Teaching guide: Algebra skills

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.

3. Algebra

Science GCSE subject criteria Maths skill:
3a. Understand and use the symbols: =, <, <<, >>, >, ∝, ~
3b. Change the subject of an equation
3c. Substitute numerical values into algebraic equations using appropriate units for physical quantities
3d. Solve simple algebraic equations

1. Brief explanation	GCSE Maths does not use << or >>.
	Algebra is used to find an unknown quantity or to summarise real-life problems in equations that can then be solved.
2. Statement of coverage from: KS3 Mathematics programme of study (POS)	- use and interpret algebraic notation, including: ab in place of $a \times b$ $3y$ in place of $y + y + y$ and $3 \times y$ $a2$ in place of $a \times a$, $a3$ in place of $a \times a \times a$; $a2\ b$ in place of $a \times a \times b$ $\frac{a}{b}$ in place of $a \div b$ - brackets - substitute numerical values into formulae and expressions, including scientific formulae - understand and use the concepts and vocabulary of expressions, equations, inequalities, terms and factors - understand and use standard mathematical formulae; rearrange formulae to change the subject - use algebraic methods to solve linear equations in one variable (including all forms that require rearrangement) - work with coordinates in all four quadrants - 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 - interpret mathematical relationships both algebraically and graphically - 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
KS4 Mathematics programme of study (POS)	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**}
3. Maths introduction and development	The skills in b, c, and d are the building blocks for GCSE Maths and students will have been using them since KS3. Typically students will have first learnt how to simplify algebraic expressions, before moving on to solving, substituting and finally rearranging.
4.Ref AQA All About Maths AQA All About Maths Basic algebra AQA All About Maths Algebra and graphs AQA All About Maths Algebra recap and extension AQA All About Maths Algebra: quadratics, rearranging formulae and identities	**Lesson 1** – This lesson revises and builds on the knowledge that students should have of basic powers, roots, reciprocals and using BIDMAS. **Lesson 2** – focusses on students becoming confident with correct algebraic notation and the best way of writing simple expressions. It will also challenge frequent misconceptions such as $a2 = a \times 2$. **Solving linear equations activity** **Standards unit A6; Algebra Match and Algebra Sort activity** **Lesson 1** – introductory session, recapping main skills of algebraic manipulation. A shift from linear to quadratic functions. Surds are considered. **Lesson 6** – substitution into formulae of different nature, including worded formulae and worded problems. Includes negative and fractional substitution. Formulae used in Science are considered. Function notation, input and output language are used in the starter. **Lesson 7** – rearranging formulae of different nature to change the subject of the formula.
5. Misconceptions	Confusing the multiply sign (✗) with the variable (x). Not using the balance method correctly when solving equations.

6. Some examples of where it is applied in science	**Biology** Microscopy
	                Rate of photosynthesis
	                Genetic inheritance

	Chemistry	Moles
		Percentage yield
		Using concentrations of solutions in mol/dm^3 (chemistry only) (HT only)
	Physics	Changes in energy
		Efficiency
		Series and parallel circuits