 33.02°

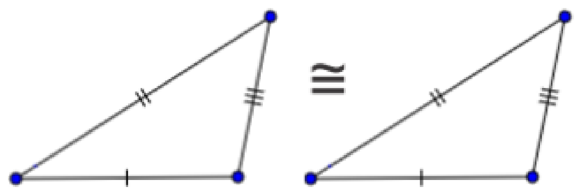
Year 9
FOUR RULES OF CONGRUENCE

Key Concepts

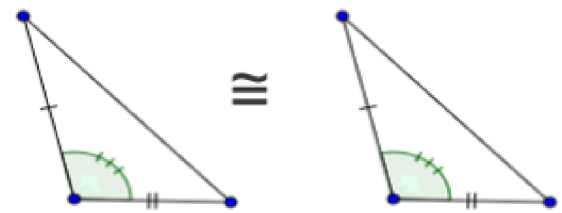
Congruent triangles are triangles that have the **same size and shape**. This means that the corresponding sides are equal and the corresponding angles are equal.

There are four rules of congruency that prove whether a triangle is congruent or not.

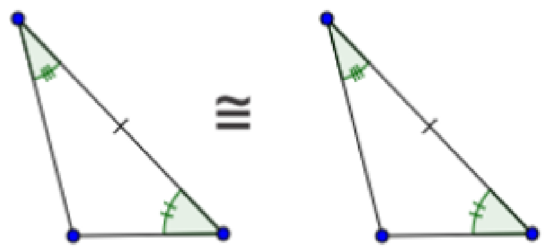
Examples



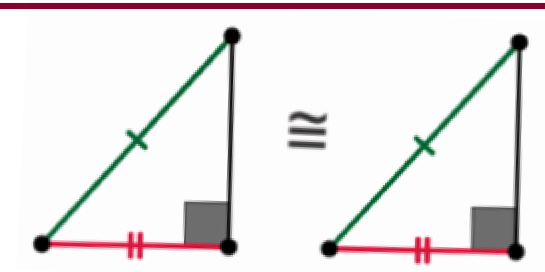
SSS = 3 sides on triangle A are equal to those on triangle B



SAS = 2 sides with the included angle on triangle A are equal to those on triangle B



ASA = 2 angles with the included side on triangle A are equal to those on triangle B



RHS = When the hypotenuse and another side on triangle A are equal to those on triangle B

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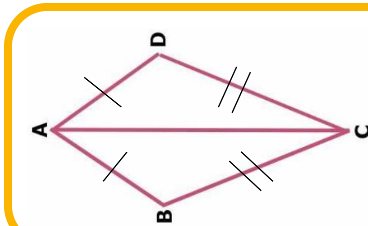
680-682, 684-690

Key Words

Congruent
Angle
Side



Prove that triangle ACD and ABC are congruent to one another.

ANSWERS AD = AB, CD = BC, AC is common to both triangles, therefore they are congruent proved by the SSS rule.

Year 9
SIMILARITY - LENGTHS

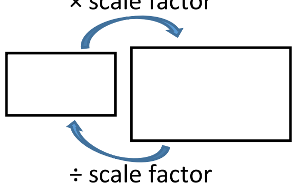
Key Concepts

Similar shapes are an enlargement of one another.

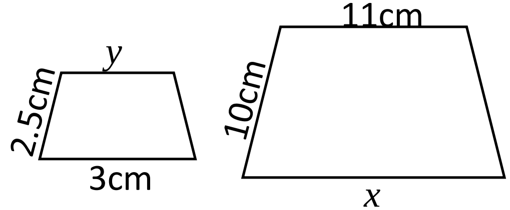
A **scale factor** is used, whereby all lengths are multiplied by the same number.

When finding a missing length on the larger shape we **multiply** by the scale factor.

When finding a missing length on the smaller shape we **divide** by the scale factor.



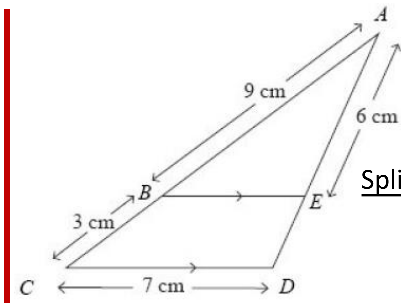
Examples



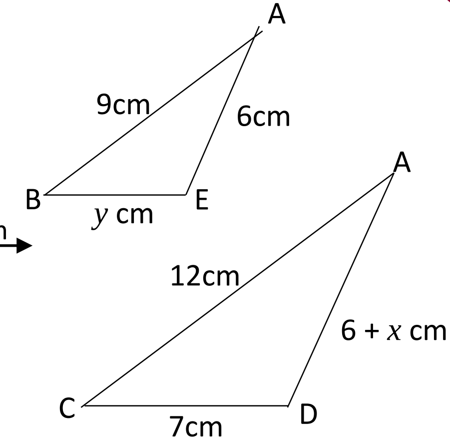
$$Scale\ factor = \frac{10}{2.5} = 4$$

$$x = 3 \times 4 = 12cm$$

$$y = 11 \div 4 = 2.75cm$$



Split the diagram



$$Scale\ factor = \frac{12}{9} = \frac{4}{3}$$

$$x + 6 = 6 \times \frac{4}{3}$$
$$x + 6 = 8$$
$$x = 8 - 6$$
$$x = 2cm$$

$$y = 7 \div \frac{4}{3} = 5.25cm$$

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608-614

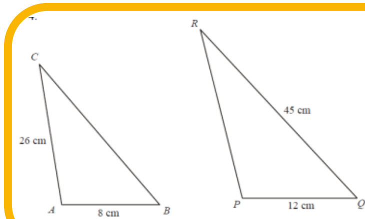
Key Words

Similar

Scale factor

Enlarge

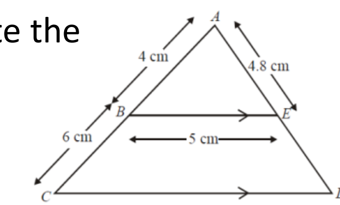
Length



1) Calculate the length of:

