**NUMERACY POLICY**

Introduction

Aspire North East Multi Academy Trust is committed to raising the standards of numeracy of all of its students; we want our pupils to be confident and capable in the use of numeracy to support their learning in all areas of the curriculum and to acquire the skills necessary to help achieve success in further education, employment and adult life.

What is Numeracy?

"The ability to understand and work with numbers" (Oxford English Dictionary).

Numeracy is the fluency with numbers and the ability to make use of mathematical skills, enabling a person to cope with the practical mathematical demands of everyday life. A numerate student should be able to appreciate and understand some of the ways in which mathematics can be used as a means of communication.
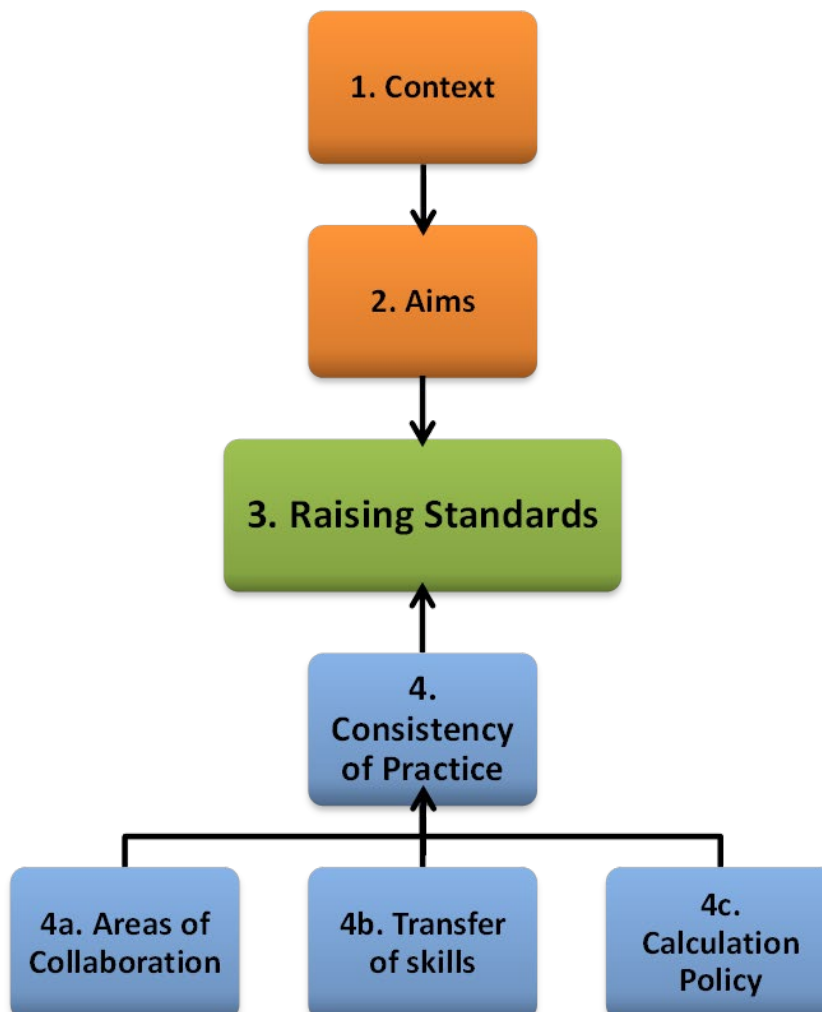
1. **Context**

Some students enter Aspire North East Multi Academy Trust with literacy and numeracy skills as barriers to their learning. As a result, in order to ensure accelerated progress throughout KS3 and KS4 the Trust has developed calculation, numeracy and literacy polices.

2. **Aims**

- To develop students' skills and application of numeracy across the curriculum in order that students are able to make accelerated progress.
- To raise the standards of numeracy of all students, so they develop the ability to use numeracy skills effectively in all areas of the curriculum and the skills necessary to cope confidently with the demands of further education, employment and adult life.
- To ensure consistency of practice including methods, vocabulary, notation, etc.
- To indicate areas for collaboration between subjects.
- To encourage learners to transfer mathematical skills and apply them in everyday and unknown contexts.
- To adopt a whole Trust approach to numeracy across the curriculum in order to raise standards of attainment for all learners.
- To recognise the importance of numeracy in all subjects across the curriculum.
- To identify similarities and differences in mathematical teaching in different curriculum areas and develop a common approach.
- To encourage staff to take responsibility for the development of numeracy in each subject area and to support staff in other subjects by compiling numeracy audits each year.
- To raise staff and pupil awareness of key numeracy strategies.

