ACET NUMERACY & CALCULATION POLICY

PHASE	**SECONDARY**
POLICY LEAD	**CHERYL HARVEY**
DATE OF APPROVAL BY TRUSTEES	**OCTOBER 2023**
DATE OF RECEIPT BY LOCAL GOVERNING BODY	
FREQUENCY DATE	**ANNUALLY**
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Rationale

'Mathematics equips pupils with a uniquely powerful set of tools to understand and change the world. These tools include logical reasoning, problem-solving skills, and the ability to think in abstract ways.'

Aston Community Education Trust is committed to raising the standards of numeracy of all of its students; we want them 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.

Numeracy is a proficiency which is developed mainly in mathematics but also in other subjects. It is more than an ability to do basic arithmetic. It involves developing confidence and competence with numbers and to think mathematically. This involves being able to make estimates, identify possibilities, weigh up different options and choose the most appropriate approach to tackle a problem. It requires understanding of the number system, a repertoire of mathematical techniques, and an inclination and ability to solve quantitative or spatial problems in a range of contexts. Numeracy also demands an understanding of the ways in which data are gathered by counting and measuring, and presented in graphs, diagrams, charts and tables.

Alongside the learning of specific skills, it is necessary to build 'mathematical resilience'. This involves seeing the intrinsic value of learning, believing that you can improve and putting in the effort where it is needed, accepting that everyone struggles in order to succeed.

We recognise that every teacher must become a teacher of numeracy. That does not mean that every teacher becomes a mathematics teacher, but that numeracy – just like literacy – is recognised as an intrinsic part of every subject across the school curriculum.

Aims

- To develop students' skills and application of numeracy across the curriculum in order that students can make accelerated progress.
- To raise the standards of numeracy of all students, 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.

Teaching and Learning

The trust uses a variety of teaching and learning styles in mathematics lessons. We do this through lessons that have a high proportion of whole-class and group-direct teaching. During these lessons we encourage children to ask as well as answer mathematical questions. They have the opportunity to use a wide range of resources such as number lines, and small apparatus to support their work. Children use ICT in mathematics lessons where it will enhance their learning, as in modelling ideas and methods. Calculation skills are taught through word problems designed to encourage the use and application of skills.

All teachers should:

1. Ensure that they are familiar with correct mathematical language, notation, conventions and techniques, relating to their own subject, and encourage students to use these correctly.
2. Be aware of appropriate expectations of students and difficulties that might be experienced with numeracy skills.
3. Encourage and promote the use of problem solving.
4. Raise the profile of mathematics throughout the school promoting the use of numbers and measures whenever possible.
5. Seek opportunities to highlight applications of numeracy within their own subject, including examination questions.
6. Adopt a consistent approach to teaching numeracy skills (see calculation policy).
7. Be aware of strategies and interventions being employed in the mathematics department to raise numeracy standards.

Areas for Collaboration

- Mental Arithmetic:
  Opportunities for students to develop mental strategies for calculations should be given, and students should be encouraged to estimate answers to calculations before they start so that they can check whether their answers are correct, including when using a calculator. Students can draw on many techniques for mental arithmetic and should be encouraged to use those methods that they are confident with. (see calculations policy for examples)

- Written calculations:
  We recognise there may be more than one method that is suitable for calculations. However, to ensure consistency, ACET has begun to standardise methods that all teachers should use to teach students. Students should be encouraged to show all their workings when doing written calculations and must estimate their answer first, particularly when working with decimal numbers.

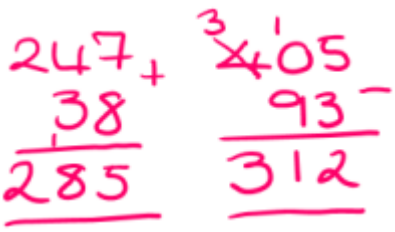
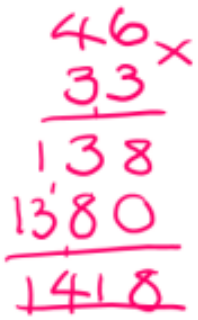
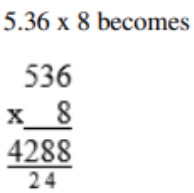
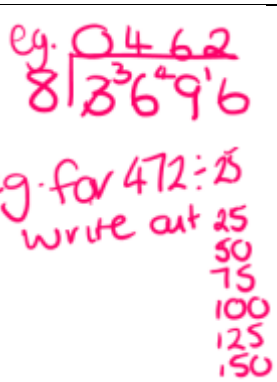
- Vocabulary:
  The following are all important aspects of helping students with technical vocabulary of mathematics.
  1. Display Key Words
  2. Using a variety of words that mean the same thing (multiply, product)
  3. Encouraging students to use sophisticated mathematical language (use of multiply rather than times)
  4. Discuss words which have multiple meanings such as volume, product etc.
  5. Partitioning words to understand meaning. For example, 'Percent'; 'Per' meaning 'parts out of' and 'cent' meaning 'one hundred'. This will help students to understand and remember some keywords and gives them strategies to understand unfamiliar words which they may come across.

