

MATHS PROGRESSION OF SKILLS KS3

NUMBER		
STRUCTURE		
Year 7	Year 8	Year 9
understand and use place value for decimals, measures and integers of any size	state the multiplicative relationship between the numbers represented by any two digits in any number	state in the form $A \times 10^n$ (n any positive or negative integer) the multiplicative relationship between the numbers represented by any two digits in any number
order positive and negative integers, decimals and fractions	order positive and negative integers, decimals, fractions and numbers given in the form \sqrt{n}	order positive and negative integers, decimals, fractions and numbers given in the standard form $A \times 10^n$ $1 \leq A < 10$, where n is a positive or negative integer or zero
use the number line as a model for ordering integers, decimals and fractions	use the number line as a model for ordering integers, decimals, fractions and numbers given in the form \sqrt{n}	use the number line as a model for ordering of the real numbers
use the symbols =, \neq , <, >, \leq , \geq to make order statements about positive and negative integers, decimals and fractions	use the symbols =, \neq , <, >, \leq , \geq to make order statements about integers, decimals, fractions and numbers given in the form \sqrt{n}	use the symbols =, \neq , <, >, \leq , \geq to make order statements about real numbers
define percentage as 'number of parts per hundred', and know their decimal and fraction equivalents	relate percentages to decimals and fractions by showing their relative positions on a number line	relate percentages to decimals and fractions, moving efficiently between the different forms in any context
appreciate the infinite nature of the set of integers	appreciate the infinite nature of the sets of integers and rational numbers	appreciate the infinite nature of the sets of integers, real and rational numbers
use standard units of mass, length, time, money and other measures, including with decimal quantities	use standard units of mass, length, time, money and other measures, including with decimal and fractional quantities	use standard units of mass, length, time, money and other measures, including with decimal quantities and quantities given in the standard form $A \times 10^n$ $1 \leq A < 10$, where n is a positive or negative integer or zero
round numbers and measures to different degrees	round numbers and measures to different degrees	round numbers and measures to different degrees

MATHS PROGRESSION OF SKILLS KS3

of accuracy, for example to the nearest whole number or to one decimal place	of accuracy, for example, to the nearest whole number or to one or two decimal places	of accuracy, for example, to a number of decimal places or significant figures
CALCULATION		
Calculators should not be used as a substitute for good written and mental arithmetic. Teachers should use their judgement about when ICT tools should be used.		
Year 7	Year 8	Year 9
use the four operations, including formal written methods, applied to integers and decimals; multiply proper and improper fractions, and mixed numbers, all both positive and negative	multiply and divide a whole number by a fraction, whether positive and negative	use the four operations applied to real numbers, whether positive or negative
use conventional notation for the priority of operations, including brackets	use conventional notation for the priority of operations, including brackets and powers,	use conventional notation for the priority of operations, including brackets, powers, roots and reciprocals
recognise and use relationships between the operations +, -, ×, ÷, including inverse operations	recognise and use relationships between the operations +, -, ×, ÷, squaring and finding the square root, including inverse operations	recognise and use relationships between any operations including inverse operations
	interpret fractions and percentages as operators	use $A = \frac{1}{n}$ of B implies $B = nA$, and $A = n\%$ of B implies $B = \frac{(100A)}{n}$
STRUCTURE DEPENDING ON OPERATIONS: INTEGERS		
Year 7	Year 8	Year 9
use the concepts and vocabulary of prime numbers, factors (or divisors), multiples, common factors, common multiples, highest common factor, lowest common multiple	use prime factorisation	use prime factorisation, including using product notation and the unique factorisation property
use square, cube, square root and cube root	use integer powers	use integer powers and associated real roots (square, cube and higher), recognise powers of 2, 3, 4, 5
STRUCTURE DEPENDING ON OPERATIONS: BEYOND INTEGERS		
Year 7	Year 8	Year 9

