

# NUMERACY POLICY

2016-2017



**Ecclesfield**  
**SCHOOL**

Numeracy is a key pillar of education and it is a core function of the school to equip our students with the skills required to be confidently and creatively numerate. This policy sets out the school's commitment to the numeracy of our students and clarifies how the school's commitment will be enacted by all staff and governors.

Date approved:

Signed:

(Headteacher)

Signed:

(Chair of committee)

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## Ethos

Ecclesfield School understands the power of education to transform lives, communities and society.

We aspire to achieve individual and collective excellence in all that we do through nurturing every student's unique potential, expanding their horizons and promoting their understanding of the invaluable contributions they can make as citizens in a global society.

By fostering our students' spirit of engagement, adventure and ingenuity, we will nurture all young people as fully-rounded individuals, providing them with the challenge and support they require to succeed. We will protect their childhoods, allowing our learners to carry their innate creativity, inquisitiveness and sense of wonder about the world throughout their lives.

Ecclesfield School recognises the importance of students leading rich and diverse lives and will encourage them to seize the opportunities available to them as a means of celebrating the joy and brief wonder of being young.

As staff at Ecclesfield School, we recognise the privilege we enjoy in working with every member of our community. We see it as our public duty to serve this community and to deliver for the students of High Green, Chapeltown and Ecclesfield outstanding outcomes and extraordinary experiences.

## Mathematics department ethos

**We believe that everybody can do mathematics.** As mathematics teachers, we aim to promote and nurture enjoyment and enthusiasm for mathematics. To expect all pupils to reach their full potential and give every pupil the opportunity of succeeding beyond his or her expectation. We will achieve this in part, by catering to individual needs successfully. To develop mathematical self-confidence and problem solving skills; encouraging imagination, flexibility and initiative. To insist on and develop independent thinking. To allow every child opportunity for enquiry and discovery of mathematics for themselves. To show the practical applications of mathematics and links to other facets of everyday life. To deliver this in a supportive and motivating environment through the modelling of growth mind-set approaches to learning.

In particular, we want each pupil to develop:

- A belief that everyone can do mathematics.
- A genuine feeling of how numbers fit together; the ability to carry out calculations, understand the significance of results and estimate whether or not an answer is reasonable.
- The ability to apply mathematics in everyday situations and develop an understanding of the part which maths plays in the world.
- The ability to apply maths to other subjects across the curriculum.
- The ability to solve problems, present solutions clearly, check and interpret results.
- The ability to communicate what they have learned clearly, both in written form and orally.

- The ability to interpret their own and other people's writings about the processes and procedures of mathematics.
- The ability to work individually (including in silence for extended periods) and as part of a group.
- The confidence to experiment and make mistakes, and persevere when problems arise.
- The ability to produce and appreciate imaginative and creative work using mathematical concepts.
- To be reflective learners who see the power of their mistakes and harness it to improve.
- To be proactive in taking ownership for their learning.

## **Statement of Intent**

Ecclesfield School is committed to:

- Developing, maintaining and improving standards in numeracy across the school.
- Ensuring consistency of practice, including methods, vocabulary, notation etc.
- Finding areas for collaboration between subjects.
- Assisting the transfer of students' knowledge, skills and understanding between subjects.
- Ensuring that all teachers are teachers of numeracy.

Teachers will use every relevant subject to develop students' mathematical fluency. Confidence in numeracy and other mathematical skills is a precondition of success across the national curriculum.

# 1. Key roles and responsibilities

- 1.1. The Governing Body has overall responsibility for the implementation of this Numeracy Policy and procedures.
- 1.2. The Governing Body has overall responsibility for ensuring that this Numeracy Policy, as written, does not discriminate on any grounds, including but not limited to ethnicity/national origin, culture, religion, gender, disability or sexual orientation.
- 1.3. The Governing Body has overall responsibility for annually reviewing the Numeracy Policy.
- 1.4. The Headteacher has responsibility for handling complaints regarding this policy as outlined in the school's Complaints Policy.
- 1.5. The Director of maths will be responsible for the day-to-day implementation and management of this Numeracy Policy and procedures.
- 1.6. The Director of Mathematics will be responsible for liaising with teachers across all of the departments to facilitate the delivery of cross-curricular numeracy skills.
- 1.7. The mathematics department will be responsible for teaching basic mathematics skills.
- 1.8. All teachers will be responsible for making and taking opportunities to develop numeracy skills across their subjects.

