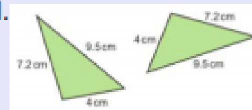
Unit 12 Higher Similarity and Congruence

Congruent Triangles

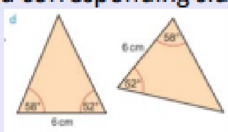
Are exactly the same size and shape. Triangles are congruent when one of these conditions are true:

- SSS – all three sides are equal.

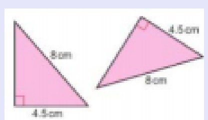


- SAS – two sides and included angle are equal.

- AAS – two angles and corresponding side are equal.



- RHS – right angle, hypotenuse and another side are equal.



V67

You need to prove it by using one of the above reasons.

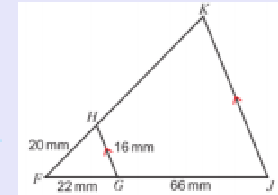
Similarity

V291

Shapes are similar when one shape is an enlargement of each other. Corresponding sides are in the same ratio. Corresponding angles are equal. When comparing two similar shapes, a scale factor can be found. This scale factor helps to find missing sides of the shape.

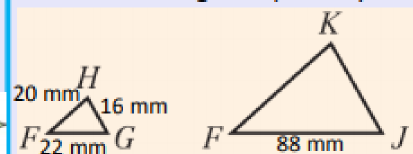
Similar Triangles

Prove FGH and FJK are similar.



Angle F occurs in both triangles. Therefore the same.

Draw the triangles separately.



FGH = FJK as corresponding angles.

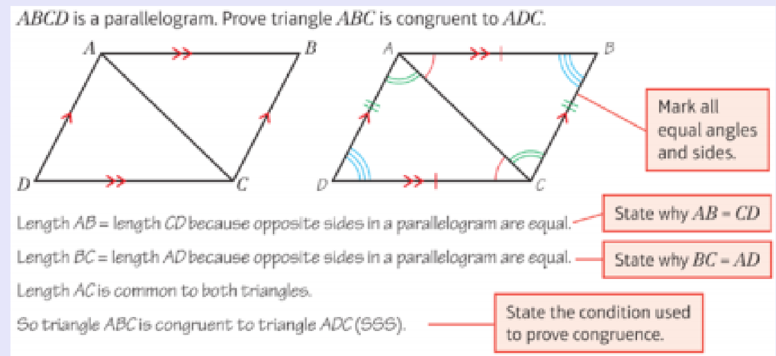
FHG = FKJ as corresponding angles.
Therefore all angles are equal so triangle is similar.

Congruence is used to solve problems and prove that shapes are the same.

To prove it: write a series of logical statements. Each statement needs must be supported by a mathematical reason.

Proving Geometric Congruence

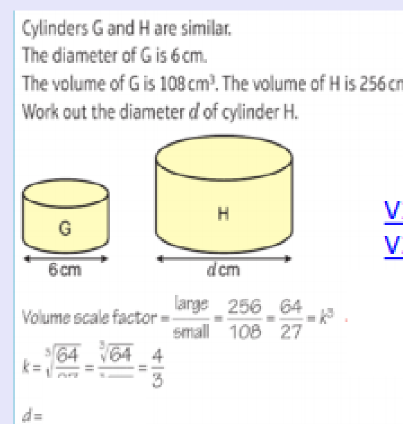
V66



Similarity in 3D shapes

If a shape is enlarged by a linear scale factor of k, the area of the shape is enlarged by scale factor of k^2.

If a shape is enlarged by a linear scale factor of k, the volume of the shape is enlarged by scale factor of k^3.



V293a
V293b

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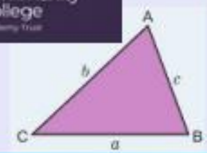
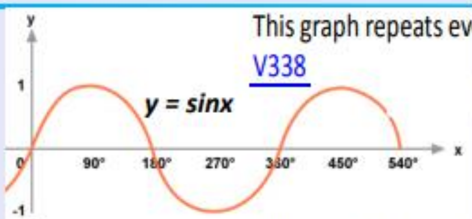
Unit 13 Higher More Trigonometry



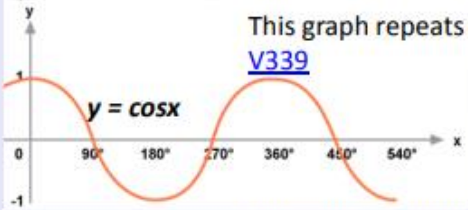
Transforming trigonometric graphs

y= f(x) is a function where x is the input. The output is *y* or *f(x)*.

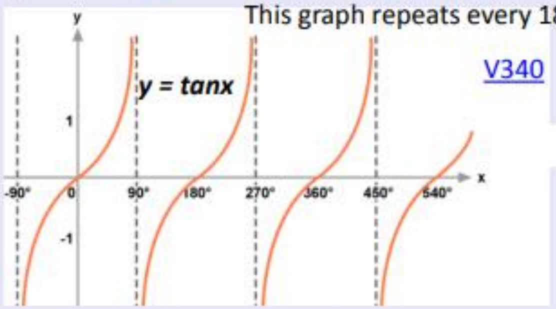
- *y= -f(x)* is a reflection in the *x*-axis.
- *y = f(-x)* is a reflection in the *y*-axis.
- *y=-f(-x)* is a reflection in the *y* and *x* axis. It is equivalent to a rotation of 180° about the origin.
- *y = f(x + a)* is a translation by $\binom{-a}{0}$ V323
- *y=af(x)* is a vertical stretch by scale factor *a*, parallel to the *y*-axis.
- *Y=f(ax)* is a horizontal stretch by the scale factor $\frac{1}{a}$