MATHS PROGRESSION OF SKILLS KS3

		distinguish between exact representations of roots and their decimal approximations
work interchangeably with terminating decimals and their corresponding fractions (such as 3.5 and $\frac{7}{2}$ or 0.375 and $\frac{3}{8}$)	work interchangeably with terminating decimals their corresponding fractions and percentages (such as 3.5, $\frac{7}{2}$, and 350% or 0.375, $\frac{3}{8}$, and 37.5%)	work interchangeably with terminating decimals their corresponding fractions and percentages, and know the fraction and percentage equivalents of some common recurring decimals (such as 3.5, $\frac{7}{2}$, and 350% or 0.375, $\frac{3}{8}$, and 37.5%, or 0.33333..., $\frac{1}{3}$ and 33 $\frac{1}{3}$ %)
		interpret and compare numbers in standard form $A \times 10^n$ $1 \leq A < 10$, where n is a positive or negative integer or zero
LINKING AND EXTENDING PERCENTAGES, DECIMALS AND FRACTIONS		
Year 7	Year 8	Year 9
	interpret percentages and percentage changes as a fraction or a decimal, interpret these multiplicatively, express one quantity as a percentage of another, compare two quantities using percentages, and work with percentages greater than 100%	understand why an "n% increase" is not the inverse operation of an "n% decrease"
UNDERSTANDING NUMBERS in CONTEXTUAL CALCULATIONS		
Year 7	Year 8	Year 9
round numbers and measures to an appropriate degree of accuracy, for example to the nearest whole number or to one decimal place	round numbers and measures to an appropriate degree of accuracy, for example to the nearest whole number or to one or two decimal places	round numbers and measures to an appropriate degree of accuracy, for example, to a number of decimal places or significant figures
use approximation, through rounding to the nearest whole number or to one decimal place, to estimate answers	use approximation, through rounding to the nearest whole number or to one or two decimal places, to estimate answers	calculate possible resulting errors expressed using inequality notation $a < x \leq b$
use a calculator and other technologies to calculate results accurately and then interpret them appropriately		

MATHS PROGRESSION OF SKILLS KS3

ALGEBRA		
NOTATION AND VOCABULARY		
Year 7	Year 8	Year 9
use and interpret algebraic notation, including: ab in place of $a \times b$ a^2 in place of $a \times a$, a/b in place of $a \div b$	$3y$ in place of $y + y + y$ and $3 \times y$ a^3 in place of $a \times a \times a$, brackets $a^2 b$ in place of $a \times a \times b$	use and interpret algebraic notation, including coefficients written as fractions rather than as decimals
substitute positive integer values into formulae and expressions, including scientific formulae	substitute integer values into formulae and expressions, including scientific formulae	substitute numerical values into formulae and expressions, including scientific formulae
understand the correct and incorrect use of '='; understand and use the concepts and vocabulary of expressions, equations, inequalities, terms and factors	understand and use the concepts and vocabulary of expressions, equations, inequalities, terms, factors and correlation / covariation	understand and use the concepts and vocabulary of expressions, equations, inequalities, terms, factors, correlation / covariation and parameters
MANIPULATION		
Year 7	Year 8	Year 9
simplify and manipulate algebraic expressions to maintain equivalence by: - collecting like terms - multiplying a single term over a bracket	simplify and manipulate algebraic expressions to maintain equivalence by: - taking out common factors - expanding products of two or more binomials	think about relational meanings before acting on expressions, such as recognise situations in which different ways of seeing the situation lead to equivalent expressions, and use manipulation and simplification to show that the expressions are equivalent (e.g. sequences of "dot patterns")
understand and use standard mathematical formulae	rearrange formulae to change the subject	recognise situations in which it is helpful to rearrange formulae to change the subject, and explain why it is helpful
use algebraic methods to solve linear equations in one variable	use algebraic methods to solve linear equations in one variable (including all forms that require rearrangement)	use algebraic methods to solve linear equations in one variable (including all forms that require rearrangement) that express facts observed in situations, and interpret the solution
EXPRESSING AND EXPLORING RELATIONS: FUNCTIONS AND GRAPHS		

