MATHS ACROSS THE CURRICULUM

Mathematics is a key skill in students' learning and all learners are entitled to quality experiences in this area. The teaching of Mathematics is the responsibility of all staff at Settle College and this policy further supports the College's drive for consistency in approaches to Literacy and Mathematics across the curriculum. Our aim is to raise the achievement of all learners in the College by seeking to develop their Mathematical skills by consistent and accurate application across the curriculum. We believe that Mathematics can be consolidated and enhanced when students have opportunities to apply and develop them across the curriculum. Poor mathematics skills, in particular, hold back students' progress and can lower their self-esteem. To improve these skills is a whole college matter.

Settle College is committed to:
- Raising the profile of mathematics within the College;
- Raising standards of mathematics;
- Making mathematics teaching an overt part of every curriculum area.

Settle College will:
- Create a positive and attractive environment which celebrates mathematics;
- Ensure that there are activities in the curriculum to allow pupil/students to learn and practise their range of mathematics skills;
- Use and refer to methods in mathematics available through VLE across the curriculum;
- Provide Professional Development on teaching and using mathematics as appropriate.

The College Leadership Team will:
- Support the development and implementation of cross curricular mathematics policy and practice;
- Monitor the effectiveness of cross curricular mathematics strategy in raising standards of achievement;
- Monitor the implementation of the whole College mathematics policy through learning walks and book scrutiny with subject leader;
- Provide Professional Development opportunities and resources for teachers and associate staff as appropriate to further support their own understanding and practical competency in mathematics.

The Leader of Whole School Mathematics will:
- Work with the Leadership Team to determine a strategy for dealing with mathematics across the curriculum and to ensure the effective development of the whole College mathematics policy;
- Monitor the implementation of the whole College mathematics policy through learning walks and book scrutiny with the college Leadership Team;
- Evaluate the effectiveness of the strategy and modify it as necessary;
- Facilitate staff Professional Development on common practices and methods to be adopted across the whole College and provide exemplar materials for use in classroom;
- Work systematically with TAs, Subject Teachers and individual staff;
- Encourage teachers of Mathematics to provide assistance and advice to other staff and subject teachers so that a consistent approach is used across the whole College;
- Raise the profile of mathematics across the whole College;
- Seek opportunities for topics from other subjects to be used in mathematics lessons;
- Ensure publication of mathematical methods to be used consistently across the College on VLE;
- Ensure staff from other subjects are consulted on updates and requirements.

The Role of Staff
In order for the cross curricular strategy to be effective, it is important that all staff:
- Understand what mathematics is;
- Are aware of how they can support the delivery of mathematics within their subject;
- Ensure that mathematical tasks included in their lessons are age and ability appropriate and used accurately;
- Consider mathematics in their short and mid-term planning, using the Mathematics methods/toolkit for guidance or seek additional guidance where required.
The Role of Learning Managers and Subject Leaders

In order that the policy becomes whole College practice, it is important that Learning Managers and Subject Leaders ensure that:

- Schemes of work have opportunities for mathematics included and identified;
- Lesson plans include relevant mathematics learning outcomes;
- Each subject area has identified relevant mathematical methods from those accessible to staff;
- New staff are aware of the Mathematics Policy and its inclusion in the subject area;
- The promotion of mathematics in lessons is included in the regular monitoring of learning and teaching and departmental self-review.

Subject areas will:

Contribute to the raising of mathematics standards within their curriculum area by:

- The provision of high quality exemplar materials;
- The use of relevant ICT (websites/software e.g. MyMaths);
- Displaying examples of mathematics within curriculum based contexts;
- Highlighting opportunities for the use of mathematics within their subject area;
- Ensuring that materials presented to students will match their capability both in subject content and in mathematical demand;
- Ensuring that all staff are familiar with the 'Mathematics Across the Curriculum' document and Toolkit document which support this policy.

Establishing links between Mathematics and other Subject Areas

Mathematics contributes to subject areas across all key stages within the College and often provides practical applications of skills acquired in Mathematics lessons. It is a good opportunity to apply and use Mathematics in real contexts.

The following guidelines summarise the mathematical skills students, of different abilities, should have.

