

## Key stage 3 Studies

### CORE STUDIES

Subject: MATHEMATICS

Levels of Achievement: NC 1 – NC 8

### What you will study in this course

During this course you will study the main strands of Mathematics:

- Number
- Algebra
- Geometry
- Measures
- Statistics
- Probability

Calculators will be used at times but you will continue to be taught written and mental methods of calculation. Pupils who have their own suitable calculator in lessons and at exams will be much better prepared through familiarity with their calculator.

### How you will get your level

Your Maths levels will be achieved mostly by completing a single level test at the end of each half term. Your teacher will use the results of this test, consider how successful your classwork and homework has been, and award you a level.

Each test contains all the Mathematical skills from a single NC Level.

- For example, if you achieve a level 4b at KS2, your first test will be at Level 4.
- Each test is an opportunity to move up to the next level.

Each test:

- 1 hour long
- 20-30 questions

### Who to see for more information

Mrs Reynolds or Mr Kelly

# Overview of Syllabus

<b>Level 1</b>	
	<b>Counting and understanding numbers</b>
1	Count reliably up to 10 everyday objects: first to 5, then 10 (ELG 6, P8)
2	Read, write numbers to 10: perhaps with some reversals (ELG 8)
3	Order numbers to 10: one more/less, ascending/descending order, point to first, second object etc
4	Begin to use the fraction one-half: half shapes by folding, fill containers half full, halve an even number of objects etc
	<b>Calculating</b>
5	Understand addition as finding the total of two or more sets of objects
6	Understand subtraction as 'taking away' objects from a set and finding how many are left
7	Add and subtract numbers of objects to 10
8	Begin to use some addition facts: doubles of numbers to double 5
9	Solve addition/subtraction problem involving up to 10 objects: how many more to make..., how many balance with..., coin values to 10p, solve money problems etc
10	Record work with objects, pictures, diagrams
11	Begin to use symbols '+' and '=' to record additions
	<b>Shape, Space and Measure</b>
12	Use everyday language to describe properties of 2D and 3D shapes: sort shapes, refer to features- sides, corners, use properties-large, small, roll, stack etc
13	Use everyday language to describe positions of 2D and 3D shapes: <b>positional language</b> - 'behind, under, on top of, next to, in between etc
14	Use everyday language to describe positions of 2D and 3D shapes: <b>directional language</b> - forwards, backwards, turn etc
15	Measure & order objects using direct comparison: order objects by length (longer/shorter), weight (heavier/lighter), capacity (holds more/less than 1 litre etc)
16	Order events: describe the sequence of everyday events- breakfast, morning play, lunch etc
17	Order events: Use the vocabulary of time including days of the week- today, tomorrow, yesterday etc
18	Order events: read the time on an analogue clock at the hour and begin to know the half hour
	<b>Handling data and Using and applying mathematics</b>
19	Sort objects using one criterion or into disjoint sets using two criteria: boy/girl, thick/thin etc
20	Sort objects into a given large scale Venn or Carroll diagram
21	Use objects/pictures to create simple block graphs
22	Demonstrate the criterion used: talk about how they have sorted objects and why each belongs in a set
23	Talk about which set has most: most children stayed for lunch etc