MATHS PROGRESSION OF SKILLS KS3

Year 7	Year 8	Year 9
work with coordinates in all four quadrants	understand how the position of a point changes if one or both of its coordinates are multiplied by ± 1	know the relationship between the coordinates of two points when each point is the reflection of the other in the y -axis, the x -axis, the line $y = x$ or the line $y = -x$
model simple situations or procedures involving two variables by translating them into linear algebraic expressions or formulae and by using graphs	model situations or procedures by translating them into algebraic expressions or formulae and by using graphs	relate changes in situations or procedures to changes in algebraic expressions, formulae or graphs
produce graphs of linear functions of one variable with appropriate scaling, using equations in x and y and the Cartesian plane	recognise, sketch and produce graphs of linear functions of one variable with appropriate scaling, using equations in x and y and the Cartesian plane	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 simple linear mathematical relationships, such as <i>y equals 5 times x</i> or <i>p is 3 more than twice q</i> , both algebraically and graphically	interpret linear mathematical relationships, such as <i>A plus 7 is 6 less than half of B</i> or <i>three-quarters of x is 3 times one more than half y</i> , both algebraically and graphically	interpret linear and quadratic mathematical relationships, such as <i>$(P$ subtract 1) halved is 6 times Q plus 10</i> or <i>A equals the positive-square-root of $(B$ plus 1)</i> , 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	reduce a linear equation that expresses a relationship between two variables in a situation to the standard form $y = mx + c$; calculate and interpret gradients and intercepts of graphs of such linear equations numerically, graphically, algebraically and in the situation
use linear graphs to estimate values of y for given values of x and vice versa	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 when at least one equation is of the form $y = k$ or $x = k$	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
from given linear graphs find approximate answers	from given linear graphs find approximate	find approximate solutions to contextual problems

MATHS PROGRESSION OF SKILLS KS3

to simple contextual questions	solutions to contextual problems	from given graphs of a variety of functions, including piece-wise linear, exponential and reciprocal graphs
SEQUENCES		
Year 7	Year 8	Year 9
generate terms of a sequence with a simple linear position-to-term rule (such as 'an expression for the value of the n th term is $n + 2$ ') from either the term-to-term or the position-to-term rule	generate terms of a sequence with a linear position-to-term rule from either the term-to-term or the position-to-term rule; begin to generate terms of a sequence from a quadratic position-to-term rule	generate terms of a sequence from either a term-to-term or a position-to-term rule
	recognise arithmetic sequences and find an expression for the value of the n th term	recognise geometric sequences and appreciate other sequences that arise
RATIO, PROPORTION AND RATES OF CHANGE		
MULTIPLICATIVE RELATIONSHIPS		
Year 7	Year 8	Year 9
change freely between related standard units, for example: time ($4 \text{ hours} = 4 \times 360 \text{ seconds}$), length ($7 \text{ mm} = 7 \times 0.1 \text{ cm}$), area ($9 \text{ m}^2 = 9 \times 10000 \text{ cm}^2$), volume/capacity ($3 \text{ mm}^3 = 3 \times 0.001 \text{ cm}^3$), mass ($5 \text{ kg} = 5 \times 1000 \text{ g}$)	change freely between related standard units, for example speed (m per sec to km per hour and vice-versa)	change freely between related standard units, for example acceleration
express one quantity as a whole-number multiple of another, and by reversing the expression of the same relationship express one quantity as a unit fraction of another	express one quantity as a fraction of another, where the fraction is less than 1 and where it is greater than 1	given the expression of quantity A as a non-unit fraction of quantity B know immediately how to express quantity B as a fraction of quantity A
RATIO NOTATION AND NUMBER MULTIPLIERS		
Year 7	Year 8	Year 9
understand that a multiplicative relationship between two quantities that can be expressed as a ratio of the form $1 : n$ where n is an integer can	understand that a multiplicative relationship between two quantities can be expressed as a ratio or a fraction	understand that a multiplicative relationship between two quantities can be expressed as a ratio, fraction or decimal