3. **Raising Standards**

Raising standards in numeracy across the Trust cannot be solely judged in increased test percentages. There is a need to evaluate the pupils' ability to transfer mathematical skills into other subject areas, applying techniques to problem solving. Their confidence in attempting this is initially as important as achieving the correct solution. The Senior Leadership Team also has a commitment to the implementation and evaluation of this work. They are aware of the need to create time for liaison to sustain the cross curricular links forged between subject areas. The effectiveness of these links will reduce the replication of work by teachers and pupils.

4. **Consistency of Practice**

Improving numeracy skills is a whole-school matter. Each department should identify the contribution it can make towards the teaching of numeracy and other mathematical skills through the yearly numeracy audit. So that pupils become confident in tackling mathematics in any context, the teaching of numeracy is the responsibility of all staff and the Trust's approaches should be as consistent as possible across the curriculum.

Areas of Collaboration
Staff need to look for opportunities for drawing mathematical experience out of a wide range of children's activities. Mathematics contributes to many subjects of the curriculum, often in practical ways. Activities such as recording the growth of a plant or an animal, measuring temperature and rainfall, or investigating the cog wheels in a bicycle can provide data or starting points for discussion

and the opportunities to apply and use mathematics in real contexts. The key to making the most of all these opportunities is to identify the mathematical possibilities in your subject at the planning stage.

- All teachers should consider pupils' ability to cope with the numerical demands of everyday life.
- All departments have a responsibility for identifying aspects of their schemes of work that contribute to raising standards of numeracy and highlighting these aspects, in their planning and making them explicit to learners.
- All staff should encourage and promote the use of problem solving.
- Raise the profile of mathematics throughout the school promoting the use of numbers and measures whenever possible.
- Adopt a consistent approach to teaching numeracy skills.
- Be familiar with and use strategies to equip students with numeracy skills for life.
- Indicate in schemes of work where numeracy skills are taught.
- Handle number and measurement competently, mentally, orally and in writing.
- Use calculators consistently, accurately and appropriately.
- Interpret and use numerical and statistical data represented in a variety of forms.

Teachers of mathematics will:
Ensure consistency of practice as mentioned above, mathematics teachers and teachers of other subjects co-operate on agreed strategies;
- Be aware of the mathematical techniques used in other subjects and provide assistance and advice to other departments, so that a correct and consistent approach is used in all subjects.
- Offer support and guidance to other departments on developing mastery in mathematics.
- Provide information to other subject teachers on appropriate expectations of students and difficulties likely to be experienced in various age and ability groups.
- Liaise with other teachers, attempt to ensure that students have appropriate numeracy skills by the time they are needed for work in other subjects across the curriculum.
- Seek opportunities to use topics and examination questions from other subjects in mathematics lessons.

Teachers of subjects other than mathematics:
It is important to recognise that all teachers are teachers of numeracy. It is the key for academic success and the long-term sustainable improvement in pupil attainment. Teachers of subjects other than mathematics will:
- Ensure they are familiar with correct mathematical language, notation, conventions and techniques, relating to their own subject, and encourage students to use these correctly;
- Be aware of appropriate expectations of students and difficulties that might be experienced with numeracy skills;
- Provide information for mathematics teachers on the stage at which specific numeracy skills will be required for particular groups;
- Provide resources for mathematics teachers to enable them to use examples of applications of numeracy relating to other subject in mathematics lessons.
- Encourage the use of mental work in the classroom and frequently ask learners to explain their answers. Providing opportunities for learners to discuss enabling them to share and compare ideas.
- Question learners on strategies undertaken and promote the use of problems solving. Discuss efficiency of calculations encouraging learners to develop their own methods.
- Regularly ask learners to consider 'rough' answers and invite them to estimate using these to provide a suitable check for their answers.

- Encourage the learning of facts and skills providing learners with opportunities to practice times tables.
- Use diagrams and equipment to aid understanding when possible.
- Use mathematical words often to familiarise learners with their meanings and to develop their understanding.
- Support and encourage the use of the numeracy policy throughout.

Transfer of Skills

The Mathematics Department will deliver the National Curriculum knowledge, skills and understanding through the Numeracy Framework using direct interactive teaching, predominantly in lessons. They will make references to the applications of Mathematics in other subject areas and give contexts to many topics. The transfer of skills is something that many pupils find difficult – especially if the approaches in other subjects differ significantly from those in the Mathematics Department. This will include updating and communicating numeracy ages on SIMs so that all staff are aware of the numeracy abilities of their students.