# Level 2

<b>Counting and understanding numbers</b>	
1	Count sets of objects reliably: group objects in tens, twos or fives to count them
2	Begin to understand the place value of each digit; use this to order numbers up to 100: know relative size of numbers to 100, use 0 as a place holder
3	Recognise and continue sequences of numbers, including odd and even numbers: increasing/decreasing in regular steps, counting in tens or twos
4	Know by heart the two, five and ten times tables
5	Begin to use halves and quarters: sharing sweets between 2 or 4, work out halves of numbers to 20, shade half/quarter of a shape etc
<b>Calculating</b>	
6	Use the knowledge that subtraction is the inverse of addition: $6+8 = 14$ , $14-8 = 6$ , $8+6 = 14$ , $14-8 = 8$
7	Understand halving as a way of 'undoing' doubling and vice versa: double 4 is 8, half of 8 is 4
8	Use mental recall of addition and subtraction facts to 10: know $3+7 = 10$ and use place value to derive $30+70 = 100$
9	Use mental calculation strategies to solve number problems including those involving money and measures: recall doubles to $10+10$ , double 50p is £1 etc
10	Choose the appropriate operation when solving addition and subtraction problems: repeated addition to solve multiplication problems, repeated subtraction for sharing
11	Solve number problems involving money and measures: add/subtract two-digit and one-digit numbers, using units such as pence, pounds, centimetres
12	Record work in writing: record mental calculations as number sentences
<b>Shape, Space and Measure</b>	
13	Use mathematical names for common 3-D and 2-D shapes: square, triangle, hexagon, pentagon, octagon, cube, cylinder, sphere, cuboid, pyramid
14	Describe their properties, including numbers of sides and corners: edge, face, corner; sort shapes to a single criterion i.e. pentagons, shapes with a right angle etc
15	Describe the position of objects: first, second, third, upside down
16	Distinguish between straight and turning movements: left/right, clockwise/anti clockwise
17	Recognise right angles in turns and understand angle as a measurement of turn: whole turns/half turns/quarter turns
18	Begin to use everyday non-standard and standard units to measure length and mass: hand widths, cm/m/g, read scales to the nearest labelled division
<b>Handling data and Using and applying mathematics</b>	
19	Sort objects and classify them using more than one criterion: sort shapes into triangle/not triangle and blue/not blue
20	Understand vocabulary relating to handling data: sort, group, set, list, table, most common, most popular
21	Collect and sort data to test a simple hypothesis: count a show of hands to test "Most children in our class are in bed by 7.30pm"
22	Enter data into a simple computer database
23	Record and communicate findings, using the simple lists, tables, pictograms and block graphs

# Level 3

<b>Counting and understanding numbers</b>	
1	Understand place value in numbers to 1000: represent numbers using number lines, 100 squares etc, multiply/divide whole numbers by 10
2	Recognise negative numbers in contexts such as temperature
3	Recognise a wider range of sequences: multiples of 2, 5, 10
4	Understand and use simple fractions; $\frac{1}{2}$ , $\frac{1}{4}$ , $\frac{1}{3}$ , $\frac{1}{5}$ , $\frac{1}{10}$ ; those that are several parts of a whole; $\frac{3}{4}$ , $\frac{2}{5}$ and recognise some fractions equivalent to $\frac{1}{2}$ ( $\frac{5}{10}$ etc)
5	Begin to use decimal notation in contexts such as money: order decimals with one or two dp, know that £3.06 = 306p
6	Know by heart the three, four and six times tables
<b>Calculating</b>	
7	Derive associated division facts from known multiplication facts: if $14 \times 5 = 70$ then $70 \div 5 = 14$ and $70 \div 14 = 5$
8	Begin to understand the role of '=' when solving 'balancing' problems: $7 \times 10 = 82 - \square$
9	Add and subtract two-digit numbers mentally: $36 + 19$ , $63 - 26$
10	Use mental recall of addition/subtraction facts to 20 in solving problems involving larger numbers
11	Solve whole number word problems including those involving multiplication or division that may give rise to remainders: identify appropriate operations/ round up or down
12	Add and subtract three digit numbers using written method: $132 + 239$ ; $327 - 119$ using carrying and decomposition methods
13	Multiply and divide two digit numbers by 2, 3, 4 or 5 as well as 10 with whole number answers and remainders: $22 \div 5 = 4 \text{ r } 2$
<b>Shape, Space and Measure</b>	
14	Classify 3-D and 2-D shapes in various ways using mathematical properties such as reflective symmetry for 2-D shapes
15	Begin to recognise nets of familiar 3-D shapes: cube, cuboid, triangular prism, square-based pyramid
16	Recognise shapes in different orientations and reflect shapes, presented on a grid, in a vertical or horizontal mirror line or at 45 degrees to the mirror line
17	Describe position and movement: left/right, clockwise/anticlockwise/quarter turns /90degrees to give directions along a route
18	Use standard units in a range of contexts (length, capacity and mass): measure length to nearest $\frac{1}{2}$ cm, read simple scales, read a 12 hour clock
19	Use a wider range of measures: find areas of shapes by counting squares, angles as measure of turn, perimeter as a measure of length
<b>Handling data and Using and applying mathematics</b>	
20	Gather information: decide what data to collect, make appropriate choice of tally chart, frequency table etc
21	Construct bar charts and pictograms, where the symbol represents a group of units
22	Use Venn and Carroll diagrams to record their sorting and classifying of information: shapes sorted using properties such as right angles and equal sides.
23	Extract and interpret information presented in simple tables, lists, bar charts and pictograms: use keys, read scales, compare data etc