From Key Stage 2 onwards (see tables below for KS3/KS4)

a. All students should:

- Have a sense of the size of a number and where it fits into the number system;
- Be able to do simple addition, subtraction, multiplication and division using either a mental or written method;
- Make estimates of measurement and be able to identify different units of measurement;
- Have a knowledge of the times tables either by recall or by adding on.

b. More Able students should:

- Be able to use mental methods to perform calculations involving addition, subtraction, multiplication and division of numbers including simple decimals;
- Be able to convert between metric units;
- Have a knowledge of simple equivalent fractions, decimals and percentages (1/2, 0.5, 50%, etc.);
- Be able to find a simple percentage of a quantity (10%, 25%, 50% and 100%);
- Be able to perform simple fractions by cancelling common factors;
- Be able to read information from simple diagrams, charts and graphs (bar charts, pictograms and pie charts);
- Make sense of number problems and be able to identify the operations required to solve the problem.

c. High ability students should:

- Calculate accurately using a variety of strategies both mental and written methods, including two and three digit numbers and decimals;
- Be able to identify equivalent fractions, as well as their related decimals and percentages;
- Be able to find the percentage of a quantity with or without a calculator and understand problems involving percentage increase and decrease;
- Explain their methods and reasoning for solving a problem using mathematical language;
- Judge whether their answers are reasonable and have a range of strategies for checking their answers explain and interpret charts, diagrams, graphs and tables.
**English**

Mathematics lessons help to develop literacy skills by teaching mathematical vocabulary and technical terms and by requiring learners to read and interpret problems and identify the mathematics necessary to solve the problem. It also requires learners to explain their methods and strategies to others and present their findings and conclusions. English lessons may provide non-fiction texts in which mathematical information in the form of graphs, tables or charts may need to be interpreted and explained.

**Science**

A large part of the Science curriculum requires the application of mathematical skills. Every part of scientific enquiry (including Working Scientifically at Key Stage 3) requires some mathematical skills. This involves classifying, counting, measuring, calculating, estimating and recording in charts, tables or graphs. It also involves the use of mathematical equations and formulae, where the learners have to use and manipulate various formulae. Science provides the learners with many opportunities to apply mathematical skills in real life contexts.

**Art, Design and Technology**

All of these areas rely quite heavily on the learner being able to measure and use spatial skills and the properties of shapes including the use of symmetry and tessellations. Designs may require enlarging or reducing and the use of ratios and proportions may be required in the context of modifying recipes. Both metric and imperial measurements and conversions may be taught and used. The need for plans in D&T requires students to be able to produce scale drawings and be able to draw 2D and 3D shapes and elevations as well as scale work.

**Business Studies**

Mathematics is an important part of all Business Studies and Economics courses. Learners use mathematics in both the creation and interpretation of graphs, charts and tables. Percentages are widely used in data comparisons. Learners need to be able to calculate using mental calculations but they also need to be confident in the use of a calculator. Skills of analysis are involved when looking at primary and secondary data and in the scrutiny of questionnaire results. Learners also use Excel spread sheets.

**Computing**

Learners will be able to use skills of collecting, classifying and representing data by using data handling software and produce graphs and tables and interpret their results. They may use computer models and simulations that will require their ability to manipulate numbers and identify patterns and relationships. When using programming software, they require arithmetic skill and algebraic understanding to structure, store and manipulate data successfully in their applications. Computational thought is central to the algorithm and programming element of the curriculum which has a strong emphasis on problem solving and logic. The Data and data representation strand of the Computing curriculum requires arithmetic skill to convert to and be able to manipulate different number systems (binary and hex). In addition, programs may require the manipulation of numbers and a knowledge of mathematical methods to enable them to function ie work out the area of a circle. The key to making the most of these opportunities is to identify the mathematical possibilities across the curriculum at the planning stages. Students’ attention should also be drawn to the links between subjects both in mathematics lessons and when using mathematical skills in other areas of the curriculum.

**History and Geography**

In History and Geography learners may collect data by measuring or counting and record results in the form of charts, tables or graphs. They will also need to interpret data presented in the form of charts or graphs. Historical ideas require an understanding of time and time lines similar to the number line. Map skills require the understanding of coordinates and ideas of angles, directions, position, scale and ratios, height, length movement.

**Modern Foreign Languages (MFL)**

Learners use mathematics in MFL when learning to tell the time, calculating café bills, handling money, working on days and dates and doing simple arithmetic calculations involving addition, subtraction and multiplication. Work in MFL offers some learners the additional opportunity they need to grasp the fundamentals of number work.
**Physical Education**

Mathematics is a vital part of PE. Students use maths to calculate with time, speed and space. They need to interpret data to be able to analyse improvement in progress and achievement through their performance. Coaches and officials within PE also use data and percentages to support the decision making that affects students’ progress and achievement. Most able students will be able to use calculations to analyse acceleration and deceleration. Some students will also be able to use advanced maths such as trajectories to improve their performance. Students will also be able to use graphs and excel spread sheets to scrutinise progress and achievement.

