Topic: KS4 Higher Unit 5 Angles and trigonometry

MathsWatch clips: 9, 54, 150, 174

Duration: 11 Lessons

Composite: Unit Test

Key vocabulary:

Angles

Triangles

Quadrilaterals

Interior

Exterior

Polygons

Pythagoras

Theorem

Trigonometry

Elevation

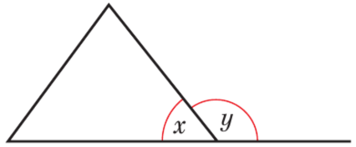
Depression

Sine, Cosine and Tangent

Powerful knowledge components crucial to commit to long term memory. Declarative knowledge.

I know that:

The angle marked x is called the **interior angle**. The angle marked y is called the **exterior angle**.



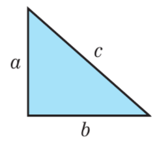
$x + y = 180°$ (angles on a straight line add up to 180°)

The sum of the interior angles of a polygon with n sides = $(n - 2) \times 180°$.

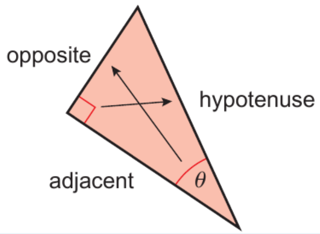
The sum of the exterior angles of a polygon is always 360°.

Pythagoras' theorem states that in a right-angled triangle, the square of the hypotenuse is equal to the sum of the squares of the other two sides.

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



In a right-angled triangle, the side opposite the angle θ is called the **opposite**. The side next to the angle θ is called the **adjacent**.



The **sine** of angle θ is the ratio of the opposite side to the hypotenuse, $\sin\theta = \frac{\text{opp}}{\text{hyp}}$

The **cosine** of angle θ is the ratio of the adjacent side to the hypotenuse, $\cos\theta = \frac{\text{adj}}{\text{hyp}}$

The **tangent** of angle θ is the ratio of the opposite side to the adjacent side, $\tan\theta = \frac{\text{opp}}{\text{adj}}$

Core knowledge components. Procedural and conditional knowledge.

I know how to:

- Derive and use the sum of angles in a triangle and in a quadrilateral.
- Derive and use the fact that the exterior angle of a triangle is equal to the sum of the two opposite interior angles.
- Calculate the sum of the interior angles of a polygon.
- Calculate the length of the hypotenuse in a right-angled triangle.
- Solve problems using Pythagoras' theorem.
- Calculate the length of a shorter side in a right-angled triangle.
- Find angles of elevation and angles of depression.
- Use trigonometric ratios to solve problems.
- Know the exact values of the sine, cosine and tangent of some angles.

know when to:

- Use the interior angles of polygons to solve problems.
- Use the angles of polygons to solve problems.

Links to previous and future topics

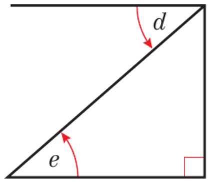
This topic builds on prior knowledge:

- Rearrange simple formulae and equations, as preparation for rearranging trig formulae.
- Recall basic angle facts.
- Recall the properties of special types of triangles and quadrilaterals.

This topic will be used in future learning:

- Using angle facts with similar and congruent shapes. Use angles in triangle and quadrilaterals when solving circle theorem problems.

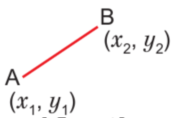
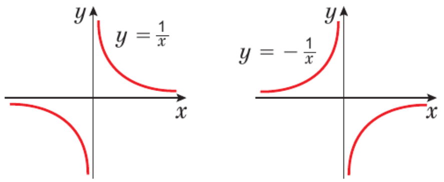
The **angle of elevation** (e) is the angle measured upwards from the horizontal. The **angle of depression** (d) is the angle measured downwards from the horizontal.



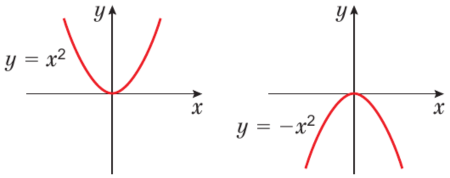
The sine, cosine and tangent of some angles may be written exactly.

	30°	**45°**	**60°**	**0**	**90°**
sin	$\frac{1}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{\sqrt{3}}{2}$	0	1
cos	$\frac{\sqrt{3}}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{1}{2}$	1	0
tan	$\frac{\sqrt{3}}{3}$	1	$\sqrt{3}$	0	

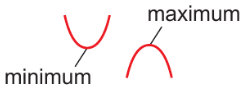
- Use trigonometric ratios to find lengths in a right-angled triangle.
- Use trigonometric ratios to solve problems.
- Use trigonometric ratios to calculate an angle in a right-angled triangle.