# Level 4

<b>Counting and understanding numbers</b>	
1	Recognise and describe number patterns: continue sequences involving decimals 1.3, 1.6, 1.9, 2.2, etc
2	Recognise and describe number relationships including multiple, factor and square: 5 is factor of 20, 20 is multiple of 5
3	Use place value to multiply and divide whole numbers by 10 or 100: $342 \times 10 = 3420$ $2456 \div 100 = 24.56$
4	Recognise approximate proportions of a whole and use simple fractions/percentages to describe these: simple equivalence between fractions, decimals and percentages
5	Convert mixed numbers to improper fractions and vice versa: $1\frac{3}{4} = 7/4$ etc
6	Begin to understand simple ratio: girls to boys ratio = 2 to 3 so 20 girls means 30 boys
<b>Calculating</b>	
7	Use inverse operations: 'undo' two step operations, understand 'balancing' sums $20 + \square = 100 \div 4$
8	Understand the use of brackets in simple calculations: brackets take priority in calculation $(3 \times 4) + 14$ $12 + 14 = 26$
9	Recall multiplication facts up to $10 \times 10$ and quickly derive corresponding division facts: Gold Standard
10	Solve problems with or without a calculator: solve two step problems choosing appropriate operations, interpret calculator display of 4.5 as £4.50
11	Use and interpret coordinates in the first quadrant
12	Use efficient written methods of addition and subtraction: column addition, subtraction and of short multiplication and division: TU x U, HTU x U, HTU ÷ U
13	Add and subtract decimals to two places and multiply a simple decimal by a single digit: $36.2 \times 8$
<b>Shape, Space and Measure</b>	
14	Use the properties of 2-D and 3-D shapes: recognise most quadrilaterals, all triangles, oblique lines of symmetry, use terms horizontal, vertical, congruent
15	Reflect simple shapes in a mirror line: at 45 degrees to the mirror line, begin to use the distance of vertices from mirror line to reflect more accurately
16	Translate shapes horizontally or vertically and begin to rotate a simple shape or object about its centre or a vertex
17	Interpret, with appropriate accuracy, numbers on a range of measuring instruments: measure to within 2mm, measure acute and obtuse angles to nearest 5 degrees
18	Find perimeters of simple shapes and find areas by counting squares and part squares: begin to find areas shapes that need dividing into rectangles
<b>Handling data and Using and applying mathematics</b>	
19	Collect, record and group discrete data: test a hypothesis about the frequency of an event (how many 6s in 50 throws of a die), record using frequency table
20	Continue to use Venn and Carroll diagrams to record their sorting and classifying of information: sorting numbers 'multiples of 8' and 'multiples of 6'
21	Construct and interpret frequency diagrams and simple line graphs: interpret simple pie charts, scale on bar graphs reading between the labelled divisions etc
22	Understand and use the mode and range to describe sets of data: mode = most common, range = highest – lowest
23	Understand the language of probability: more likely, equally likely, fair, unfair, certain, impossible etc