# 2. Definitions

- 2.1. Numeracy is the capacity to take mathematics and apply knowledge, skills and strategies to deal with everyday life in a variety of situations.
- 2.2. For the purposes of this policy, numeracy has been sub-divided into four key areas: [Handling Information](#), [Shape, Space and Measure](#), [Operations and Calculations](#) and [Numbers](#).
- 2.3. For the purposes of this policy, we have identified three core skills: [Reasoning](#), [Problem Solving](#) and [Decision-making](#).
- 2.4. Numerate students are able to:
  - Understand the size of a number and where it fits into the number system
  - Read numbers correctly from a range of equipment
  - Know and recall basic number facts and use mental arithmetic
  - Use calculators and other equipment to solve mathematical problems
  - Work confidently with the four operations (+, -, x and ÷)
  - Know and recall their times tables up to 12 x 12
  - Know and recall their square numbers and the corresponding square roots up to 15 x 15
  - Know when answers are reasonable and give accurate results
  - Manipulate algebraic expressions and simple formulae
  - Understand and use correct mathematical notation and terminology
  - Explain methods, reasoning and conclusions

- Use units of measurement of length, angle, mass, capacity and time
- Suggest suitable units for measuring
- Make sensible estimates of measurements and measure accurately using a range of apparatus
- Understand and use compound measures and rates
- Use simple formulae and substitute numbers in them
- Measure and estimate measurements, choosing suitable units, and calculate simple perimeters, areas and volumes
- Understand the concept of scale in geometrical drawings and maps
- Understand the difference between the mean, median and mode, and the purpose for which each is used
- Effectively use proportional reasoning
- Understand the equivalence between fractions, decimals and percentages and use the latter in a variety of situations
- Collect data, draw, interpret and predict from graphs, diagrams, charts and tables
- Understand probability and risk

2.5. Numerate students are able to deal with numbers in real life situations, such as:

- Calculating change when shopping
- Creating a household budget
- Calculating compound interest on a loan
- Calculating interest on savings
- Deciding which gas / electricity supplier to use
- Understanding interest rates when opening a bank account
- Recovering from debt

### 3. Numeracy audits

- 3.1. Heads of department will complete a [subject specific numeracy audit](#).
- 3.2. Based on the subject specific numeracy audit, the Director of Mathematics will complete a [whole school numeracy audit](#) to ensure that numeracy skills are covered for each year group across the curriculum.

### 4. Our commitment to developing Numeracy Skills

We will ensure that all members of staff:

- 4.1. adheres to the school's numeracy policy;
- 4.2. create a positive environment that celebrates numeracy and provides students with role-models by celebrating the numeracy successes of older students;
- 4.3. plan activities to allow students to learn and practice their numeracy skills;
- 4.4. publicly display examples of high-quality numeracy work from across the curriculum.

Individual departments will:

- 4.5. ensure that they are teaching mathematics in a clear and consistent way, as set out by the Director of Mathematics in the supporting numeracy methods booklet.

- 4.6. highlight the opportunities for the use of numeracy within their subject and ensure that the learning materials that are presented to students match both their capability in the subject and their numerical demands.

All members of staff will:

- 4.7. have high expectations of all their students and ensure that the numerical content of their lesson is of high standard;
- 4.8. encourage students to show their numerical working out where relevant and encourage the use of estimation, particularly for checking work;
- 4.9. encourage students to write mathematically correct statements and to vocalise their mathematics;
- 4.10. encourage students to use non-calculator methods wherever possible;
- 4.11. inform the mathematics department as soon as possible if any numeracy problems are identified;
- 4.12. Encourage and support Key Stage 3 students to pass their numeracy competencies at Y7 and Y8 that will contribute to their Ecclesfield GRIT passport.