Specific Cross Curricular Mathematical Links

The Aspire North East Multi Academy Trust is also committed to developing cross curricular links between subjects. In terms of the cross curricular links with a numerical focus, we can see the following links:

Art and Technology:

Measurements are often needed in art and design and technology. Many patterns and constructions are based on spatial ideas and properties of shapes, including symmetry. Designs may need enlarging or reducing, introducing ideas of scaling and ratio.

Business

Students of business will be expected to calculate profit, loss and revenue.

Computing:

Learners will apply and use mathematics in a variety of ways when they solve problems using ICT. For example:
- Binary to hexadecimal - addition / subtraction
- Databases - recording data
- Flowol - sequence of instructions, including directional instructions
- Programming - problem solving
- Modelling - creating graphs
- Modelling - sums, averages

Graph skills are also a key part of ICT, with students expected to be able to read and interpret line graphs, pie charts and other data representations.

English:

The English department can help students improve their reading fluency, specifically helping them interpret the demands of abstract scenario based mathematical examination questions.

Engineering:

Mathematics forms the basis of a great deal of the engineering studied at GCSE. Students will be exposed to a vast range of topics including working with percentages and standard form; geometry skills including working with shapes and orthographic drawing and working with compound measures such as density and speed.

Food Technology:

Numeracy has a vital role in food technology, learners will be exposed to:

- a great deal of measurements, including working out times, measuring masses of solids and volumes of liquids using various apparatus
- there are opportunities to calculate the quantity of ingredients required when a recipe is adapted to feed different numbers of people
- costs may need to be calculated

Geography:

In geography students have opportunities to collect, present and interpret data. It is important that there is consistency in the way that number skills and data handling is taught in mathematics and geography. In addition, map work involves the use of coordinates (6 figure grid references), map scales and compass bearings. There is significant overlap in the area of averages and substitution, with A-Level geography encompassing even more advanced mathematical principles such as Spearman's Rank.

History:

Timelines are of significant importance in history and it is important that pupils can can not only calculate the passage of time between historical events, but grasp the magnitude of time between events and eras.

MFL:

Aspects of mathematics such as counting, calculations, money, the time and the date can be explored in MFL lessons.

Music:

In music there are opportunities to explore:
- time (time signatures and rhythm)
- the relationship between mathematics and the musical scale (using the idea of ratio)

PE:

Athletic activities require measurement of height, distance, time and speed, in addition, students will need to make body calculations such as heart rate, BMI and respiratory rates. They should be able to use this information to draw conclusions and make recommendations. This provides significant opportunities between PE and Science. Students will be expected to use graphs to interpret data.

Psychology

Key skills for psychology include working with averages; scatter graphs; percentages; sampling methods and standard form.

SMSC:

Students should be encouraged to make reasoned and informed decisions, based on facts and to recognise biased data and misleading representations. The discussion of moral and social issues is likely to lead to the use of primary and secondary data and the interpretation of graphs, charts and tables. By applying mathematics to problems set in financial and other real-life contexts students will develop their financial capability and awareness of the applications of mathematics in the workplace.

Science:

Mathematical skills are an essential requirement when it comes to science, particularly scientific investigation. Most lessons will contain an element of classifying, counting, measuring, calculating, estimating, and recording in tables and graphs. In science students will:-
- calculate means and percentages
- record primary data in tables and express the data in appropriate graph forms
- Identify patterns and draw conclusions in data
- order numbers, including decimals
- use scientific equipment to make measurements
- understand and use SI units
- use prefixes and powers of ten for orders of magnitude
- use appropriate numbers of significant figures in calculations
- substitute values into formulae
- re-arrange equations

Sociology

Mathematics skills relevant to sociology include interpreting trends from graphs.

Three times each academic year subjects with overlapping cross curricular mathematical skills will take part in delivering shared connect activities to students. These shared connect activities will take place simultaneously across the different subject areas, with the intention of highlighting the shared knowledge and skills to students. These shared connect activities will be designed to last a week and are differentiated by ability. In some cases these connect activities will be used as an opportunity to highlight how the shared content may be presented differently across these subjects.