# Level 5

<b>Counting and understanding numbers</b>	
1	Use understanding of place value to multiply and divide whole numbers and decimals by 10, 100 and 1000 and explain the effect: $2.6 \times 1000$ : $2.6 \div 100$
2	Round decimals to the nearest decimal place and order negative numbers in context: $38.47 = 38.5$ to 1 d.p.
3	Recognise and use number patterns and relationships: say whether much larger numbers will be in the sequence or not
4	Use equivalence between fractions and order fractions and decimals: convert fractions such as $\frac{2}{5}$ into tenths or hundredths/express as decimals or percentages
5	Reduce a fraction to its simplest form by cancelling common factors: $\frac{16}{20} = \frac{8}{10} = \frac{4}{5}$
<b>Calculating</b>	
6	Use known facts, place value, knowledge of operations and brackets to calculate including using all four operations with decimals to two places
7	Use a calculator where appropriate to calculate fractions/percentages of quantities/measurements: $\frac{3}{8}$ of 400g or 60% of £300
8	Understand and use an appropriate non-calculator method for solving problems that involve multiplying and dividing any three digit number by any two-digit number
9	Solve simple problems involving ordering, adding, subtracting negative numbers in context
10	Solve simple problems involving ratio and direct proportion: use multiplication rather than trial and error
11	Apply inverse operations and approximate to check answers to problems are of the correct magnitude
<b>Shape, Space and Measure</b>	
12	Use a wider range of properties of 2-D and 3-D shapes: name quadrilaterals, recognise right angled, equilateral, isosceles etc parallel, perpendicular, no. of faces/vertices
13	Identify all the symmetries of 2-D shapes: reflective, rotational etc
14	Use language associated with angle and know and use the angle sum of a triangle and that of angles at a point: acute, obtuse, reflex: triangle $180^\circ$ : point $360^\circ$
15	Reason about position and movement and transform shapes: visualise 3D shapes from nets; transfer patterns from shapes to nets, draw shapes with given lines of symmetry
16	Measure and draw angles to the nearest degree, when constructing models and drawing or using shapes
17	Read and interpret scales on a range of measuring instruments, explaining what each labelled division represents: thermometer, scales, measuring cylinder, ruler etc
18	Solve problems involving the conversion of units and make sensible estimates of a range of measures in relation to everyday situations
19	Understand and use the formula for the area of a rectangle and distinguish area from perimeter: find length given perimeter and width/find area/perimeter of simple L shapes
<b>Handling data and Using and applying mathematics</b>	
20	Understand and use the probability scale from 0 to 1: 0-impossible, 1-certain, 0.5-equally likely, 0.2-unlikely, etc
21	Understand and use the mean of discrete data and compare two simple distributions, using the range and one of mode, median or mean
22	Understand that different outcomes may result from repeating an experiment: rolling a die 36 times may give different no of sixes rolled but probability stays 1 in 6
23	Interpret graphs and diagrams, including pie charts and line graphs (where the intermediate values have meaning), and draw conclusions

# Level 6

	<b>Numbers and the Number System</b>
1	Use the equivalence of fractions, decimals and percentages to compare proportions
	<b>Calculating</b>
2	Calculate percentages and find the outcome of a given percentage increase or decrease
3	Divide a quantity into two or more parts in a given ratio and solve problems involving ratio and direct proportion
4	Use proportional reasoning to solve a problem, choosing the correct numbers to take as 100%, or as a whole
5	Add and subtract fractions by writing them with a common denominator, calculate fractions of quantities (fraction answers), multiply and divide an integer by a fraction
	<b>Algebra</b>
6	Use systematic trial and improvement methods and ICT tools to find approximate solutions to equations such as $x^3 + x = 20$
7	Construct and solve linear equations with integer coefficients, using an appropriate method
8	Generate terms of a sequence using term-to-term and position-to-term definitions, on paper and using ICT; write an expression to describe the $n$ th term of a sequence
9	Plot the graphs of linear functions, where $y$ is given explicitly in terms of $x$ ; recognise that equations of the form $y = mx + c$ correspond to straight-line graphs
10	Construct functions arising from real-life problems and plot their corresponding graphs
11	Interpret graphs arising from real situations
	<b>Shape, Space and Measure</b>
12	Classify quadrilaterals by their geometric properties
13	Solve geometric problems using properties of angles, of parallel and intersecting lines, and of triangles and other polygons
14	Identify alternate and corresponding angles; understand a proof that the sum of the angles of a triangle is $180^\circ$ and of a quadrilateral is $360^\circ$
15	Devise instructions for a computer to generate and transform shapes and paths
16	Visualise and use 2D representations of 3D objects
17	Enlarge 2D shapes, given a centre of enlargement and a positive whole-number scale factor
18	Know that translations and reflections preserve length and angle and map objects onto congruent images
19	Use straight edge and compasses to do standard constructions
20	Deduce and use formulae for the area of a triangle and parallelogram, and the volume of a cuboid; calculate volumes and surface areas of cuboids
21	Know and use the formulae for the circumference and area of a circle
	<b>Handling data and Using and applying mathematics</b>
22	Design a survey/experiment to capture the necessary data from one/more sources; trial and refine data collection sheets; construct tables for large discrete and continuous sets of raw data, choosing suitable class intervals; design and use two-way tables
23	Select, construct and modify, on paper/ICT: pie charts for categorical data; bar charts/ frequency diagrams for discrete/continuous data; simple time graphs for time series; scatter graphs, and identify which are the most useful in the context of the problem
24	Find and record all possible mutually exclusive outcomes for single and two successive events in a systematic way
25	Know that the sum of all mutually exclusive outcomes is 1 and use this when solving problems
26	Communicate interpretations and results of a statistical survey using selected tables, graphs and diagrams in support