This graph repeats every 360°.
V338



This graph repeats every 360°.
V339



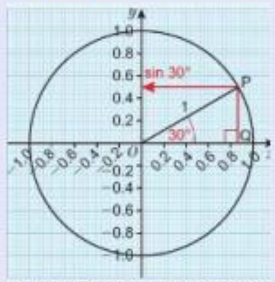
This graph repeats every 180°.
V340

Area of a triangle

$$\frac{1}{2}ab\sin C$$

To be used when you can't use: $\frac{1}{2}$ base x height

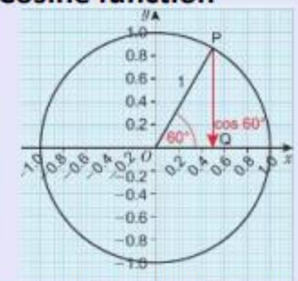
Sine function



The diagram shows a circle with radius 1 and centre (0,0). The length of PQ gives the sine of the angle.

sin30° = $\frac{PQ}{1}$ = PQ = 0.5

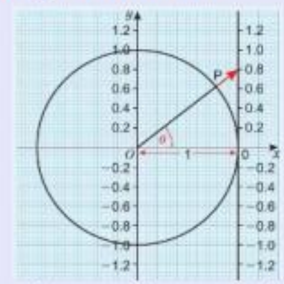
Cosine function



The diagram shows a circle with radius 1 and centre (0,0). The length of OQ gives the cosine of the angle.

cos60° = $\frac{OQ}{1}$ = OQ = 0.5

Tangent function



The diagram shows a circle with radius 1 and centre (0,0). Extend OP to hit the tangent. This gives a value for tanθ.

tanθ = $\frac{0.8}{1}$ = 0.8

The sine rule

$\frac{a}{SinA} = \frac{b}{SinB} = \frac{c}{SinC}$ To find a side.

V333 $\frac{SinA}{a} = \frac{SinB}{b} = \frac{SinC}{c}$ To find an angle.

Can be used in any triangle. You need to know one angle and the opposite side. Then:

- If you know another angle, you can calculate its opposite side.
- If you know another side, you can calculate the opposite angle.

The cosine rule

V335 V336

$a^2 = b^2 + c^2 - 2bc\cos A$ To find a side.

$\cos A = \frac{b^2+c^2-a^2}{2bc}$ To find an angle.

Can be used in any triangle. Use it to find:

- The length of a side if you know two sides and the included angle
- An unknown angle if you know all three sides.

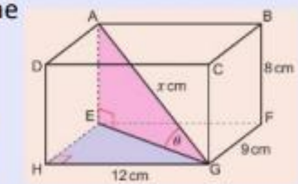
3D Pythagoras

V259

A plane is a flat surface.
EFGH is a horizontal plane. AEG is a vertical plane. AG is the diagonal named *x*. To calculate the value of *x*, you need to find the value of EG using Pythagoras' Theorem.

EG: $\sqrt{12^2 + 9^2}$ = 15cm

x: $\sqrt{15^2 + 8^2}$ = 17cm



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Key Words

- Population
- Census
- Sample
- Bias
- Random Sample
- Strata

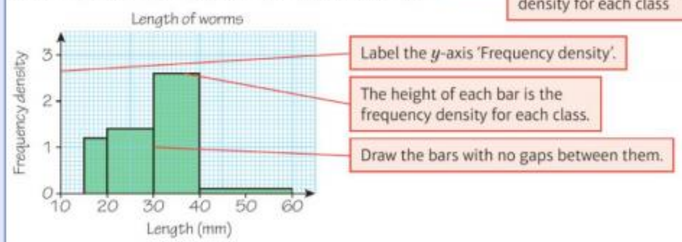
Histogram

The lengths of 48 worms are recorded in this table.

Length, x (mm)	$15 < x \leqslant 20$	$20 < x \leqslant 30$	$30 < x \leqslant 40$	$40 < x \leqslant 60$
Frequency	6	14	26	2

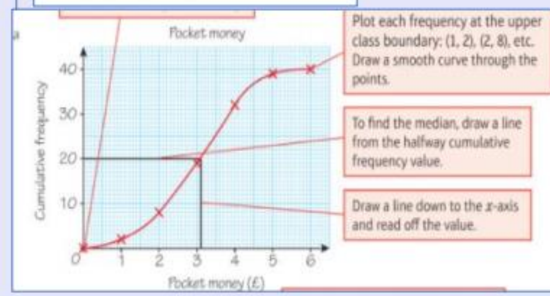
Draw a histogram to display this data.

$6 \div 5 = 1.2$, $14 \div 10 = 1.4$, $26 \div 10 = 2.6$, $2 \div 20 = 0.1$ — Work out the frequency density for each class



Cumulative Frequency

Pocket money, x (£)	Cumulative frequency
$0 < x \leqslant 1$	2
$0 < x \leqslant 2$	8
$0 < x \leqslant 3$	19
$0 < x \leqslant 4$	32
$0 < x \leqslant 5$	39
$0 < x \leqslant 6$	40



Stratified Sample

$$\frac{Sample}{Population} \text{ X Stratum Size}$$

Unit 14 Higher Further Statistics V149 V159 V154 V281

Box Plot

Range is Max – Min

Catch and Release

$$\frac{n}{N} = \frac{m}{M}$$

$$\text{So } N = \frac{n}{m} \times M$$

Always Compare a measure of 'spread' and a value

The **median** and **quartiles** can be estimated from the cumulative frequency diagram. For a set of n data values

- the estimate for the **median** is the $\frac{n}{2}$th value
- the estimate for the **lower quartile** (LQ) is the $\frac{n}{4}$th value
- the estimate for the **upper quartile** (UQ) is the $\frac{3n}{4}$th value
- the **interquartile range** (IQR) = UQ – LQ