Maths Department

Personalised Learning Ladder Descriptors

These ‘I can’ statements should be used as best fit descriptors and show the expected progression required for a student on any given learning path in order to reach their projected destination at GCSE level..

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Year | E | D | S | M |
| 7 | * solve simple problems (with assistance if necessary)
* work with different types of number including fractions
* discover mathematical patterns
* understand and use some graphical representations
* use basic arithmetic and numerical operators
* work with 2-D shapes
 | * use routine calculation strategies to solve problems
* identify simple number relationships
* use basic ideas of ratio and proportion
* test simple conjectures
* begin to reason deductively in introductory geometry, number and algebra
* use additive or multiplicative reasoning
* work with 2-D shapes, probability and statistics
 | * use calculation strategies to solve problems
* begin to model situations and express the results
* identify number relationships
* use basic ratio and proportion
* test conjectures
* reason deductively in introductory geometry, number and algebra
* use additive or multiplicative reasoning when appropriate
* work with 2-D and 3-D shapes, probability and statistics
 | * select and use calculation strategies to solve problems
* begin to model situations mathematically and express the results
* make connections between number relationships, and their graphical representations
* use ratio and proportion in working with measures and geometry
* test conjectures about patterns and relationships
* begin to reason deductively in geometry, number and algebra
* decide whether to use additive or multiplicative reasoning
* analyse 2-D and 3-D shapes, probability and statistics
 |
| 8 | * use routine calculation strategies to solve problems
* identify simple number relationships
* use basic ideas of ratio and proportion
* test simple conjectures
* begin to reason deductively in introductory geometry, number and algebra
* use additive or multiplicative reasoning
* work with 2-D shapes, probability and statistics
 | * use calculation strategies to solve problems
* begin to model situations and express the results
* identify number relationships
* use basic ratio and proportion
* test conjectures
* reason deductively in introductory geometry, number and algebra
* use additive or multiplicative reasoning when appropriate
* work with 2-D and 3-D shapes, probability and statistics
 | * select and use calculation strategies to solve problems
* begin to model situations mathematically and express the results
* make connections between number relationships, and their graphical representations
* use ratio and proportion in working with measures and geometry
* test conjectures about patterns and relationships
* begin to reason deductively in geometry, number and algebra
* decide whether to use additive or multiplicative reasoning
* analyse 2-D and 3-D shapes, probability and statistics
 | * select and use appropriate calculation strategies to solve increasingly complex problems
* begin to model situations mathematically and express the results using a range of formal mathematical representations
* make connections between number relationships, and their algebraic and graphical representations
* use ratio and proportion in working with measures and geometry
* make and test conjectures about patterns and relationships
* reason deductively in geometry, number and algebra
* interpret when the structure of a numerical problem requires additive or multiplicative reasoning
* explore what can and cannot be inferred in statistical and probabilistic settings
 |
| 9 | * use calculation strategies to solve problems
* begin to model situations and express the results
* make connections between number relationships
* use ratio and proportion
* test ideas
* begin to reason deductively in basic geometry, number and algebra
* use additive or multiplicative reasoning
* work with 2-D and 3-D shapes, probability and statistics
 | * select and use calculation strategies to solve problems
* begin to model situations mathematically and express the results
* make connections between number relationships, and their graphical representations
* use ratio and proportion in working with measures and geometry
* test conjectures about patterns and relationships
* begin to reason deductively in geometry, number and algebra
* decide whether to use additive or multiplicative reasoning
* analyse 2-D and 3-D shapes, probability and statistics
 | * select and use appropriate calculation strategies to solve increasingly complex problems
* begin to model situations mathematically and express the results using a range of formal mathematical representations
* make connections between number relationships, and their algebraic and graphical representations
* use ratio and proportion in working with measures and geometry
* make and test conjectures about patterns and relationships
* reason deductively in geometry, number and algebra
* interpret when the structure of a numerical problem requires additive or multiplicative reasoning
* explore what can and cannot be inferred in statistical and probabilistic settings
 | * select and use appropriate concepts, methods and techniques to apply to complex, unfamiliar and non-routine problems
* model situations mathematically and express the results using a range of formal mathematical representations
* identify variables and move freely between different numerical, algebraic, graphical and diagrammatic representations
* use ratio and proportion in working with measures and geometry, and formulate proportional relations algebraically
* make and test conjectures about patterns and relationships; look for proofs or counterexamples
* reason deductively in geometry, number and algebra, including using geometrical constructions
* interpret when the structure of a numerical problem requires additive, multiplicative or proportional reasoning
* explore what can and cannot be inferred in statistical and probabilistic settings, and begin to express arguments formally
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Maths Department

