Teaching guide: Graphs

Mathematics for GCSE Science

This resource helps you to deliver the mathematical requirements that students are required to demonstrate in the new GCSE Science specifications.
It consists of a teaching guide and PowerPoint presentation.

4. Graphs

Science GCSE subject criteria Maths skill:
4a. Translate information between graphical and numeric form
4b. Understand that $y=mx+c$ represents a linear relationship
4c. Plot two variables from experimental or other data
4d. Determine the slope and intercept of a linear graph
4e. Draw and use the slope of a tangent to a curve as a measure of rate of change
4f. Understand the physical significance of area between a curve and the x-axis and measure it by counting squares as appropriate

1. Brief explanation	Graphs are used to display the relationships between variables. Accuracy is vital when drawing graphs as is an understanding of basic linear algebra.
2. Statement of coverage from: KS3 Mathematics programme of study (POS)	• model situations or procedures by translating them into algebraic expressions or formulae and by using graphs • recognise, sketch and produce graphs of linear and quadratic functions of one variable with appropriate scaling, using equations in x and y and the Cartesian plane • reduce a given linear equation in two variables to the standard form $y = mx + c$; calculate and interpret gradients and intercepts of graphs of such linear equations numerically, graphically and algebraically • use linear and quadratic graphs to estimate values of y for given values of x and vice versa and to find approximate solutions of simultaneous linear equations • find approximate solutions to contextual problems from given graphs of a variety of functions, including piece-wise linear, exponential and reciprocal graphs • describe simple mathematical relationships between two variables (bivariate data) in observational and experimental contexts and illustrate using scatter graphs.
KS4 Mathematics programme of study (POS)	• recognise, sketch and interpret graphs of linear functions, quadratic functions, simple cubic functions, the reciprocal function with $x \neq 0$, {**the exponential function for positive values of k, and the trigonometric functions (with arguments in degrees) $y = \cos x$, $y = \sin x$ and $y = \tan x$, for angles of any size**} • plot and interpret graphs (including reciprocal graphs {**and exponential graphs**}) and graphs of non-standard functions in real contexts, to find approximate solutions to problems such as simple kinematic problems involving distance, speed and acceleration • {**calculate or estimate gradients of graphs and areas under graphs (including quadratic**

	and other non-linear graphs), and interpret results in cases such as distance-time graphs, velocity-time graphs and graphs in financial contexts} • interpret the gradient of a straight line graph as a rate of change; recognise and interpret graphs that illustrate direct and inverse proportion • interpret and construct tables and line graphs for time series data • use and interpret scatter graphs of bivariate data; recognise correlation and know that it does not indicate causation; draw estimated lines of best fit; make predictions; interpolate and extrapolate apparent trends whilst knowing the dangers of so doing.
3. Maths introduction and development	Statistical graphs such as bar charts followed by scatter graphs are introduced at an early age. Linear graphs come later with the introduction of algebra and sequences. Students will first be introduced to coordinates and how to read and plot them in four quadrants. From that they will move on to plotting a straight line using a table of values (derived from the equation of the line). For this they need to have algebraic substitution skills (see Algebra resource.) Once they are familiar with how to use substitution they will then be shown how to use the y-intercept and the gradient to plot a straight line without the need for substitution.
4.Ref AQA All About Maths AQA All About Maths Algebra and graphs AQA All About Maths Real life graphs AQA All About Maths Algebra recap and extension AQA All About Maths Sketching graphs	
5. Misconceptions	Confusing the x and y axes. Incorrectly substituting negative x values into the equation when determining the y coordinate.
6. Some examples of where it is applied in science	**Biology** Osmosis Plant organ system Levels of organisation

	Chemistry	Ionic compounds Calculating rates of reaction Flame emission spectroscopy
	Physics	Resistors Half-lives and the random nature of radioactive decay The distance-time relationship