## 5. Key stage 3

- 5.1. Students at key stage 3 will be taught the following numeracy skills across the curriculum:

- Place value, ordering and rounding
- Calculations with whole numbers and decimals
- Fractions, decimals, percentages, ratios and proportions
- Calculator methods
- Reasoning and generalising
- Measures
- Coordinates
- Transformations
- Handling data
- Applying mathematics.
- Checking results

- 5.2. In mathematics, students at key stage 3 will be taught to:

- 5.2.1. Develop fluency in mathematics by:

- Learning to consolidate numerical and mathematical skills learned at primary school and developing further understanding of the number system and place value to include decimals, fractions, powers and roots
- Developing an ability to use appropriate calculation methods to solve increasingly difficult problems
- Using algebra to generalise the structure of arithmetic

- Substituting values in expressions, rearranging and simplifying expressions, and solving equations
- Moving freely between different numerical, algebraic, graphical and diagrammatic representations
- Using mathematical language

#### 5.2.2. Reason mathematically by:

- Increasing their understanding of the number system
- Make connections between number relationships and their algebraic and graphical representations
- Developing their knowledge of ratio and proportion, in working with measures and geometry, and in formulating proportional relations algebraically
- Identifying variables and expressing relations between variables algebraically
- Making and testing estimations about patterns and relationships and looking for proofs or counter-examples
- Learning deductive reasoning
- Interpreting when the structure of a numerical problem requires additive, multiplicative or proportional reasoning
- Exploring what can and cannot be inferred in statistical and probabilistic settings, and beginning to express their arguments formally

#### 5.2.3. Solve problems and make decisions by:

- Developing their mathematical knowledge through problem solving and evaluating the outcomes
- Developing their use of formal mathematical knowledge to interpret and solve problems, including in financial mathematics
- Beginning to model situations mathematically and learning to express the results using a range of formal mathematical representations
- Selecting appropriate concepts, methods and techniques to apply to unfamiliar and non-routine problems

## 6. Key stage 4

### 6.1. Students will be taught to:

#### 6.1.1. Use correct mathematical representation by:

- Identifying the mathematical aspects of the situation or problem
- Comparing and evaluating representations of a situation before making a choice
- Simplifying the situation or problem in order to represent it mathematically using appropriate variables, symbols, diagrams and models
- Selecting mathematical information, methods, tools and models to use

#### 6.1.2. Analyse mathematically by:

- Making connections within mathematics
- Using knowledge of related problems
- Visualising and working with dynamic images
- Identifying and classifying patterns

- Making and justifying conjectures and generalisations, considering special cases and counter-examples
- Exploring the effects of varying values and looking for invariance and covariance.
- Taking account of feedback and learning from mistakes
- Working logically towards results and solutions, recognising the impact of constraints and assumptions
- Identifying a range of techniques that could be used to tackle a problem, appreciating that more than one approach may be necessary
- Reasoning inductively, deducing and proving

6.1.3. Use appropriate mathematical procedures by:

- Making accurate mathematical diagrams, graphs and constructions on paper and on screen
- Calculating accurately, using mental methods or calculating devices as appropriate.
- Manipulating numbers, algebraic expressions and equations and applying routine algorithms
- Using accurate notation, including correct syntax when using ICT to record methods, solutions and conclusions
- Estimating, approximating and checking working

6.1.4. Interpreting and evaluating data by:

- Creating convincing arguments to justify findings and general statements
- Considering the assumptions made and the appropriateness and accuracy of results and conclusions
- Appreciating the strength of empirical evidence and distinguishing between evidence and proof
- Finding patterns and exceptions in data
- Relating their findings to the original question or conjecture, and indicating reliability
- Making sense of someone else's findings and judging their value in the light of the evidence they present
- Critically examining strategies adopted