Topic: KS4 Higher Unit 6 Graphs **MathsWatch clips: 96, 97, 133, 143, 159**		**Duration: 12 Lessons**	**Composite: Unit Test**
Key vocabulary:	**Powerful knowledge components crucial to commit to long term memory. Declarative knowledge.**	**Core knowledge components. Procedural and conditional knowledge.**	**Links to previous and future topics**
Linear Gradient Intercept Distance-time graphs Speed Accelerations Velocity Proportion Midpoint Line segment Parallel Perpendicular Quadratic Cubic	I know that: A **linear equation** generates a straight-line (linear) graph. **Parallel lines** have the same gradient. A **distance–time graph** represents a journey. ○ Straight lines mean constant speed ○ horizontal lines mean no movement ○ the gradient is the speed, since average speed = $\frac{\text{total distance}}{\text{total time}}$ ○ Average speed = $\frac{\text{total distance}}{\text{total time}}$ On a **velocity-time graph** ○ straight lines mean constant acceleration ○ horizontal lines mean no change in velocity (i.e. travelling at a constant velocity) ○ the gradient is the acceleration, since acceleration = $\frac{\text{change in velocity}}{\text{time}}$ ○ the area under a velocity–time graph is the distance travelled. When two quantities are in **direct proportion** ○ the graph is a straight line through the origin ○ when one variable is multiplied by n, so is the other. The coordinates of the **midpoint** of a line segment are $\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$  **Reciprocal functions** are in the form $\frac{k}{x}$ where k is a number.  	I know how to: • Find the gradient and y-intercept from a linear equation. • Sketch graphs using the gradient and intercepts. • Find the equation of a line, given its gradient and one point on the line. • Calculate average speed from a distance–time graph. • Find the coordinates of the midpoint of a line segment. • Find the equations of lines parallel or perpendicular to a given line. • Draw quadratic graphs, graphs of cubic and reciprocal functions, and graph of a circle. • Solve equations using graphs. • Identify the line of symmetry of a quadratic graph. know when to: • Interpret linear and non-linear real-life graphs. • Draw and interpret real-life linear graphs. • Find acceleration and distance from velocity–time graphs.	This topic builds on prior knowledge: • Identify coordinates of given points in the first quadrant or all four quadrants. • Write the equation for a straight line graph. • Use and draw conversion graphs. • Use function machines and inverse operations. • Use compound units, such a speed. This topic will be used in future learning: • Trigonometry graphs. Graphs on direct and inverse proportion.

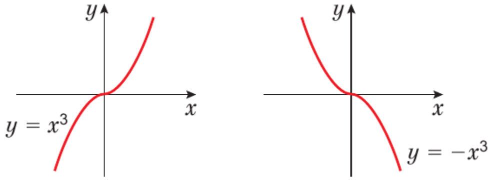
A **quadratic equation** contains a term in x^2 but no higher power of x.
The graph of a quadratic equation is a curved shape called a **parabola**.



A quadratic graph has either a **minimum point** or a **maximum point** where the graph turns.



A **cubic function** contains a term in x^3 but no higher power of x.
It can also have terms in x^2 and x and number terms.



Topic: KS4 Higher Unit 7 Area and Volume

MathsWatch clips: 44, 117, 118, 132, 149, 167, 169, 170

Duration: 11 Lessons

Composite: Unit Test

Key vocabulary:

Compound

Trapezium

Volume

Surface area

Prisma

Circumference

Semicircle

Sectors

Cylinder

Sphere

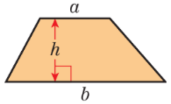
Pyramids

Cones

Powerful knowledge components crucial to commit to long term memory. Declarative knowledge.

I know that:

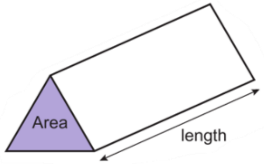
Area of a trapezium = $\frac{1}{2}(a+b)h$



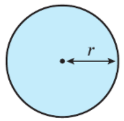
The **surface area** of a 3D solid is the total area of all its faces.

A **prism** is a 3D solid that has the same cross-section all through its length.

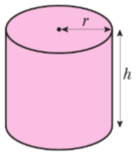
Volume of a prism
= area of cross-section × length.



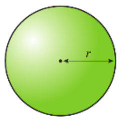
The **circumference** of a circle is its perimeter. For any circle
circumference = π × diameter
$C = \pi d$ or $C = 2\pi r$
The formula for the area, A, of a circle with radius r is $A = \pi r^2$

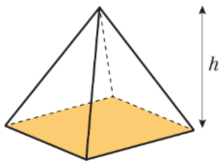


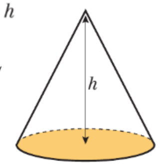
The volume of a cylinder of radius r and height h is
$V = \pi r^2 h$
The surface area of a cylinder of radius r and height h is $2\pi r^2 + 2\pi rh$



For a sphere of radius r
surface area = $4\pi r^2$
volume = $\frac{4}{3}\pi r^3$





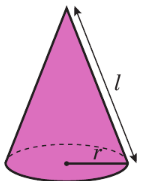


Volume of pyramid = $\frac{1}{3}$ area of base × vertical height

Volume of cone = $\frac{1}{3}$ area of base × vertical height = $\frac{1}{3}\pi r^2 h$

Curved surface area of a cone = πrl, where r is the radius and l is the slant height.

Total surface area of a cone = $\pi rl + \pi r^2$.



Core knowledge components. Procedural and conditional knowledge.

I know how to:

- Find the perimeter and area of compound shapes.
- Calculate the maximum and minimum possible values of a measurement.
- Calculate volumes and surface areas of prisms.
- Calculate the area and circumference of a circle.
- Calculate area and circumference in terms of π.
- Calculate the perimeter and area of semicircles and quarter circles.
- Calculate arc lengths, angles and areas of sectors of circles.
- Calculate volume and surface area of pyramids and cones.

know when to:

- Convert between metric units of length, area and volume.
- Solve problems involving volumes, surface areas, pyramids and cones.

Links to previous and future topics

This topic builds on prior knowledge:

- Know the names and properties of 3D shapes.
- Know the concept of perimeter and area by measuring lengths of sides.
- Identify planes of symmetry of 3D solids.
- Recall Pythagoras' theorem.

This topic will be used in future learning:

- Calculate length, area and volume in similar shapes.
  Calculate area following an enlargement on a coordinate grid.