Personalised Learning Ladder Descriptors

It is expected that, although obviously new content is gradually introduced at KS4, the main emphasis in Year 10 and Year 11 should be to develop problem solving skills, making links between different areas of mathematics and the application of knowledge to a wide variety of familiar and unfamiliar settings.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Year | 1/2 | 3/4 | 5/6/7 | 8/9 |
| 10 | * recall and use some notation, terminology, facts and definitions; perform routine procedures
* interpret and communicate basic information
* solve simple problems by translating mathematical problems into mathematical processes
* provide basic evaluation of methods or results
* interpret results
 | * recall and use some notation, terminology, facts and definitions; perform routine procedures, including some multi-step procedures
* interpret and communicate basic information
* solve simple problems by translating mathematical and non-mathematical problems into mathematical processes
* provide basic evaluation of methods or results
* interpret results in the context of the given problem
 | * recall and use notation, terminology, facts and definitions; perform routine procedures, including multi-step procedures
* interpret and communicate information; make deductions and use reasoning to obtain results
* make simple deductions and conclusions
* solve problems by translating mathematical and non-mathematical problems into mathematical processes
* provide evaluation of methods or results
* interpret results in the context of the given problem
 | * perform routine single- and multi-step procedures effectively by recalling, applying and interpreting notation, terminology, facts, definitions and formulae
* interpret and communicate information effectively
* make deductions, inferences and draw conclusions
* construct chains of reasoning, including arguments
* generate strategies to solve mathematical and non-mathematical problems by translating them into mathematical processes, realising connections between different parts of mathematics
* interpret results in the context of the given problem
* evaluate methods and results
 |
| 11 | * recall and use some notation, terminology, facts and definitions; perform routine procedures, including some multi-step procedures
* interpret and communicate basic information
* solve simple problems by translating mathematical and non-mathematical problems into mathematical processes
* provide basic evaluation of methods or results
* interpret results in the context of the given problem
 | * recall and use notation, terminology, facts and definitions; perform routine procedures, including multi-step procedures
* interpret and communicate information; make deductions and use reasoning to obtain results
* make simple deductions and conclusions
* solve problems by translating mathematical and non-mathematical problems into mathematical processes
* provide evaluation of methods or results
* interpret results in the context of the given problem
 | * perform routine single- and multi-step procedures effectively by recalling, applying and interpreting notation, terminology, facts, definitions and formulae
* interpret and communicate information effectively
* make deductions, inferences and draw conclusions
* construct chains of reasoning, including arguments
* generate strategies to solve mathematical and non-mathematical problems by translating them into mathematical processes, realising connections between different parts of mathematics
* interpret results in the context of the given problem
* evaluate methods and results
 | * perform procedures accurately
* interpret and communicate complex information accurately
* make deductions and inferences and draw conclusions
* construct substantial chains of reasoning, including convincing arguments and formal proofs
* generate efficient strategies to solve complex mathematical and non-mathematical problems by translating them into a series of mathematical processes
* make and use connections, which may not be immediately obvious, between different parts of mathematics
* interpret results in the context of the given problem
* critically evaluate methods, arguments, results and the assumptions made
 |

Flight Path Projections from Y7 to Y11

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| GCSE Grade |  |  |  | 1/2 | 3/4 | 5/6/7 | 8/9 |
| Year 9 |  |  | Emerging | Developing | Secure | Mastered |  |
| Year 8 |  | Emerging | Developing | Secure | Mastered |  |  |
| Year 7 | Emerging | Developing | Secure | Mastered |  |  |  |

KS3 Content Ladder

As additional guidance for the content based knowledge required within each flight path, the following descriptors may also be helpful. However, they should be considered as subject specific strands across the *whole* of Key Stage 3.

As stated above, ‘it is expected that, although obviously new content is gradually introduced at KS4, the main emphasis in Year 10 and Year 11 should be to develop problem solving skills, making links between different areas of mathematics and the application of knowledge to a wide variety of familiar and unfamiliar settings’.