**All subjects**

Assessment results and targets will often be placed in a numerical context, such as percentages or grade boundaries, which require scaling and a sense of ratio or proportion.

See tables over for KS3/KS4:
<table>
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<tr>
<th>Maths Skills across the curriculum</th>
<th>up to/incl. level 4 / grade F</th>
<th>up to/incl. level 5 / grade D-E</th>
<th>up to/incl. level 6 / up to grade C</th>
<th>level 7+ / grade C and beyond</th>
</tr>
</thead>
</table>
| Have a sense of the size of a number and where it fits into the number system | Place value, ordering and rounding
- Recognise and extend number sequences.
- Estimate by approximating (round to nearest 10, 100 or 1000). | Place value, ordering and rounding
- Compare and order decimals; know that when comparing measurements they must be in the same units.
- Round positive whole numbers to the nearest 10, 100 or 1000 and decimals to the nearest whole number or one decimal place. | Place value, ordering and rounding
- Round decimals to the nearest whole number or to one or two decimal places. | Place value, ordering and rounding
- Multiply and divide by any integer power of 10.  
- Understand upper and lower bounds; round numbers to three decimal places and a given number of significant figures.  
- Begin to write numbers in standard form. |
| Recall mathematical facts confidently, accurately and efficiently, both mentally and with pencil and paper, drawing on a range of calculation strategies | Calculations with whole numbers and decimals
- Understand and use the relationships between the four operations, and the principles of the arithmetic laws.
- Use brackets.
- Add and subtract two two-digit numbers mentally.
- Use column addition and subtraction of numbers involving decimals.
- Know multiplication facts to 10 and use for division facts.
- Multiply a two-digit number by a single-digit number mentally. | Calculations with whole numbers and decimals
- Know and use the order of operations, including brackets.
- Use standard column procedures to add and subtract whole numbers and decimals with up to two places.
- Multiply and divide three-digit by two-digit whole numbers; extend to multiplying and dividing decimals with one or two places by single-digit whole numbers. | Calculations with whole numbers and decimals
- Use the order of operations, including brackets, with more complex calculations.  
- Use standard column procedures for multiplication and division of integers and decimals; understand where to position the decimal point by considering equivalent calculations. | Calculations with whole numbers and decimals
- Understand the effects of multiplying and dividing by numbers between 0 and 1. |
| Calculate using fractions, decimals and percentages and use proportional reasoning to simplify and solve problems | Fractions, decimals, percentages, ratio and proportion
- Reduce a fraction to its simplest form by cancelling common factors.
- Use a fraction as an 'operator' to find fractions of numbers or quantities.
- Order a mixed set of numbers or measurements with up to three decimal places.
- Understand percentage as the number of parts in every 100.
- Find simple percentages of small whole-number quantities. | Fractions, decimals, percentages, ratio and proportion
- Simplify fractions by cancelling all common factors.
- Recognise the equivalence of percentages, fractions and decimals.
- Calculate simple percentages and fractions of quantities.
- Use ratio notation, reduce a ratio to its simplest form, and divide a quantity into two parts in a given ratio.
- Solve simple problems about ratio and proportion using informal strategies. | Fractions, decimals, percentages, ratio and proportion
- Add and subtract fractions by writing them with a common denominator; calculate fractions of quantities.  
- Calculate percentages and find the outcome of a given percentage increase or decrease.  
- Reduce a ratio expressed in different units to its simplest form; divide a quantity into two or more parts in a given ratio.  
- Use the unitary method to solve simple word problems involving ratio and direct proportion. | Fractions, decimals, percentages, ratio and proportion
- Add, subtract, multiply and divide fractions; cancel common factors before multiplying or dividing.  
- Compare two ratios; interpret and use ratio in a range of contexts.  
- Use proportional reasoning to solve a problem, choosing the correct numbers to take as 100%, or as a whole. |
<table>
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<tr>
<th>Use calculators appropriately and efficiently and select from the display the number of figures appropriate to the context of a calculation.</th>
<th>Calculator methods</th>
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<tbody>
<tr>
<td>• Develop calculator skills and use a calculator effectively.</td>
<td>• Carry out calculations with more than one step using brackets and the memory; use the square root and sign change keys.</td>
<td>• Carry out more difficult calculations effectively and efficiently using the function keys for sign change, powers, roots and fractions; use brackets and the memory.</td>
<td>• 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.</td>
<td>• Use the constant ( \pi ) and sign change keys, function keys for powers, roots and fractions, brackets and the memory.</td>
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<tr>
<th>Use simple formulae and substitute numbers in them</th>
<th>Reasoning and generalising</th>
<th>Equations, formulae and identities</th>
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<tr>
<td>• Develop from explaining a generalised relationship in words to expressing it in a formula, using letters as symbols.</td>
<td>• Use simple formulae; substitute positive integers into simple linear expressions and formulae and, in simple cases, derive a formula.</td>
<td>• Use formulae; substitute integers into simple formulae, including examples that lead to an equation to solve.</td>
<td>• Use more complex formulae; substitute numbers into expressions and formulae; derive a formula and, in simple cases change its subject.</td>
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<tr>
<th>Measure and estimate measurements, choosing suitable units and reading numbers correctly from a range of meters, dials and scales</th>
<th>Measures</th>
<th>Measures and mensuration</th>