Monitoring, Evaluation and Review

The Trust Numeracy Policy will be reviewed to ensure that it is in line with ongoing numeracy developments. Numeracy across the curriculum will be monitored through the whole school / Trust quality assurance system including:

- Departmental meetings and reviews
- Work scrutiny exercises
- Lesson observations and learning walks
- CPD sessions
- Survey of students, staff and other stakeholders
- Form part of the focus of departmental reviews
- Data analysis

The Curriculum Leaders of Mathematics and the Lead Practitioners in Mathematics will meet regularly with other areas of learning in order to coordinate the timing and depth of treatment of numeracy in their areas of learning and coordinate the assessment and reporting of using mathematics. Additionally, there will be regular meetings with the SENCO in order to support the wider impact of this policy across the academies.

The Curriculum Leader of Mathematics and the Lead Practitioner in Mathematics will meet regularly each year to review and plan for Numeracy CPD and development.

APPENDIX 1 – Calculation Policy
APPENDIX 2 – Agreed Methods in Mathematics
APPENDIX 3 – Agreed methods Across the Trust

Last review date: 04.10.23

Person responsible: Sarah Barnes (Deputy Head – Sandhill View Academy)
                                 Linzi Armitage (Assistant Head – Southmoor Academy)

APPENDIX 1 – CALCULATION POLICY

The Calculation Policy should be referred to as an accompaniment to the Numeracy Policy to ensure that consistent approaches are being employed by staff and students around each academy and at home. The document provides an overview of strategies used to teach calculations. The methods are used in mathematics classrooms to support the learning of pupils and need to be remembered and employed by all staff when doing calculations. To support progress in the formal methods of calculations, students, parents and teachers must be aware of the starting points of the class.

GENERAL ADVICE:

1.   Calculators:

In order to improve numeracy skills, it is essential that students should be encouraged to use non-calculator methods whenever possible particularly at KS3. However, departments should ensure students have access to calculators when they are necessary. It is recognised that where calculators are to be used their correct use may have to be taught. At KS4 there becomes a turning point whereby more focus should be placed on the use of calculators, as 2 out of 3 of the students' GCSE examinations require one.

2.   Methods and Presentation:

Where a student is gaining success with a particular method it is important that s/he is not confused by being given another method. This does not disallow the possibility of introducing alternatives in order to improve understanding or as part of a lesson deliberately designed to investigate alternative methods, provided students can manage this without confusion. This will often lead to deeper understanding.

3.   Working out:

In all arithmetic, the importance of place value and neat column keeping should be stressed. In a line of workings an "equals" sign should only appear once.

This is poor practice:
£3.50 x 0.85 = 2.975 + 3.50 = 6.475 = £6.48

This is good practice:
£3.50 x 0.85 = 2.975
2.98 + 3.50 = £6.48

4.   Language:

- When referring to decimals say "three point one four" rather than "three point fourteen".
- Read numbers out in full, so say three thousand four hundred rather than three, four, zero, zero.
- Use a variety of words that have the same meaning e.g. add, plus, sum etc.
- Encourage pupils to be less dependent on simple words e.g. exposing them to the word multiply as a replacement for times.
- Discuss that some words have different meanings in Mathematics from everyday life e.g. take away, volume, product, etc.
- Highlight word sources e.g. quad means four, lateral means side, so that pupils can use them to help remember meanings. (This applies to both prefixes and suffixes to words).

- Use correct mathematical notation consistently across the school e.g. £3.20 NOT £3:20 or £3.20p
- It is important to use the correct mathematical term for the type of average being used, i.e. mean, median or mode.
  - Mean: Total of values of sample ÷ sample size. [The term average is commonly used when referring to the mean]
  - Median: Middle value of sample when sample values are arranged in size order.
  - Mode: Sample values which occur most frequently.
- The decimal point is fixed does not move, number move around the decimal point.

5. Checking:

- Encourage students to check divisions by multiplication and subtractions by adding.
- Encourage the use of estimation particularly for checking work.
- Allow and encourage students to have mathematical conversations - a necessary step towards deeper understanding for many students.
- When constructing/ using graphs and charts students should be encouraged to:
  o Use a sharp pencil.
  o Label both axes and give a title
  o Use independent variable on x-axis, and dependent variable on the y-axis, e.g.: if graphing temperature of a cooling liquid, time should go on the x-axis and temperature on the y-axis. [The temperature of the liquid is dependent on the time of the reading.]
  o Label lines not spaces, unless a bar-chart with discrete data
  o Use equally spaced intervals
  o Use convenient scales
  o Mark points by a small cross not a dot
  o Draw graphs on squared or graph paper
  o To draw graphs of a sensible size (they tend to make them too small)
- Pupils should be exposed to Bar Charts, Pie Charts, Pictograms, Line graphs and Cumulative frequency curves. Histograms are only tackled by higher-level students.
- If axes do not start from zero, a break represented by a zig-zag line should be shown on the axis.
- Students need to be taught when each type of graph is appropriate. (This is very important as students will generally produce the type of graph they last met without much thought to appropriateness.)

