



Maths: Year 11H- Topic 8 Overview



Graphs: Using graphs

This unit develops students' understanding of transformations and graphs. Students will reflect shapes in given lines and construct and interpret a range of graphs, including conversion, distance-time, speed-time, and real-life graphs. They will also explore direct and inverse proportion, use graphs to solve equations, and, at Higher Tier, estimate the area under a curve.

Key questions

Does it matter which axis represents which quantity when using a conversion graph?

What does the gradient of a conversion graph tell you?

Do all conversion graphs go through the origin?

What is the connection between the gradient of a distance/time graph and the speed of travel?

What does a "flat" section on a distance / time graph represent?

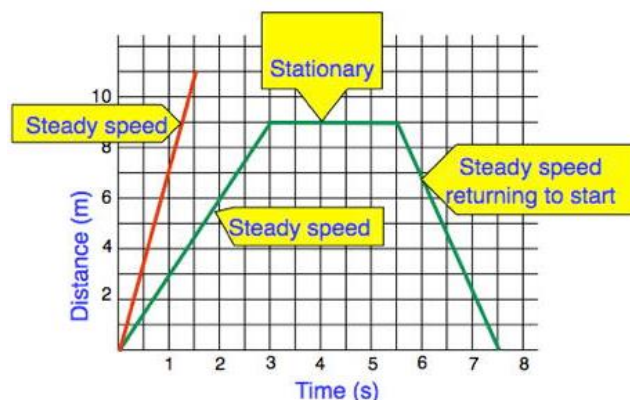
What is the difference between speed and acceleration?

What do we mean by the roots of a quadratic? Is it the same as, or different to, solutions?

How do we find the area of a trapezium?

Specialist key terms for this unit

Parallel, Horizontal, Vertical, Straight line, Axis, Reflection, Mirror, Convert, Gradient, Direct Proportion, Intercept, Interpret, Model, Distance, Speed, Time, Constant, Scale, Acceleration, Piece-wise, Direct, Inverse, Proportion, Pressure, Quadratic, Solutions, Root, Estimate, Approximate, Trapezium, Area, Speed/time graph



Practise makes perfect

<https://www.mathsgenie.co.uk/real-graphs.html>

<https://www.mathsgenie.co.uk/proportion.html>

<https://www.mathsgenie.co.uk/velocity-time-graphs.html>

Assessment / Topic Reviews

1. Reflect shapes in given lines
2. Construct and interpret conversion graphs
3. Construct and interpret other real-life straight line graphs
4. Interpret and construct distance/time graphs
5. Interpret and construct speed/time graphs
6. Direct and inverse proportion graphs
7. Find approximate solutions to equations using graphs
8. Estimate the area under a curve (H)

Suggested enrichment activities

School Run

A student walks to school at a constant speed and arrives after **20 minutes**.

Tasks:

1. Sketch a distance-time graph for the journey.
2. Describe what the graph would look like if the student stopped for 5 minutes on the way.
3. Explain how you can tell from a graph when someone is travelling faster.

★ **Challenge:** Draw a second journey that takes the same time but covers a greater distance.

Thinking Question:

How can distance-time graphs help us compare different journeys?



Maths: Year 11H- Topic 9 Overview



Multiplicative Reasoning

Students develop their multiplicative reasoning in a variety of contexts, from simple scale factors through to complex equations involving direct and inverse proportion. They link inverse proportion with the formulae for pressure and density. There is also the opportunity to review ratio problems.

Key questions:

If an object is enlarged, does it always get bigger?

How can you work out the scale factor? Is there more than one method?

When are two shapes similar?

List as many examples as you can of relationships that are in direct proportion to one another.

When is appropriate to use the equation $y = kx$?

How can we work out k ?

If we compare two solids on a table which apply the same force, how can we tell which one will apply a greater pressure?

What is the same and what is different about direct and inverse proportion?

Will it take less time for more people to complete a task?

How can we use the bar model to represent the problem?

What does the bar model(s) tell us about our problem?

How can we find a percentage/fraction of a quantity using a calculator? Without a calculator?