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<tbody>
<tr>
<td>• Use, read and write standard metric units.</td>
<td>• Measure, estimate, calculate and solve problems involving length, area, mass, capacity and angle.</td>
<td>• Measure, estimate, calculate and solve problems involving length, area, volume, capacity, mass, angle and bearings.</td>
<td>• Measure, estimate, calculate and solve problems in a variety of contexts.</td>
<td>• Convert between area measures (( \text{mm}^2 ) to ( \text{cm}^2 ), ( \text{cm}^2 ) to ( \text{m}^2 ), and vice versa).</td>
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<td>• Convert smaller to larger units, and vice versa.</td>
<td>• Know rough equivalents between common metric and imperial units.</td>
<td>• Know rough metric equivalents of imperial measures in daily use (feet, miles, pounds, pints, gallons).</td>
<td>• Recognise that measurements given to the nearest whole unit may be inaccurate by up to one half of the unit in either direction.</td>
<td></td>
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<tr>
<td>• Record estimates and readings from scales to a suitable degree of accuracy.</td>
<td>• Read and interpret scales on a range of measuring instruments.</td>
<td>• Convert one metric unit to another (e.g. ( \text{g} ) to ( \text{kg} )).</td>
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<tr>
<th>Calculate simple perimeters, areas and volumes, recognising the degree of accuracy that can be achieved</th>
<th>Measures</th>
<th>Measures and mensuration</th>
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<tr>
<td>• Calculate the perimeter and area of simple compound shapes that can be split into rectangles.</td>
<td>• Use the formula for the area of a rectangle; calculate the perimeter and area of shapes made from rectangles.</td>
<td>• Use formulae for the area of a triangle, parallelogram and trapezium.</td>
<td>• Use the formula for the circumference and area of a circle.</td>
<td>• Calculate the surface area and volume of right prisms.</td>
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<td>• Use the formula for the area of a cuboid.</td>
<td>• Calculate the surface area of cubes and cuboids.</td>
<td>• Use the formula for the volume of a cuboid.</td>
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<tr>
<td>Understand and use measures of <strong>time</strong> and <strong>speed</strong>, and <strong>rates</strong> such as £ per hour or miles per litre</td>
<td><strong>Measures</strong></td>
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<td>Appreciate different times around the world.</td>
<td><strong>Measure</strong>, estimate, calculate and solve problems involving time.</td>
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<td><strong>Measure</strong>, estimate, calculate and solve problems involving time.</td>
<td>Understand and use measures of speed, and other compound measures such as density and pressure.</td>
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<td>Solve problems using time.</td>
<td><strong>Sequences, functions and graphs</strong></td>
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<td><strong>Sequences, functions and graphs</strong></td>
<td>Solve problems involving constant or average rates of change.</td>
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<td><strong>Measures and mensuration</strong></td>
<td><strong>Sequence, functions and graphs</strong></td>
<td><strong>Sequence, functions and graphs</strong></td>
<td><strong>Sequence, functions and graphs</strong></td>
<td>Plot graphs of functions arising from real-life problems; interpret graphs arising from real situations.</td>
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<td><strong>Measure</strong>, estimate, calculate and solve problems involving time.</td>
<td><strong>Plot the graphs of linear functions arising from real-life problems; discuss and interpret graphs arising from real situations.</strong></td>
<td><strong>Plot the graphs of linear functions arising from real-life problems; discuss and interpret graphs arising from real situations.</strong></td>
<td><strong>Plot graphs of functions arising from real-life problems; interpret graphs arising from real situations, including distance-time graphs.</strong></td>
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<tr>
<th><strong>Draw plane figures to given specifications and appreciate the concept of scale in geometrical drawings and maps</strong></th>
<th><strong>Construction</strong></th>
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<tr>
<td>Measure and draw lines to nearest mm.</td>
<td>Measure and draw lines to the nearest millimetre and angles to the nearest degree.</td>
<td>Use straight edge and compasses to construct: the mid-point and perpendicular bisector of a line segment; the bisector of an angle; the perpendicular from a point to a line; the perpendicular from a point on a line.</td>
<td>Use straight edge and compasses to construct: the mid-point and perpendicular bisector of a line segment; the bisector of an angle; the perpendicular from a point to a line; the perpendicular from a point on a line.</td>
<td>Use straight edge and compasses to construct triangles.</td>
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<td>Measure and draw acute and obtuse angles to the nearest degree.</td>
<td>Use coordinates in all four quadrants.</td>
<td>Recognise reflection symmetry and rotation symmetry in 2-D shapes.</td>
<td>Recognise reflection symmetry and rotation symmetry in 2-D shapes.</td>
<td>Use coordinates in all four quadrants.</td>
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<td>Recognise where a shape will be after: reflection; two translations; a rotation of 90° about one of its vertices.</td>
<td>Use coordinates in all four quadrants.</td>
<td>Recognise translations of 2-D shapes.</td>
<td>Recognise translations of 2-D shapes.</td>
<td>Recognise reflection symmetry and rotation symmetry in 2-D shapes.</td>
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<th><strong>Understand the difference between the mean, median and mode and the purpose for which each is used</strong></th>
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**Approved Q&P Feb 2015**
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<th>Collect data, discrete and continuous, and draw, interpret and predict from graphs, diagrams, charts and tables</th>
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**Handling data**