Theme: Number

|  |  |  |  |
| --- | --- | --- | --- |
| EMERGINGGrade Descriptor | DEVELOPINGGrade Descriptor | SECUREGrade Descriptor | MASTEREDGrade Descriptor |
| I can… | I can… | I can… | I can… |
| Order whole numbers. | Understand use and compare decimals including measures. | Solve problems involving ordering, adding and subtracting positive and negative numbers. | Divide by a decimal number. |
| Recognise negative numbers such as temperatures. | Add and subtract whole numbers. | Multiply and divide whole numbers and decimal numbers. | Use inverse operations and approximations to check answers. |
|  | Add and subtract decimals. |  |  |
| Can use place value to multiply and divide whole numbers by 10, 100, 1000. | Can use place value to multiply and divide decimals by 10,100,1000. | Round numbers to 1 or 2 significant figures. | Use rounded numbers to estimate answers to calculations and problems. |
| Round numbers to nearest 100, 1000. | Round numbers to 1 or 2 decimal places. |  |  |
| Round decimals to the nearest whole number. |  |  |  |
| Understand the terms ‘numerator’ and ‘denominator’. | Find equivalent fractions. | Add and subtract fractions with different denominators. | Understand the equivalence of fractions, decimals and percentages. |
| Simplify simple fractions. | Add and subtract fractions with the same denominator. | Understand equivalent fractions and can order fractions, decimals and percentages. | Solve worded problems giving fractions as answers and understand how to round fractional answers. |
| Find simple fractions of amounts. | Find fractions of amounts. | Use a calculator to do sums with fractions. | Multiply and divide an integer by a fraction. |
|  | Convert between improper fractions and mixed numbers | Convert and calculate with improper fractions and mixed numbers |  |
| Identify prime numbers. | Define and find factors of numbers.  | Identify square numbers and square roots, cube numbers and cube roots. | Express numbers in prime factor form. |
|  | Define and find multiples of numbers. |  | Find HCF and LCM of two numbers. |
| Know multiplication and division facts to 10x10. | Know multiplication and division facts to 12x12. | Do long division sums without a calculator. | Calculate a division expressing the remainder as either a decimal or fraction.  |
|  | Do long multiplication sums without a calculator. |  | Interpret and solve word problems which include remainders. |
|  | Use BODMAS to perform calculations in the right order. |  |  |

Theme: Algebra

|  |  |  |  |
| --- | --- | --- | --- |
| EMERGINGGrade Descriptor | DEVELOPINGGrade Descriptor | SECUREGrade Descriptor | MASTEREDGrade Descriptor |
| I can… | I can… | I can… | I can… |
| Understand and recognise terms, expressions, equations and formulae. | Collect like terms by addition and subtraction to simplify expressions. | Multiply and divide algebraic terms. | Expand and factorise brackets including quadratics. |
| Generate simple sequences. | Find missing terms by using function machines. | Generate the next term by using double function machines. | Write an expression for the nth term of an arithmetic sequence. |
| Solve a simple one stage equation. | Solve 2-stage equations using function machines. | Solve equations using inverse operations. | Form and solve equations from worded problems. |
| Write simple formulae. | Substitute positive and negative numbers into formulae. | Solve equations with ‘x’ on both sides. | Use trial and improvement to solve equations. Solve equations with x on denominator. |
| Describe and plot coordinates in the first quadrant. | Use coordinates in all four quadrants. | Solve equations with brackets and with non-integer solutions. | Derive formula from worded problems. |
|  |  | Substitute into formulae using negative numbers. | Substitute into formulae with powers.  |
|  |  | Plot and name horizontal, vertical and diagonal lines on a grid. | Rearrange formulae. |
|  |  |  | Find the midpoint of a line segment. |
|  | Find the y intercept of linear graphs | Use various methods for finding gradients of linear graphs | Plot and recognise the graphs of linear functions where y=mx+c |

Theme: Ratio, Proportion & Rates of Change

|  |  |  |  |
| --- | --- | --- | --- |
| EMERGINGGrade Descriptor | DEVELOPINGGrade Descriptor | SECUREGrade Descriptor | MASTEREDGrade Descriptor |
| I can… | I can… | I can… | I can… |
| Recognise ratio notation. | Understand simple ratio. | Share an amount in a given ratio | Understand the link between ratio problems and fractions |
|  | Write ratio in its simplest form. |  | Solve word problems involving ratio. |
|  | Find equivalent ratios. |  | Solve problems involving ratio and direct proportion using the unitary method. |
| Convert between metric measures. | I can choose appropriate units. | Solve problems involving the conversion of metric and imperial measures and make sensible estimates of measures. | Convert between metric measures for area and volume, between cubic cm, ml and litres. |
| Calculate speed | Rearrange speed equation to calculate distance or time | Confidently work with other compound units | Use compound units such as speed, unit pricing and density to solve problems. |
|  | Use scale factors | Work with basic scale diagrams and maps | Work with scale diagrams and maps |
| Understand percentage as ‘out of 100’. | Find percentages of amounts mentally and with a calculator  | Use a calculator to do sums with fractions, decimals and percentages | Calculate percentage increase and decrease (including reverse percentage problems). |
| Know basic fraction/decimal/percentage conversions. | Understand that a multiplicative relationship between two quantities can be expressed as a ratio or a fraction | Relate the language of ratios and the associated calculations to the arithmetic of fractions and to linear functions | Solve problems involving direct and inverse proportion, including graphical and algebraic representations |