MATHS PROGRESSION OF SKILLS KS3

also be expressed as the unit fraction $\frac{1}{n}$		
use ratio notation, including reduction to simplest form	use ratio notation, including deriving the fraction $A / (A + B)$ from the ratio $A : B$ in appropriate contexts	use ratio notation to express relationships between side-lengths of right-angled triangles
use scale factors of scale diagrams and maps in everyday contexts	use scale factors when constructing similar shapes by enlargement	use scale factors when solving problems involving similar shapes
relate the language of ratios and the associated calculations to the arithmetic of fractions	relate the language of ratios and the associated calculations to gradients	relate the language of ratios and the associated calculations to linear functions
relate dividing a given quantity into two parts in a given part:whole ratio to finding a fraction of a quantity; relate part:part ratios of quantities to the corresponding part:whole ratios	divide a given quantity into two parts in a given part:part or part:whole ratio; express the division of a quantity into two parts as a ratio	distinguish between contexts involving comparisons expressed using $a : b$ notation in which the idea of 'part' is a helpful model and contexts in which the idea of 'part' is not a helpful model
PERCENTAGE CHANGE		
Year 7	Year 8	Year 9
	solve problems involving percentage change, including: percentage increase, decrease and original value problems	solve problems involving simple interest in financial mathematics
DIRECT AND INVERSE PROPORTION		
Year 7	Year 8	Year 9
	solve problems involving direct proportion, including graphical and algebraic representations	solve problems involving direct and inverse proportion, including graphical and algebraic representations
COMPOUND UNITS		
Year 7	Year 8	Year 9
use the idea of compound units (A 'per' B), as in unit pricing, to solve problems	use familiar compound units, such as speed, to solve problems	use compound units, such as density, to solve problems
GEOMETRY AND MEASURES		
MEASURING AND CALCULATING		
Year 7	Year 8	Year 9
draw and measure line segments and angles in geometric figures; calculate lengths represented by line segments in scale drawings given scale factors	draw and measure line segments and angles in geometric figures; calculate lengths represented by line segments in scale drawings given scale factors	draw and measure line segments and angles in geometric figures, including interpreting scale drawings

MATHS PROGRESSION OF SKILLS KS3

as ratios in the form 1 : n, and understand that the lengths are approximate	as ratios in any form, and understand implications of the accuracy of the measurements for the accuracy of the calculated lengths	
derive and apply formulae to undertake calculations and solve problems involving perimeter and area of rectangles	derive and apply formulae to undertake calculations and solve problems involving: perimeter and area of triangles, parallelograms, trapezia, volume of cuboids (including cubes) and other prisms (including cylinders)	undertake calculations and solve problems involving: perimeters of 2-D shapes (including circles), areas of circles and composite shapes
		use Pythagoras' Theorem and trigonometric ratios in similar triangles to solve problems involving right-angled triangles
DRAWING AND CONSTRUCTING		
Year 7	Year 8	Year 9
describe, sketch and draw: points, lines, parallel lines, perpendicular lines, right angles, regular polygons, and other polygons that are reflectively and rotationally symmetric; use conventional terms and notations, such as using 'dashes' to indicate equal lengths and (multiple) arrows to indicate parallel lines	describe, sketch and draw: points, lines, parallel lines, perpendicular lines, right angles, regular polygons, and other polygons that are reflectively and rotationally symmetric; use conventional terms and notations, such as <i>complementary</i> to describe angles with a sum of 90° and <i>supplementary</i> to describe angles with a sum of 180°	describe, sketch and draw: points, lines, parallel lines, perpendicular lines, right angles, regular polygons, and other polygons that are reflectively and rotationally symmetric; use conventional terms and notations, such as <i>definition</i> , <i>derived property</i> and <i>convention</i>
	derive and use the standard ruler and compass constructions (perpendicular bisector of a line segment, constructing a perpendicular to a given line from/at a given point, bisecting a given angle); recognise and use the perpendicular distance from a point to a line as the shortest distance to the line	use construction methods to: investigate what happens (for example to the angle bisectors, or perpendicular bisectors of sides, of triangles) in changing situations; explore derived shapes, such as circumcircles and inscribed circles of triangles, and other polygons (where possible)
use the standard conventions for labelling the sides and angles of triangle ABC		know and use the criteria for congruence of triangles
PROPERTIES AND RELATIONSHIPS		
Year 7	Year 8	Year 9
derive and illustrate properties [for example, equal lengths and angles] of triangles, quadrilaterals, and other plane figures using appropriate language	classify quadrilaterals by their geometric properties, and provide convincing arguments to support classification decisions	derive and illustrate properties of circles