# Level 7

	<b>Numbers and the Number System</b>
1	Understand and use proportionality
	<b>Calculating</b>
2	Calculate the result of any proportional change using multiplicative methods
3	Understand the effects of multiplying and dividing by numbers between 0 and 1, add, subtract, multiply and divide fractions
4	Make and justify estimates and approximations of calculations; estimate calculations by rounding numbers to one significant figure and multiplying and dividing mentally
5	Use a calculator efficiently and appropriately to perform complex calculations with numbers of any size, knowing not to round during intermediate steps of a calculation
	<b>Algebra</b>
6	Square a linear expression and expand and simplify the product of two linear expressions of the form $(x \pm n)$ and simplify the corresponding quadratic equation
7	Use algebraic and graphical methods to solve linear equations in two variables
8	Solve inequalities in one variable and represent the solution set on a number line
9	Use formulae from mathematics and other subjects; substitute numbers into expressions and formulae; derive a formulae and, in simple cases, change its subject
10	Find the next term and nth term of quadratic sequences and functions and explore their properties
11	Plot graphs of simple quadratic and cubic functions, e.g. $y = x^2$ , $y = 3x^2 + 4$ , $y = x^3$
	<b>Shape, Space and Measure</b>
12	Understand and apply Pythagoras' theorem when solving problems in 2D
13	Calculate lengths, areas and volumes in plane shapes and right prisms
14	Enlarge 2D, given a centre of enlargement and a fractional scale factor, on paper and using ICT; recognise the similarity of the resulting shapes
15	Find the locus of a point that moves according to a given rule, both by reasoning and using ICT
16	Recognise that measurements given to the nearest whole unit may be accurate by up to one-half of the unit in either direction
17	Understand and use measures of speed (and other compound measures such as density or pressure) to solve problems
	<b>Handling data and Using and applying mathematics</b>
18	Suggest a problem to explore using statistical methods, frame questions and raise conjectures; identify possible sources of bias and plan how to minimise it
19	Select, construct and modify, on paper/using ICT suitable graphical representation to progress an enquiry including frequency polygons and lines of best fit on scatter graphs
20	Estimate the mean, median and range of a set of grouped data and determine the modal class, selecting the statistic most appropriate to the line of enquiry
21	Compare two or more distributions and make inferences, using the shape of the distributions and measures of average and range
22	Understand relative frequency as an estimate of probability and use this to compare outcomes of an experiment
23	Examine critically the results of a statistical enquiry, and justify the choice of statistical representation in written presentation

# Level 8

	<b>Numbers and the Number System</b>
1	Understand the equivalence between recurring decimals and fractions
	<b>Calculating</b>
2	Use fractions or percentages to solve problems involving repeated proportional changes or the calculation the original quantity given the result of a proportional change
3	Solve problems involving calculating with powers, roots and numbers expressed in standard form, checking for correct order of magnitude and using a calculator as appropriate
	<b>Algebra</b>
4	Factorise quadratic expressions including the difference of two squares
5	Manipulate algebraic formulae, equations and expressions, finding and multiplying two linear expressions
6	Derive & use more complex formulae and change the subject of the formula
7	Evaluate algebraic formulae, substituting decimals, fractions and negative numbers
8	Solve inequalities in two variables and find the solution set
9	Sketch, interpret and identify graphs of linear, quadratic, cubes & reciprocal functions and graphs that model real life situations
10	Understand the effect on a graph of addition of (or multiplication by) a constant
	<b>Shape, Space and Measure</b>
11	Understand and use congruence and mathematical similarity
12	Understand and use trigonometrical relationships in right angled triangles, and use them to solve problems, including those involving bearings
13	Understand the difference between formulae for perimeter, area and volume in simple contexts by considering dimensions
	<b>Handling data and Using and applying mathematics</b>
14	Estimate and find the median, quartiles and inter-quartile range for large data sets, including using a cumulative frequency diagram
15	Compare two or more distributions and make inferences, using the shape of the distributions and measures of average and spread including median and quartiles
16	Know when to add and when to multiply two probabilities
17	Use tree diagrams to calculate probabilities of combinations of independent events