Topic: KS4 Higher Unit 8 Transformations and constructions

MathsWatch clips: 48, 49, 50, 148, 182

Duration: 11 Lessons

Composite: Unit Test

Key vocabulary:

Plans

Elevations

Rotation

Reflection

Enlargement

Negative

Scale factors

Bearing

Bisector

Perpendicular

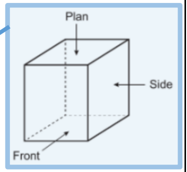
Compasses

Locus and Loci

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

I know that:

The **plan** is the view from above an object. The **front elevation** is the view of the front of the object. The **side elevation** is the view of the side of the object.

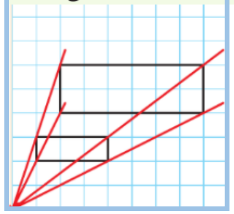


Reflections, **rotations**, **translations** and **enlargements** are all types of transformation.

To describe a **rotation** you need to give the direction of turn (clockwise or anticlockwise), the angle of turn and the **centre of rotation**.

To describe an enlargement you need to give the **centre of enlargement** and the scale factor. To find the centre of enlargement, join corresponding points of the object and the image

Draw lines through each vertex on the image and the equivalent vertex on the original. All the lines should meet at the **centre of enlargement**.



A negative scale factor takes the image to the opposite side of the centre of enlargement.

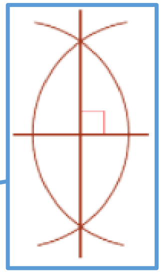
You can describe a translation using a **column vector**. The column vector for a translation 2 squares right and 3 squares down is $\begin{pmatrix} 2 \\ -3 \end{pmatrix}$.

The top number in the column vector gives the movement parallel to the x-axis and the bottom number gives the movement parallel to the y-axis.

In reflections, rotations and translations, the object and the image are **congruent**, as the lengths of the sides and the angles do not change.

A **bearing** is an angle in degrees, clockwise from north. A bearing is always written using three digits.

A **perpendicular bisector** cuts a line in half at right angles.



An **angle bisector** cuts an angle exactly in half.

Core knowledge components. Procedural and conditional knowledge.

I know how to:

- Draw plans and elevations of 3D solids.
- Reflect 2D shapes.
- Rotate a 2D shape about a centre of rotation.
- Describe reflections and rotations.
- Enlarge shapes by fractional and negative scale factors about a centre of enlargement.
- Translate shapes using vectors.
- Draw and use scales on maps and scale drawings.
- Construct triangles using a ruler and compasses.
- Construct the perpendicular bisector of a line.
- Construct the shortest distance from a point to a line.
- Bisect and construct angles.
- Draw a locus.

I know when to:

- Carry out and describe combinations of transformations.
- Solve problems involving bearings and loci.

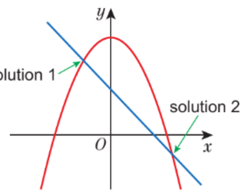
Links to previous and future topics

This topic builds on prior knowledge:

- Recognise 2D shapes.
- Plot coordinates in four quadrants and linear equations parallel to the coordinate axes.
- Convert metric measures.

This topic will be used in future learning:

- Recognise and enlarge shapes and calculate scale factors with similarity. Recognise and draw transformations of trigonometry graphs.

Topic: KS4 Higher Unit 9 Equations and Inequalities MathsWatch clips:		Duration: 11 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**
Quadratic Functions Expression Simultaneous Straight line Unknowns Inequalities Notation	I know that: The **roots** of a quadratic function are its solutions when it is equal to zero. You can use the quadratic formula to find the solutions to the **quadratic equation** $ax^2 + bx + c = 0$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ Expressions such as $(x + 2)^2$, $(x - 1)^2$ and $(x + \frac{1}{2})^2$ are called **perfect squares**. $x^2 + bx + c$ can be written in the form $\left(x + \frac{b}{2}\right)^2 - \left(\frac{b}{2}\right)^2 + c$ This is called **completing the square**. $ax^2 + bx + c$ can be written as $a\left(x + \frac{b}{a}x\right)^2 + c$ before completing the square for the expression inside the brackets. When there are two unknowns, you need two equations to find their values. These are called **simultaneous equations**. A pair of quadratic and linear simultaneous equations can have two possible solutions. To find the coordinates where two graphs intersect, solve their equations simultaneously.  You can show **inequalities** on a number line. An empty circle ○ shows that the value is not included. A filled circle ● shows that the value is included. An arrow ○⟶ shows that the solution continues towards infinity. You can write the solution to an inequality using **set notation**. $\{x : x > 2\}$ the set of x such that	I know how to: • Find the roots of quadratics. • Rearrange and solve quadratic equations. • Use the quadratic formula to solve a quadratic equation. • Complete the square for a quadratic expression. • Solve quadratic equations by completing the square. • Solve simultaneous equations, including for real-life situations. • Solve linear simultaneous equations where both equations are multiplied. • Solve simultaneous equations with one quadratic equation. • Solve inequalities and show the solution on a number line and using set notation. I know when to: • Use simultaneous equations to find the equation of a straight line. • Use real-life situations to construct quadratic and linear equations and solve them.	This topic builds on prior knowledge: • Understand the ≥ and ≤ symbols. • Substitute into, solve and rearrange linear equations. • Factorise simple quadratic expressions. • Recognise the equation of a circle. This topic will be used in future learning: • Rearrange formulae relating to trigonometry, Pythagoras and compound measures, such as speed, density and pressure. Represent inequalities graphically.