a) PR

b) BC



2) Calculate the length of:

a) CD

b) ED

ANSWERS 1a) 39cm b) 30cm 2a) 12.5cm b) 7.2cm

Year 9
SIMILARITY – LENGTHS, AREA AND VOLUME

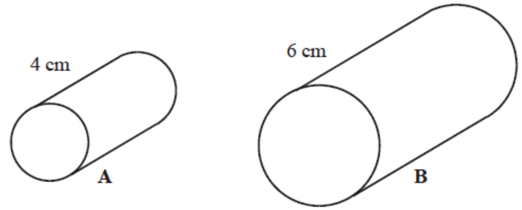
Key Concepts

Similar shapes are an enlargement of one another.

Length, area and volume scale factors are all linked.

Example:
Length scale factor = 2
Area scale factor = 2^2
Volume scale factor = 2^3

Examples



The volume of cylinder A is 80 cm^3.
Calculate the volume of cylinder B.

$$Length\ scale\ factor = \frac{6}{4} = 1.5$$

$$Volume\ of\ B = 80 \times 1.5^3 = 270cm^3$$

The total surface area of cylinder P is 90cm^2.
The total surface area of cylinder Q is 810cm^2.
Calculate the length of Q.

$$Area\ scale\ factor = \frac{810}{90} = 9$$

$$Length\ scale\ factor = \sqrt{9} = 3$$

$$Length of\ Q = 4 \times 3 = 12cm$$

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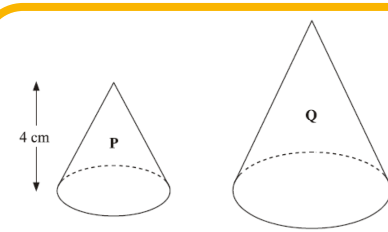
615-621

Key Words
Similar
Scale factor
Enlarge
Length
Area
Volume



The total surface area of cone P is 24 cm^2.
The total surface area of cone Q is 96 cm^2.

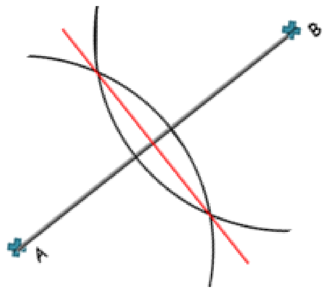
1) Calculate the height of Q
2) If the volume of Q is 80cm^3, what is the volume of P?

ANSWERS 1) 8cm 2) 10cm^3

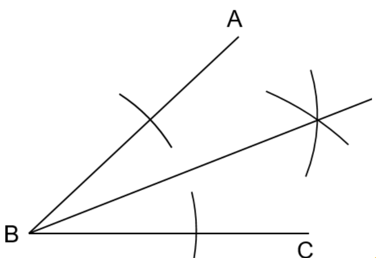
Year 9
CONSTRUCTIONS

Key Concept

Line Bisector



Angle Bisector



Key Words

Construction: To draw a shape, line or angle accurately using a compass and ruler.
Loci: Set of points with the same rule.
Parallel: Two lines which never intersect.
Perpendicular: Two lines that intersect at 90°.
Bisect: Divide into two parts.
Equidistant: Equal distance.

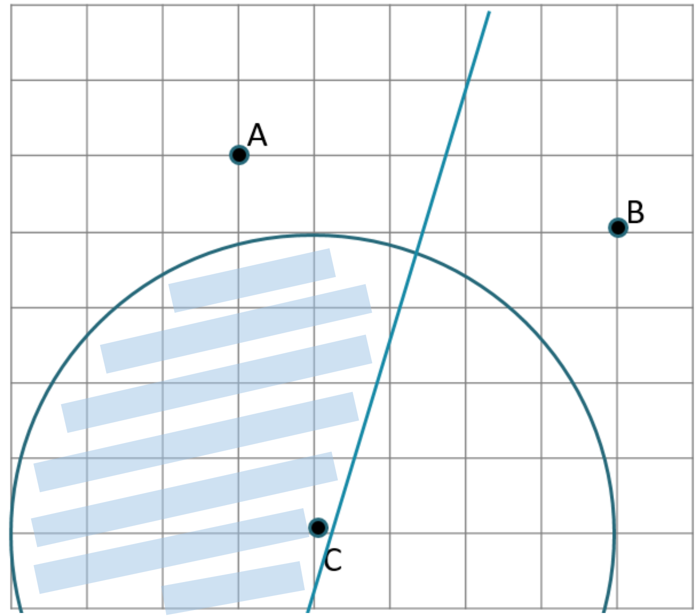
Examples

Shade the region that is:

- closer to A than B
- less than 4 cm from C

Line bisector of A and B

Circle with radius 4cm



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Clip Numbers

660-662, 674-677

Tip

Watch for scales.

For a scale of:
1 cm = 4 km.

20 km = 5 cm
6 cm = 24 km

Questions

1) Draw these angles then bisect them using constructions:
a) 46° b) 18° c) 124°

2) Draw these lines and bisect them: a) 6cm b) 12cm