KEY STAGE 3 PROGRESS LADDER

SUBJECT: Mathematics

STM STAGE

1

NUMBER

Know the place value headings up to millions

Recall primes to 19

Know the first 12 square numbers

Know the Roman numerals I, V, X, L, C, D, M

Know the % symbol

Know percentage and decimal equivalents for 1/2, 1/4, 1/5, 2/5, 4/5

Identify multiples and factors of a number

Count forwards and backwards through zero

Round to one decimal place

Use columnar addition and subtraction with numbers of any size

Multiply a three- or four-digit number by a two-digit number using long multiplication

Divide numbers up to four-digits by a single-digit number using short division and interpret the remainder

Add and subtract fractions with denominators that are multiples of the same number

Write decimals as fractions

Understand that per cent relates to number of parts per hundred

SHAPE, SPACE & MEASURE

Know rough conversions between metric and Imperial units

Know that angles are measured in degrees

Know angles in one whole turn total 360°

Know angles in half a turn total 180°

Know that area of a rectangle = length × width
Convert between adjacent metric units of measure for length, capacity and mass

Measure and draw angles

Calculate the area of rectangles

Distinguish between regular and irregular polygons

STATISTICS

Understand the difference between a line graph and a bar-line chart.

Identify when a line graph is an appropriate way to show data.

Read values from a line graph .

Solve problems using information presented in a line graph.

KEY STAGE 3 PROGRESS LADDER

STM

2

NUMBER

Multiply and divide whole numbers by 10 (100, 1000). Understand and use negative numbers when working in context.

Identify common multiples (and factors) of two numbers.

Know which operation has priority. Understand the method of long division.

Simplify a fraction and compare fractions.

Use the equivalence between fractions, decimals and percentages when solving problems.

Find a next/missing term in a linear sequence.

Add (subtract and multiply) a mixed number and a fraction, including with different denominators.

Use non-calculator methods to find a percentage of an amount.

Approximate any number by rounding to a specified degree of accuracy then estimate a calculation.

ALGEBRA

Substitute numbers into a one and two-step formula written in words.

Know the basic rules of algebraic notation.

Solve missing number problems expressed in words and algebraically.

Find all combinations of two variables that solve a missing number problem with two unknowns.

Solve problems involving coordinates

SHAPE, SPACE & MEASURE

Use a protractor to work out and construct angles.

Know the names of common 3D shapes and to be able to construct their nets.

Classify 2D shapes using given categories.

Know how to find the angle sum of a any polygon.

Know how to calculate the missing angles. Solve problems involving converting between measures.

Identify that vertically opposite angles are equal.

Find areas of 2D shapes including compound shapes. Find the volume of cube and cuboids.

Use and find a scale factor to complete an enlargement.

STATISTICS

Calculate the mean of a set of data.

Use the mean to find a missing number in a set of data.

Construct a pie chart.

Interpret and construct a simple line graph.

KEY STAGE 3 PROGRESS LADDER

SUBJECT: Mathematics

STM

3

NUMBER

Know of prime numbers, factors (divisors), multiples, common factors, common multiples, highest common factor and lowest common multiple

Know what powers are and associated roots (square, cube and higher)

Know triangular, square and cube numbers and simple sequences

Use the symbols $=, \neq, <, >, \leq, \geq$

Know and use BIDMAS (BODMAS – priority of operations).

Express one quantity as a fraction of another. Express one quantity as a percentage of another.

Generate terms of a sequence from a term-to-term rule.

Solve problems involving percentage change, including percentage increase/decrease.

Round numbers and measures to an appropriate degree of accuracy (e.g. to a specified number of decimal places or significant figures).

Estimate answers; check calculations.

ALGEBRA

Algebraic notation – how we write and simplify using algebra.

Simplify and manipulate algebraic expressions by collecting like terms and expanding brackets.

Function machines with simple inputs and outputs.

Substitution into formulae and expressions.

Recognise and use relationships between operations, including inverse operations (e.g. cancellation to simplify calculations and expressions).

Solve linear equations in one unknown algebraically.

Coordinates in all four quadrants.

Understand and use lines parallel to the axes, $y = x$ and $y = -x$

RATIO & PROPORTION

Use ratio notation, including reduction to simplest form

Divide a given quantity into two parts in a given part:part or part:whole ratio

STATISTICS

Calculate the mean, median and mode from a list of numbers and a frequency table.

Calculate the range. To be able to compare and contrast sets of data. To be able to construct and interpret a range of different types of charts.

GEOMETRY & MEASURE

Know the following; points, lines, vertices, edges, planes, parallel lines, perpendicular lines, right angles, polygons, regular polygons and polygons with reflection and/or rotation symmetries

Label sides and angles with the standard conventions

Identify properties of 3D Shapes.

Work out and use the properties and definitions of 2D Shapes. Use standard units of mass, length, time, money and other measures.

Change freely between related standard units.

Apply the properties of angles at a point, angles at a point on a straight line, vertically opposite angles.

Calculate perimeters and areas of 2D shapes (including compound shapes).

Calculate surface area and volume of 3D Shapes.

Solve geometrical problems on coordinate axes

KEY STAGE 3 PROGRESS LADDER

SUBJECT: Mathematics

STM

4

NUMBER

Use the concepts and vocabulary of prime numbers, highest common factor, lowest common multiple, prime factorisation, including using product notation and the unique factorisation theorem

Round numbers and measures to an appropriate degree of accuracy including decimal places or significant figures.