Assessment / Topic Reviews:

1. Use scale factors
2. Understand direct proportion
3. Construct complex direct proportion equations -H
4. Calculate with pressure and density
5. Understand inverse proportion
6. Construct inverse proportion equations – H
7. Ratio problems

Specialist key terms for this unit:

Enlargement, Scale factor, Multiplier, Similar, Direct Proportion, Equation, Origin, Constant ration, Straight line, Linear, Density, Mass, Volume, Pressure, Force, Area, Inverse Proportion, Equation, Smooth curve, Constant of proportionality, Proportion, Fraction. Percentage, Bar model, Two-way table, LCM, Varies directly, Varies inversely, Substitute

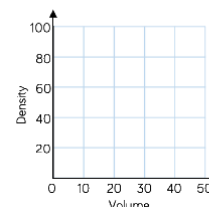
Practise makes perfect

- <https://www.mathsgenie.co.uk/similar-shapes-length.html>
- <https://www.mathsgenie.co.uk/proportion.html>
- <https://www.mathsgenie.co.uk/ratio.html>
- <https://www.mathsgenie.co.uk/speed-and-density.html>

Exemplar Questions

Complete the table.

Mass	Volume	Density
100 kg	1 cm ³	
100 kg	10 cm ³	
100 kg	20 cm ³	
100 kg	50 cm ³	



- What happens to the density of an object as the volume increases?
- Sketch a graph of volume verses density on a copy of the axis shown. What are they key features of the graph? How does this differ from direct proportion?

Suggested enrichment activities:

Mixing paints

A decorator can buy pink paint from two manufacturers.

- Paint A is made up from red and white paint in the ratio 1:3
- Paint B is made up from red and white paint in the ratio 1:7

The decorator can mix the paints to produce different shades of pink.

If Paint A and Paint B come in the same size cans, what is the least number the decorator would need of each type in order to produce pink paint containing red and white in the following ratios?

1:4

1:5

1:6





Maths: Year 11H- Topic 10 Overview



Transforming and constructing

Students revise and extend their learning from Key Stage 3, exploring all the transformations and constructions, relating these to symmetry and properties of shapes when appropriate. There is an emphasis on describing as well as performing transformations as using the language promotes deeper thinking and understanding. Higher tier students extend their learning to explore the idea of invariance and look at trigonometric graphs as a vehicle for exploring graph transformations.

Key questions

- How many lines of symmetry do regular polygons have?
- Are reflected images congruent to the original object?
- What is the order of rotational symmetry for different regular polygons? What do you notice?
- Are rotations of an object congruent to the object?
- If an object is enlarged, does it always get bigger?
- How can you work out the scale factor?
- How do we identify the centre of enlargement?
- Does a negative scale factor always reduce the dimensions of a shape?

Assessment / Topic Reviews

1. Perform and describe line symmetry and reflection – **R**
2. Perform and describe rotation/rotational symmetry – **R**
3. Perform and describe translations of shapes – **R**
4. Perform and describe enlargements of shapes – **R**
5. Perform and describe negative enlargements of shapes – **RH**
6. Identify transformations of shapes – **R**
7. Perform and describe a series of transformations of shapes
8. Identify invariant points and lines – **H**
9. Perform standard constructions using ruler and protractor or ruler and compasses – **R**
10. Solve loci problems
11. Understand and use trigonometrical graphs – **H**
12. Sketch and identify translations of the graph of a given function – **H**
13. Sketch and identify reflections of the graphs of a given function – **H**

Specialist key terms for this unit

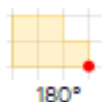
Line symmetry, Reflection, Diagonal, Vertex, Side, Mirror line, Rotate, Clockwise, Anticlockwise, Centre, Order of rotational symmetry, Translation, Vector, Axes, Scale, Congruent, Vertex, Enlargement, Scale Factor, Multiplier, Similar, Centre of enlargement, Ray, Negative, Direction, Rotation, Equation of a line, Translation, Series, Construct, Angle Bisector, Locus, Equidistant, Perpendicular Bisector, Locus/Loci, Circle, Angle Bisector, Invariant, Transformation, Sin/Cos/Tan, Asymptote, Period, Symmetry, Repeating, Mapping, Horizontal, Vertical, y-axis, x-axis

Practise makes perfect

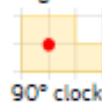
<https://www.mathsgenie.co.uk/transformations.html>
<https://www.mathsgenie.co.uk/loci-and-construction.html>
<https://www.mathsgenie.co.uk/harder-graphs.html>
<https://www.mathsgenie.co.uk/transforming-graphs.html>

Exemplar Questions

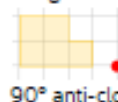
The red circle represents the centre of rotation for each question.
Rotate each object by the angle and direction of turn given.



180°



90° clockwise



90° anti-clockwise

Suggested enrichment activities

Theme Park Transformations

A theme park designer is creating a map of attractions.

1. Draw a simple shape to represent a ride.
2. Reflect it in a given line.
3. Rotate it 90° about a point.
4. Translate it 3 units right and 2 units up.

Challenge: Describe the sequence of transformations and identify any lines of symmetry or invariant points.