Topic: KS4 Higher Unit 10 Probability MathsWatch clips:		Duration: 11 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**
Events Outcomes Sample space Probabilities Mutually exclusive Experimental Theoretical Frequency trees Tree diagrams Independent Conditional Two-way table Venn diagrams	I know that: A **sample space diagram** shows all the possible outcomes of two events. Two events are **mutually exclusive** if they cannot happen at the same time. When two events are mutually exclusive you can add their probabilities. The probabilities of an exhaustive set of mutually excusive events sum to 1. For mutually exclusive events, P(not A) = 1 – P(A) If there are m outcomes for one event and n outcomes for another event, the product rule states that the total number of outcomes for the two events is $m \times n$. Expected number of outcomes = number of trials × probability. Relative frequency = $\frac{\text{frequency}}{\text{total number of trials}}$ As the number of experiments increases, the experimental probability gets closer and closer to the theorectical probability. A **tree diagram** shows two or more events and their probabilities. Two events are **independent** if one happening does not affect the probability of the other. To find the probability of two independent events multiply their probabilities, P(A and B) = P(A) × P(B) The probability for a repeated independent event is the probability multiplied by itself, P(A and A) = P(A) × P(A), P(A and A and A) = P(A) × P(A) × P(A), etc. A **conditional probability** is when one outcome affects another outcome. $P(A \cap B)$ means the probability of the **intersection** of A and B. $P(A \cup B)$ means the probability of the **union** of A and B. $P(A \cup B) = P(A) + P(B) - P(A \cap B)$ $P(A \cap B \mid B)$ means the probability of the intersection of A and B given B.	I know how to: • Use the product rule for finding the number of outcomes for two or more events. • List all the possible outcomes in a sample space diagram. • Identify mutually exclusive outcomes and events. • Find the probabilities of mutually exclusive outcomes. • Find the probability of an event not happening. • Work out the expected results for experimental and theoretical probabilities. • Compare real results with theoretical expected values. • Draw and use frequency trees. • Calculate probabilities of repeated events. I know when to: • Use two-way tables to calculate conditional probability. • Use Venn diagrams to calculate conditional probability. • Use set notation. • Draw and use tree diagrams	This topic builds on prior knowledge: • Understand that a probability is a number between 0 and 1, and distinguish between events which are impossible, unlikely, even chance, likely, and certain to occur. • Mark events and/or probabilities on a probability scale of 0 to 1. This topic will be used in future learning: • Calculate probabilities from real-life graphs.

Topic: KS4 Higher Unit 11 Multiplicative Reasoning **MathsWatch clips:**		**Duration: 8 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**
Percentage Growth Decay Speed Acceleration Compound measures Direct and indirect proportion	I know that: • In **compound interest** the interest earned each year is added to money in the account and earns interest the next year. Most interest rates are compound interest rates. • Total interest = amount in the account at the end of the investment – amount invested • You can calculate an amount after n years' compound interest using the formula amount = initial amount × $\left(\frac{100 + \text{interest rate}}{100}\right)^n$ • Compound measures such as speed, density and pressure combine measures of two different quantities. • Speed can be measured in metres per second (m/s), kilometres per hour (km/h) or miles per hour (mph). • Average speed = $\frac{\text{distance}}{\text{time}}$ or $S = \frac{D}{T}$ • These are three kinematics formulae: $v = u + at$, $s = ut + \frac{1}{2}at^2$, $v^2 = u^2 + 2as$ where a is constant acceleration, u is initial velocity, v is final velocity, s is displacement from the position when $t = 0$ and t is time taken. • **Velocity** is speed in a given direction, possible units are m/s. • **Initial velocity** is speed in a given direction at the start of the motion. • **Acceleration** is the rate of change of velocity, i.e. a measure of how the velocity changes with time, possible units are m/s². • Density is the **mass** of substance in g contained in a certain **volume** in cm³ and is often measured in grams per cubic centimetre (g/cm³). Density = $\frac{\text{mass}}{\text{volume}}$ or $D = \frac{M}{V}$ • Pressure is the **force** in newtons applied over an **area**, in cm² or m². It is usually measured in newtons (N) per square metre (N/m²) or per square centimetre (N/cm²). Pressure = $\frac{\text{force}}{\text{area}}$ or $P = \frac{F}{A}$ • When x and y are in direct proportion $y = kx$, where k is the gradient of the graph of y against x $\frac{y}{x} = k$, a constant • When x and y are in inverse proportion, y is proportional to $\frac{1}{x}$. As one doubles (×2) the other halves (÷2). • When x and y are in inverse proportion then $x \times y$ = a constant $xy = k$, so $y = \frac{k}{x}$	I know how to: • Find an amount after repeated percentage changes. • Solve growth and decay problems. • Calculate rates. • Convert between metric speed measures. • Use a formula to calculate speed and acceleration. • Solve problems involving compound measures. know when to: • Use relationships involving ratio. • Use direct and indirect proportion.	This topic builds on prior knowledge: • Convert between metric units. • Rearrange equations and use these to solve problems. • Solve simple direct and indirect proportion problems, including currency conversion. This topic will be used in future learning: • Write statements of direct proportion and forming an equation to find values. • Use and recognise graphs showing inverse proportion.