Maths: Year 11F- Topic 6 Overview

Graphs: Non-linear graphs

In this topic, students develop their knowledge of non-linear graphs, looking at quadratic, cubic and reciprocal graphs so they recognise the different shapes. They find the roots of quadratics graphically.

Key questions

Why is $(-3)^2$ the same as 3^2?

How could I tell if one of my coordinates was incorrect, or if I had plotted it incorrectly?

Why do we join the points with a smooth curve when plotting a quadratic?

What does it mean when a graph crosses or touches the x-axis?

What features make a quadratic graph different from a cubic or reciprocal graph?

What are the key features of this graph?

If you are not sure which equation matches a graph, what could you do to find out more information?

How can we locate roots from a graph?

What similarities and differences exist between quadratic, cubic and reciprocal graphs?

How do changes in an equation affect the shape and position of its graph?

How can graphs be used to model real-life situations?

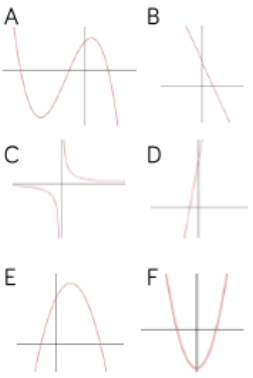
Assessment / Topic Reviews

1. Plot and read from quadratic graphs
2. Plot and read from cubic graphs
3. Plot and read from reciprocal graphs
4. Recognise graphs shapes
5. Identify and interpret roots and intercepts of quadratics
6. Approximate solutions

Key words

Quadratic, Parabola, Curve, Substitute, Equation, Vertical, Horizontal, Estimate, Cube, Cubic, Asymptote, Infinity, Reciprocal, Tends towards, Gradient, y-intercept, Coordinate, Roots, Solution, Meets, Exponential, Growth, Decay, Rapd, Tends, Radius, Diameter, Pythagoras' theorem, Origin, Simplify, Exponential, Growth, Decay, Rapid, Tends, Tangent, Curve, Equidistant

Match each graph with its equation.



Equation	Letter	Type of Graph
$y = 10x + 10$		
$y = \frac{1}{x}$		
$y = x^2 - 10$		
$y = x^3$		
$y = -x^2 + 2x + 3$		
$y = -2x + 4$		
$y = -x^3 - 2x^2 + x + 1$		

One equation in the table doesn't have a match.
Sketch a graph to match this equation.

Practise makes perfect

https://www.mathsgenie.co.uk/quadratic-graphs.html
https://www.mathsgenie.co.uk/cubic-reciprocal.html

Suggested enrichment activities

Choosing the Right Graph
A company wants to model different situations using graphs.
Tasks:

1. Match quadratic, cubic and reciprocal graphs to these situations:
   - A ball being thrown into the air
   - Profit increasing, then decreasing, then increasing again
   - Journey time for a fixed distance
2. Explain your choices.

⭐ Challenge: Draw a quick sketch of each graph and label one key feature.

Maths: Year 11F- Topic 7 Overview

Graphs: Using graphs

This unit explores how graphs can be used to represent and interpret real-life situations. Students will learn to construct and analyse conversion graphs, distance-time graphs, speed-time graphs, and other straight-line graphs. They will develop their understanding of gradient and scale, interpret information from graphs, and use graphical methods to solve practical problems involving speed, distance, time and unit conversions.

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

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?

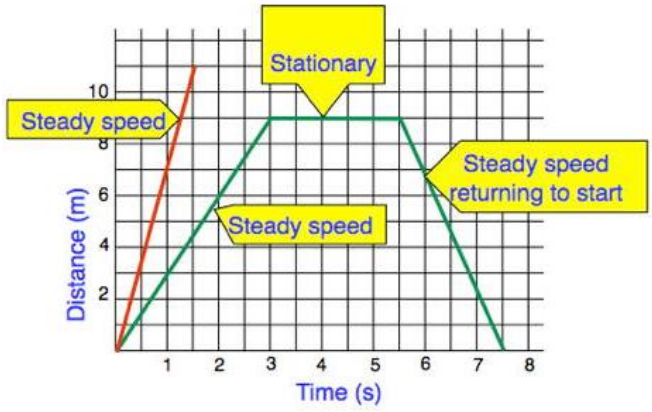
What does a "flat" section on a distance / time graph represent?

What is the difference between speed and acceleration?

How is the graph of an inverse proportion relationship different from the graph of a direct proportion relationship?

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

Exemplar quesiton



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. Construct and interpret conversion graphs
2. Construct and interpret other real-life straight line graphs
3. Interpret and construct distance/time graphs
4. Interpret and construct speed/time graphs

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 11F- Topic 8 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.
In addition, students will use rulers, protractors and compasses to complete standard constructions and solve loci problems, applying their understanding to a range of geometric contexts.

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, Single, Equation of a line, Translation, Series, Construct, Angle Bisector, Locus, Equidistant, Perpendicular Bisector, Locus/Loci, Circle, Angle Bisector

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?

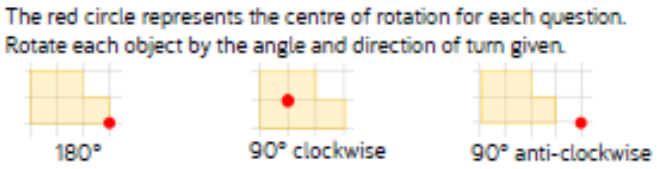
How can you work out the scale factor?

How do we identify the centre of enlargement?

Does a negative scale factor always reduce the dimensions of a shape?

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



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. Identify transformations of shapes – **R**
6. Perform and describe a series of transformations of shapes
7. Perform standard constructions using ruler and protractor or ruler and compasses – **R**
8. Solve loci problems

Suggested enrichment activities

Designing a Logo

A company wants a new logo and uses transformations to create it.

Tasks:

1. Draw a simple shape on a coordinate grid.
2. Transform it using:
   - a reflection
   - a rotation
   - a translation
3. Label each transformation.

⭐ **Challenge:**

Can you create a design using at least **two different transformations** and describe them fully?

Thinking Question:

Why are transformations useful in real-life designs such as logos, patterns and architecture?