Theme: Geometry & Measures

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| --- | --- | --- | --- |
| EMERGINGGrade Descriptor | DEVELOPINGGrade Descriptor | SECUREGrade Descriptor | MASTEREDGrade Descriptor |
| I can… | I can… | I can… | I can… |
| Measure the lengths of lines of a shape. | Find the perimeter of squares, rectangles, regular polygons and compound shapes.  | Calculate the areas of triangles, parallelograms and trapeziums.  | Learn and use the formula for the circumference and area of a circle. |
|  | Calculate the areas of rectangles and squares. | Calculate the area of compound shapes made from rectangles and triangles.  | Use algebraic expressions for perimeter and area. |
|  |  |  | Calculate volumes and surface areas of cuboids. |
| Classify angles using the terms acute, right angle, obtuse, reflex. | Draw and estimate angles. | Measure and draw angles to the nearest degree. | Solve geometric problems using properties of angles, parallel and intersecting lines, triangles and other polygons. |
|  | Find missing angles on a straight line and round a point. | Know the sum of the angles of a triangle. |  |
| Measure acute and obtuse angles. | Give reasons for calculations to find missing angles. | Work out the interior and exterior angles of a polygon. | Work out unknown angles on parallel lines by identifying alternate and corresponding angles. |
| Use compass points. | Draw and measure bearings. | Understand and use bearings to solve problems | Write algebraic equations using angle facts. |
|  |  |  | Understand proof for sum of interior angles of polygons. |
|  |  |  | Use nth term to calculate interior angles of a polygon. |
| Use a compass to construct a circle. | Construct an equilateral triangle. | Construct a triangle given SAS, ASA, SSS information. | Construct a perpendicular bisector, an angle bisector, a 30° angle. |
|  | Construct a regular hexagon. |  |  |
| Identify line symmetry in shapes. | Translate shapes. | Describe the line and rotational symmetry of triangles quadrilaterals. | Transform 2-D shapes on a grid. |
| Reflect shapes in a mirror line. | Rotate shapes. | Translate shapes using column vectors.  | Enlarge shapes given a centre of enlargement and a scale factor. |
|  | Enlarge shapes using a whole number positive scale factor. | Enlarge shapes using a fractional scale factor. | Understand that translations, rotations and reflections preserve lengths and angles. |
|  | Understand the difference between congruence and similarity. | Describe transformations using the correct terminology. |  |

Theme: Probability

|  |  |  |  |
| --- | --- | --- | --- |
| EMERGINGGrade Descriptor | DEVELOPINGGrade Descriptor | SECUREGrade Descriptor | MASTEREDGrade Descriptor |
| I can… | I can… | I can… | I can… |
| Use the language of probability i.e. impossible, unlikely, even chance, likely, certain to describe the likelihood of an event occurring. | Understand and use the probability scale from 0 to 1. | Understand that probabilities can be measured using fractions, decimals or percentages. | Find and record all possible mutual outcomes for single events and two successive events in a systematic way. |
|  |  | Calculate the probability of an event occurring.  | Use the fact that the sum of probabilities in mutually exclusive events is 1, to solve problems. |
|  |  | Understand that different outcomes may result from repeating an experiment. |  |

Theme: Statistics

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| --- | --- | --- | --- |
| EMERGINGGrade Descriptor | DEVELOPINGGrade Descriptor | SECUREGrade Descriptor | MASTEREDGrade Descriptor |
| I can… | I can… | I can… | I can… |
| Gather and organise data using a tally chart. | Group data and display the data using grouped bar charts. | Ask questions, plan how to answer them and collect the data required. | Design a survey or experiment and complete it. |
| Display and interpret data in bar charts and pictograms.   | Use Venn and Carroll diagrams to sort and classify data. | I can interpret graphs and diagrams including pie charts and draw conclusions. | Interpret and draw scatter graphs, describe the correlation and use the line of best fit to estimate values. |
|  | Understand and use frequency tables. | Understand the difference between discrete and continuous data. | Design and use two-way tables and interpret and draw dual bar charts. |
|  |  |  | Construct tables for large discrete and continuous sets of raw data, choosing suitable class intervals, and draw grouped frequency diagrams. |
| Understand the terms mode, mean, median and range. | Calculate the MMMR of a small set of data. | Calculate MMMR from a frequency table. | Calculate MMMR from a grouped frequency table. |
|  |  | Compare two sets of discrete data using the range and one of the averages. | Comment on MMMR of two sets of continuous data. |