6.1.5. Communicating and reflecting on data by:

- Using a range of formats to communicate findings to different audiences
- Engaging in mathematical discussion
- Considering the elegance and efficiency of alternative solutions
- Looking for equivalence in relation to both the different approaches to the problem and different problems with similar structures
- Giving examples of similar contexts they have previously encountered and identifying how these contexts differed from, or were similar to, the current situation and how and why the same, or different, strategies were used

## 7. Supporting documentation

7.1 This policy will be supported by the following two documents:

- A numeracy action plan that will form part of the whole school action plan. This will be reviewed three times during each academic year and rewritten every year to be in line with current priorities
- A numeracy methods booklet. This will be written and kept up to date by the Director of Mathematics. It will set out a consistent way to use and apply methods in numeracy across the school

## Appendix 1: Subject specific numeracy audit

(name of curriculum area)			
Mathematical Skill	Year group	Topic	Task/Activity
Sort and classify objects by more than one criterion.			
Record results in simple lists, tables and block graphs.			
Interpret simple tables and lists.			
Interpret pictograms.			
Draw pictograms.			
Interpret bar graphs.			
Draw bar graphs.			
Collect data and record them using frequency tables.			
Understand and use the mode, the median and the range of a set of data.			
Group collected data into equal class intervals.			
Draw frequency diagrams using grouped data.			
Interpret line graphs.			
Select and use appropriate scales for axes.			

(name of curriculum area)			
Mathematical Skill	Year group	Topic	Task/Activity
Draw line graphs.			
Use the vocabulary of probability.			
Understand and use the mean of a set of data.			
Use averages and ranges to compare two sets of data.			
Understand simple correlation.			
Specify and test hypotheses using appropriate methods and taking account of variability and bias.			
Use two-way tables to record all the possible outcomes of two events.			
Estimate the mean, median and range of grouped data.			
Draw a scatter diagram			
Draw a line of best fit on a scatter diagram.			
Understand and use sampling.			
Use basic arithmetic ( +, -, x, ÷ ) with numbers without a calculator.			
Use basic arithmetic ( +, -, x, ÷ ) with numbers with a calculator.			
Work out percentage of amounts.			
Work out fractions of amounts.			
Work with fractions and the four main operations ( +, -, x, ÷ ).			

<b>(name of curriculum area)</b>			
<b>Mathematical Skill</b>	<b>Year group</b>	<b>Topic</b>	<b>Task/Activity</b>
Identify shapes.			
Recall shape properties and apply these to solve problems.			
Plot and use coordinates.			
Measure lengths.			
Convert between different units of length/mass/capacity.			
Measure angles.			
Solve proportion problems.			
Use ratios.			
Apply deductive reasoning.			
Solve a problem where some information is missing.			
Solve a problem when they have a surplus of information.			
Spot patterns and generalise.			
Look for exceptions to patterns and rules.			
Use algebra to represent an unknown quantity.			
Substitute into given formulae.			
Recall formulae.			
Manipulate formulae.			

## Appendix 2: Whole school numeracy audit

Mathematical Skill	Year 7	Year 8	Year 9	Year 10	Year 11
	<b>Subjects</b>				
Sort and classify objects by more than one criterion.					
Record results in simple lists, tables and block graphs.					
Interpret simple tables and lists.					
Interpret pictograms.					
Draw pictograms.					
Interpret bar graphs.					
Draw bar graphs.					
Collect data and record them using frequency tables.					
Understand and use the mode, the median and the range of a set of data.					
Group collected data into equal class intervals.					
Draw frequency diagrams using grouped data.					
Interpret line graphs.					
Select and use appropriate scales for axes.					
Draw line graphs.					
Use the vocabulary of probability.					
Understand and use the mean of a set of data.					
Use averages and ranges to compare two sets of data.					
Understand simple correlation.					
Specify and test hypotheses using appropriate methods and taking account of variability and bias.					