- Solve a problem by representing, extracting and interpreting data in tables, graphs, charts and diagrams.
- Collect small sets of data from surveys and experiments.
- Construct, on paper and using ICT: bar-line graphs; frequency diagrams for grouped discrete data; pie charts.
- Interpret diagrams and graphs, and draw simple conclusions.

**Handling data**

- Collect data by observation, controlled experiment (including data logging), or questionnaire.
- Construct, on paper and using ICT: pie charts for categorical data; bar charts and frequency diagrams for discrete and continuous data; simple line graphs for time series; simple scatter graphs.
- Interpret tables, graphs and diagrams for both discrete and continuous data.

**Handling data**

- Gather data from specified secondary sources, including printed tables and lists from ICT-based sources; determine sample size; design data collection sheets.
- Construct, on paper and using ICT: scatter graphs; line graphs for time series; lines of best fit.
- Have a basic understanding of correlation.

**Probability**

- Use the language associated with probability to discuss events, including those with equally likely outcomes.
- Use the vocabulary and ideas of probability, drawing on experience.
- Use the probability scale from 0 to 1.

**Probability**

- Use the vocabulary of probability when interpreting the results of an experiment; appreciate that random processes are unpredictable.
- Know that if the probability of an event occurring is \( p \), then the probability of it not occurring is \( 1 - p \).
- Estimate probabilities from experimental data.

**Probability**

- Use the vocabulary of probability in interpreting results involving uncertainty and prediction.
- Understand relative frequency as an estimate of probability and use this to compare outcomes of experiments.

**Probability**

- Use the vocabulary of probability in interpreting results involving uncertainty and prediction.
- Understand relative frequency as an estimate of probability and use this to compare outcomes of experiments.

**Use and apply mathematics to solve problems**

- Identify and use appropriate operations (including combinations of operations) to solve word problems involving numbers and quantities.
- Explain methods and reasoning.

**Applying mathematics**

- Solve word problems and investigate in a range of contexts.
- Break a complex calculation into simpler steps, choosing and using appropriate and efficient operations, methods and resources.
- Explain and justify methods and conclusions, orally and in writing.
- Checking results
  - Check the results of calculations.

**Applying mathematics**

- Use logical argument to establish the truth of a statement.
- Represent problems and interpret solutions in algebraic, geometric or graphical form, using correct notation and appropriate diagrams.
- Give solutions to an appropriate degree of accuracy in the context of the problem.
- Checking results
  - Check a result by considering whether it is of the right order of magnitude and by working the problem backwards.

**Applying mathematics**

- Solve substantial problems by breaking them into simpler tasks, using a range of efficient techniques, methods and resources, including ICT.
- Give solutions to an appropriate degree of accuracy, recognising limitations on the accuracy of data and measurements.
- Checking results
  - Check results using appropriate methods.

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