Interpret standard form

Apply the four operations, including formal written methods, to integers, decimals, simple fractions (proper and improper), and mixed numbers

Use conventional notation for priority of operations

Write a fraction in its lowest terms by cancelling common factors

Convert between fractions, decimals and percentages with and without a calculator

Percentages: Increase and decrease, with and without calculators

Solve problems involving percentage change, finding original amounts and calculating interest

Solve problems that require calculations with fractions

Continue a sequence Find the rule of a sequence

ALGEBRA

Write expressions correctly using algebra

Use fractions when working in algebraic situations

Factorise an expression Simplifying an expression Know the laws of indices

Substitute positive and negative numbers into formulae

Change the subject of a formula

Find the nth term of a sequence and use it to calculate terms

Solve linear equations with the unknown on one side or both sides when the solution is positive, negative or fractional

Check the solution to an equation by substitution

Understand the solution to two equations is the intersection of graphs.

Plot graphs of functions of the form y = mx + c

Find the gradient of a straight line on a unit grid

Find the y-intercept of a straight line

Plot quadratic graphs

Plot and interpret distance-time graphs (speed-time graphs)

RATIO & PROPORTION

Use ratios and proportion to describe a situation

Identify proportion in a situation

Understand the connections between ratios and fractions

Know the connection between speed, distance and time

Solve problems involving speed

STATISTICS

Find the modal class of set of grouped data

Find the class containing the median of a set of data

Find the midpoint of a class

Calculate an estimate of the mean from a grouped frequency table

Estimate the range from a grouped frequency table

Analyse and compare sets of data understanding the advantages and disadvantages of the mean, median, mode, range

Construct a grouped frequency table for continuous data

Construct histograms for grouped data

Plot and interpret a scatter diagram

Understand the meaning of 'correlation'

GEOMETRY & MEASURE

Measure line segments and angles in geometric figures, including interpreting maps and scale drawings and use of bearings
Identify, describe and construct similar shapes, including on coordinate axes, and by considering enlargement
Interpret plans and elevations of 3D shapes
Use scale factors, scale diagrams and maps
Identify alternate and corresponding angles and know that they are equal
Find the size of interior/exterior angles in polygons
Label a circle
Know the value of pi
Calculate the circumference and area of a circle
Calculate the radius or diameter of a circle when the area or circumference is known
Calculate the perimeter and area of composite shapes that include sections of a circle
Calculate the volume of a right prism (cylinder)

PROBABILITY

Relate relative expected frequencies to theoretical probability, using appropriate language and the 0 - 1 probability scale
Record describe and analyse the frequency of outcomes of probability experiments using tables
Use experimental probability to calculate expected outcomes
Construct sample space diagrams and calculate probabilities
List all elements in a combination of sets using a Venn diagram
List outcomes of an event using a grid (two-way table)

Use frequency trees to record outcomes of probability experiments

KEY STAGE 3 PROGRESS LADDER

SUBJECT: Mathematics

STM

5

NUMBER

- Calculate with positive indices (roots) using written methods

- Calculate with negative indices in the context of standard form

- Use and interpret standard form on a calculator

- Interpret a number written in standard form

- Add, subtract, multiply and divide numbers written in standard form

- Convert a 'near miss' into standard form; e.g. 23 × 107

- Understand the difference between truncating and rounding

- Identify the minimum and maximum values of an amount that has been rounded (to nearest d.p., s.f.) and solve problems involving these

ALGEBRA

Understand the meaning of identity, expression, equation and formulae

Expand and factorise double brackets

Simplify expressions including $x2$ by collecting like terms

Know how to set up a mathematical argument

Recap on sequences including nth terms of decimal and fractional patterns.

Recognise and use Fibonacci type sequences and quadratic sequences.

Solve linear inequalities and represent the solution on a number line

Identify and interpret gradients and intercepts of linear functions both from graphs and using $y=mx+c$.

recognise the qualities of gradients that give parallel and perpendicular lines.

Recognise, sketch and interpret a range of graphs including quadratic, cubic and reciprocal functions.

Solve two linear simultaneous equations in two variables algebraically.

Find approximate solutions to simultaneous equations using a graph.

RATIO & PROPORTION

Understand direct and inverse proportion

Understand the connection between the multiplier, the expression and the graph

Know the meaning of similar shapes and be able to find missing lengths of similar shapes

Use and solve problems involving speed, density and pressure

Convert between units of density

STATISTICS

Interpret and construct tables, charts and diagrams, including tables and line graphs for time series data and know their appropriate use.

Draw estimated lines of best fit; make predictions.

Know that correlation does not indicate causation; interpolate and extrapolate apparent trends whilst knowing the dangers of so doing.

PROBABILITY

Calculate the probability of independent and dependent combined events, including using tree diagrams and other representations, and know the underlying assumptions.

Enumerate sets and combinations of sets systematically, using tree diagrams.

Understand that unbiased samples tend towards theoretical probability distributions, with increasing sample size.

GEOMETRY & MEASURE

Use compass to construct arcs, perpendicular bisector of a line segment, angle bisectors,, a perpendicular to a line from a point

Understand the meaning of locus (loci)

Identify which construction will be used to find the locus of an event

Construct a shape from its plans and elevations

Know the names of parts of circles, including: tangent, arc, sector and segment

Calculate arc lengths, angles and areas of sectors of circles

Calculate surface area of right prisms Calculate exactly in terms of π

Know the formulae for Pythagoras' theorem and apply it to find lengths in right-angled triangles.

Use the basic congruence criteria for triangles and use known results to obtain simple proofs