<b>Mathematical Skill</b>	<b>Year 7</b>	<b>Year 8</b>	<b>Year 9</b>	<b>Year 10</b>	<b>Year 11</b>
Use two-way tables to record all the possible outcomes of two events.					
Estimate the mean, median and range of grouped data.					
Draw a scatter diagram					
Draw a line of best fit on a scatter diagram.					
Understand and use sampling.					
Use basic arithmetic ( +, -, x, ÷ ) with numbers without a calculator.					
Use basic arithmetic ( +, -, x, ÷ ) with numbers with a calculator.					
Work out percentage of amounts.					
Work out fractions of amounts.					
Work with fractions and the four main operations ( +, -, x, ÷ ).					
Identify shapes.					
Recall shape properties and apply these to solve problems.					
Plot and use coordinates.					
Measure lengths.					
Convert between different units of length/mass/capacity.					
Measure angles.					
Solve proportion problems.					
Use ratios.					
Apply deductive reasoning.					
Solve a problem where some information is missing.					
Solve a problem when they have a surplus of information.					
Spot patterns and generalise.					

<b>Mathematical Skill</b>	<b>Year 7</b>	<b>Year 8</b>	<b>Year 9</b>	<b>Year 10</b>	<b>Year 11</b>
Look for exceptions to patterns and rules.					
Use algebra to represent an unknown quantity.					
Substitute into given formulae.					
Recall formulae.					
Manipulate formulae.					

# Appendix 3: Key Terminology

## 1 Handling information

This is about graphs and charts, comparing sets of data and types of data, processing data, and probability. Within graphs and charts, you might look at pie and bar charts. You might look at interpreting information, you might look at data in lists and tables, and you might look at reading scales.

Within comparing sets of data and types of data, you might look at measures of averages, measures of spread, discrete data and continuous data. Within processing data, you might look at decision trees and Venn diagrams. Within probability, you might look at using a probability scale, estimating probability from statistical information, and experimental probability.

## 2 Space, shape and measurements

Within measurements, you might look at standard units of measurements for length, mass, capacity, time, temperature, and area and perimeter, and consider both metric and imperial measurements. You might select and use measuring instruments and look at how to interpret numbers and read scales. You might also look at volume.

Within shape and space, you might look at coordinates to describe a position. You might look at simple positional language. You might look at symmetry. You might look at 2D and 3D shapes.

And you might look at angles. Solving problems with space, shape and measurements might involve selecting and using appropriate skills to solve geographical problems. It might involve using geographical notation and symbols correctly.

## 3 Operations and calculations

This is about addition and subtraction, multiplication and division, number operations, and the effective use of calculators. Within addition and subtraction you might look at knowing plus and minus facts to 20, at mental methods to 100, and at whole numbers to 1,000 and beyond.

Within multiplication and division you might look at knowing multiply and divide facts to 20, and remainders and rounding. Within number operations you might look at inverse operations, inter-relationships and order of operations. And within the effective use of calculators you might look at calculations with fractions, decimals and percentages, and calculations with negatives.

## 4 Numbers

Numbers (and the use of the number system) is about using numbers, whole numbers, size and order, place value, patterns and sequences, and numbers "in between" whole numbers. Within using numbers you might look at reading and writing using symbols and labels, at ratio and proportion, at using numbers for measuring and for counting, and for ratio and proportion.

Within whole numbers and size and order you might look at comparing and ordering and using number lines. Within place value you might look at zero as a place holder, at money context, at measures and at estimation. Within sequences and patterns you might look at odd and even, at square numbers, at factors and multiples and at prime numbers. And within numbers "in between" whole numbers you might look at fractions, decimals and percentages.

## Three key numeracy skills

Numeracy encompasses three sets of skills: reasoning, problem-solving and decision-making.

**Reasoning** might involve identifying structures, being systematic, searching for patterns, developing logical thinking, and predicting and checking. **Problem-solving** might involve identifying the information needed to carry out a task, breaking down a problem or task into smaller parts, interpreting solutions in context, and making mental estimates to check the reasonableness of an answer. And **Decision-making** might involve choosing appropriate strategies, identifying relevant information and choosing the right tools and equipment.