6. Environment:

- All classrooms should have a clock that supports students to tell the time.
- Individual classrooms should try to incorporate numeracy into displays when appropriate.

APPENDIX 2 – AGREED METHODS IN MATHEMATICS

The mathematics departments across Aspire North East Multi Academy Trust have agreed that the following topic areas should be consistent in teaching methods. In some cases below, a preferred method is supported by an additional method, which can be used to support student understanding.

1. Multiplication

To support KS2 transition long multiplication must be the preferred method for all students, with grid method only to be used as an additional method. Nurture group students are to be taught line multiplication to reduce cognitive overload.

2. Expansion of brackets

GRID or FOIL methods are both appropriate for the teaching of this subject.

3. Solving equations

Solving equations should be taught for understanding with students balancing equations. Terminology such as 'change the side, change the sign' is to be avoided. Staff should talk through the process step by step to aid student's understanding. Function machines may also be used to support student understanding where appropriate.

4. Drawing pie charts

Students should be taught to draw pie charts through scaling up the frequency into degrees.

5. Addition/subtraction of fractions

Students should be taught to use common denominators and if possible LCM. Broken window may also be utilized as a means to support students with SEN.

6. Division of fractions

This topic should be taught for understanding and mastery, however teachers may refer to the KFC method.

7. Factorising quadratics

Students should be encouraged to look for factor pairs, using the grid method as a scaffold if needed.

8. Finding percentages (non – calculator)

Students should 'build' percentages using 10% as a starting point. They can access 5%, 20%, 1% from this initial 10%.

9. Finding percentages (calculator)

Students should now learn the use of 'decimal multipliers', a skill needed for interest questions. Understanding decimal multipliers is vital for grade 4 and above.

10. Reverse Percentages

The preferential method is the unitary method , however use of multipliers is also acceptable.

11. Percentage change

Method agreed across Science and Geography also, (change/initial) x100

12. Multiplication of decimals

Students should be encouraged to remove the decimal points, multiply normally and then put the points back in using powers of ten.

13. Division of decimals

Students should scale decimals up into integers, and only once both numbers are whole should they then divide. However, teachers may prefer to write the division as a fraction and use equivalent fractions to scale up to integers.

14. Dividing a quantity into a given ratio

Students should use scaling either in a table or another format. Manipulatives and bar modelling methods are also acceptable. Bar modelling is a great tool to use until students become familiar with the method.

15. Enlargement from a centre

Students should use construction lines as a preferential method. However, teachers may wish to show students how multiply the column vectors from the centre to the vertices by the scale factor to find the new position. This may only be applicable for top sets.

APPENDIX 3 – AGREED METHODS ACROSS THE TRUST

Staff from across the Multi Academy Trust have agreed the following topic areas are taught across the curriculum. For some topics below an agreed method to teaching is given:

Topic	Agreed Method	
	Sandhill View Academy	**Southmoor Academy**
Number – multiplication	Column method	
Number - division	Bus stop method	
Multiplying decimals	Using powers of 10	
Division of decimals	Write the sum as a fraction before using powers of 10 to divide	
Number – addition/subtraction of fractions	Common denominator	
Number – division of fractions	KFC	
Sharing into ratio	Bar modelling leading into a formal method for division into parts	
Percentages (non-calculator)	Always find 10% and 1% first	
Percentages (calculator)	Decimal multipliers	
Percentage Change	Change/original x 100	
Simultaneous Equations	Always make the y the same	Make either the x or y values the same
Factorising Quadratics	Find common factor pairs	
Factorising Quadratics with coefficients bigger than 1	Find common factor pairs of ac	
Simplifying expressions	Circle/line like terms	
Expanding double brackets	Grid	
Solving multiple step equations	Formal method for balancing with a line down the equal sign	Formal method for balancing
Enlargement	Enlargement with construction lines or equivalent traditional method	Find column vectors and then enlarge
Constructions	Formal methods or using 'the double arc'	
Trigonometry	Formal SOHCAHTOA encouraged	SOHCAHTOA triangles are accepted