MATHS PROGRESSION OF SKILLS KS3

and technologies		
apply translations, rotations and reflections to given figures, and identify examples of translations, rotations and reflections (for example, be able to pick out from a group of shapes those that are translations, rotations or reflections of a given shape)	know that translations, rotations and reflections map shapes onto congruent shapes; understand that the relation 'is congruent to' implies that there exists a translation, rotation or reflection that takes one shape to another	identify properties of, and describe the results of, translations, rotations and reflections applied to given figures; know that any reasoning using these transformations could be replaced by reasoning using congruence criteria, and be familiar with some examples
	construct similar shapes by enlargement, with and without coordinate grids	identify and construct congruent triangles, with and without coordinate grids
apply the properties of angles at a point, angles at a point on a straight line, vertically opposite angles	understand and use the relationship between parallel lines and alternate and corresponding angles	
	derive and use the sum of angles in a triangle	use the sum of angles in a triangle to deduce the angle sum in any polygon, and to derive properties of regular polygons
		apply angle facts, triangle congruence, similarity and properties of quadrilaterals to derive results about angles and sides, including Pythagoras' Theorem, and use known results to obtain simple proofs
	use the properties of faces, surfaces, edges and vertices of cubes, cuboids, prisms and cylinders to solve problems in 3-D	use the properties of faces, surfaces, edges and vertices of cubes, cuboids, prisms, cylinders, pyramids, cones and spheres to solve problems in 3-D

PROBABILITY AND STATISTICS

PROBABILITY

Year 7	Year 8	Year 9
record and describe the frequency of outcomes of simple probability experiments; try to explain their findings using their own ideas about randomness and possible outcomes; make and explain their own judgments about the fairness of situations; understand that the probability of an impossible	record and describe the frequency of outcomes of simple probability experiments; in the light of experience begin to refine their own ideas about causal connections between aspects of experiments that involve randomness and equally and unequally likely outcomes and the properties	record, describe and analyse the frequency of outcomes of simple probability experiments involving randomness, fairness, equally and unequally likely outcomes, using appropriate language and the 0-1 probability scale; begin to notice the same patterns in different situations

MATHS PROGRESSION OF SKILLS KS3

event is 0, and of a certain event is 1, and begin to use the 0-1 probability scale	of data distributions; make better informed judgments about the fairness of situations; begin to allocate probabilities to particular outcomes by considering all possible outcomes	
	understand why, when there are only two possible outcomes, the probabilities of the two possible outcomes sum to 1	understand that the probabilities of all possible outcomes sum to 1
enumerate sets systematically, devising their own diagrams	enumerate sets systematically making use of tables and grids	enumerate sets and unions/intersections of sets systematically, using tables, grids and Venn diagrams
		generate theoretical sample spaces for single and combined events with equally likely, mutually exclusive outcomes and use these to calculate theoretical probabilities.
STATISTICS		
Year 7	Year 8	Year 9
describe, interpret and compare observed distributions of a single variable through: appropriate graphical representation involving discrete, including grouped, data; and appropriate measures of central tendency (mean, mode, median) and spread (range)	describe, interpret and compare observed distributions of a single variable through: appropriate graphical representation involving discrete, continuous and grouped data; and appropriate measures of central tendency (mean, mode, median) and spread (range)	describe, interpret and compare observed distributions of a single variable through: appropriate graphical representation involving discrete, continuous and grouped, data; and appropriate measures of central tendency (mean, mode, median) and spread (range, consideration of outliers)
construct and interpret frequency tables, bar charts, pie charts, and pictograms for simple categorical data, and vertical line (or bar) charts for small sets of ungrouped numerical data and numerical data grouped into a small number of groups	construct and interpret frequency tables, bar charts, pie charts, and pictograms for larger sets of categorical data, and vertical line (or bar) charts for larger sets of ungrouped and grouped numerical data	construct and interpret appropriate tables, charts, and diagrams, including frequency tables, bar charts, pie charts, and pictograms for categorical data, and vertical line (or bar) charts for ungrouped and grouped numerical data
describe mathematical relationships between two variables that are easily visible in the data derived from experiments or observations	describe simple mathematical relationships between two variables that can be seen in the data derived from students' own experiments or observations	describe simple mathematical relationships between two variables (bivariate data) in observational and experimental contexts

MATHS PROGRESSION OF SKILLS KS3

	represent bivariate data on a scatter graph	use a scatter graph to illustrate simple mathematical relationships between two variables
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