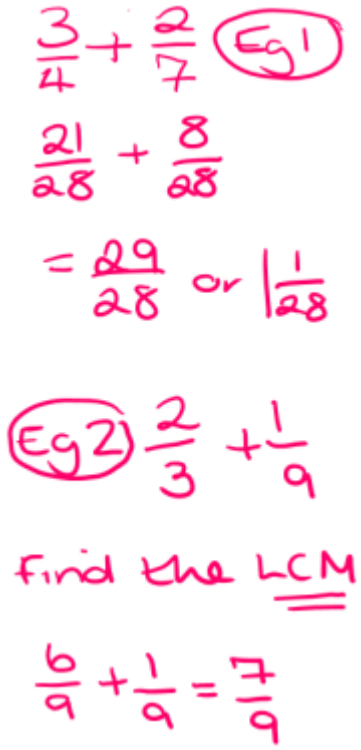
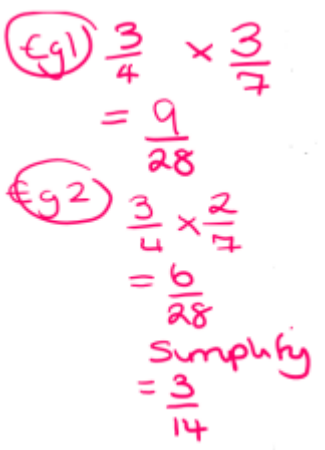
Transfer of Skills (Cross curricular)

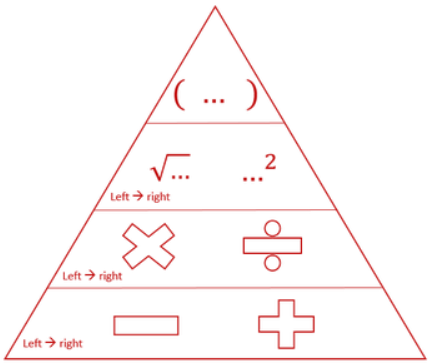
The Mathematics Faculty will deliver over and above the National Curriculum knowledge, skills and understanding through the Numeracy Framework using direct interactive teaching, predominantly in lessons. They will make references to the applications of Mathematics in other subject areas and give context 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 Faculty.

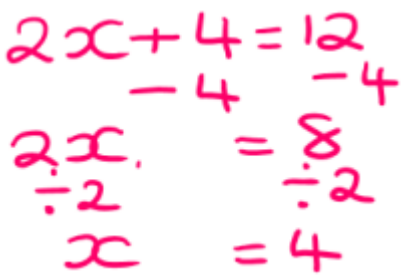
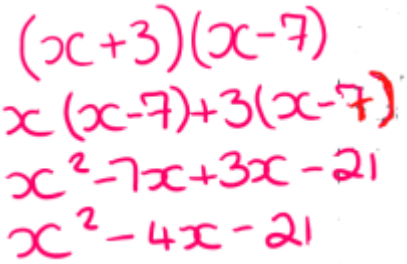
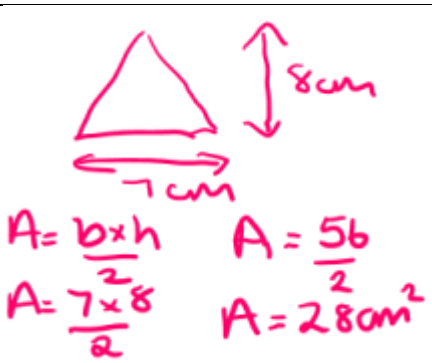
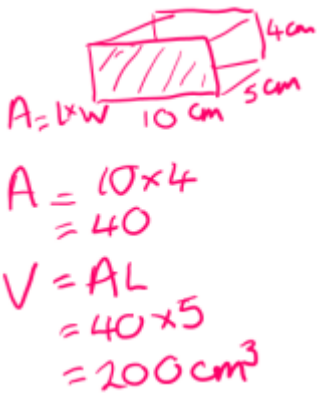
Calculation Policy

At Aston Community Education Trust, our primary focus lies in the provision of the utmost quality education for our students. We firmly believe that consistency plays a pivotal role in attaining exceptional outcomes. As students progress through their secondary school years, they are exposed to a diverse range of teaching styles and methodologies. While it is acknowledged that a standardised approach is not the definitive solution, it can be contended that each student is entitled to an equitable opportunity to excel during their tenure with us. In support of this objective, we have compiled a unified methodology for numerous foundational mathematical skills, aiming to establish a sense of uniformity. These methodologies have been carefully designed to seamlessly build upon the Key Stage 2 guidelines, ensuring a seamless transition from primary to secondary academies. Although these approaches are to be prioritised initially, they are not intended to be perceived as the exclusive methods. In the event that a student encounters difficulties with the provided guidance, colleagues are encouraged to explore alternative methodologies at that stage. It is important to note that this policy remains in a state of continual evolution, undergoing regular updates to reflect current best practices and advancements.

Topic	Methods	Example	Guidance
Addition and Subtraction	Preferred method for adding and subtracting is the column method.		Carry mark (placed as in the diagram to the right). Avoid use of the terminology 'borrow' when subtracting.
Multiplication	Preferred method is column multiplication. Moving away from grid method to remain in line with primary schools.	 	For decimals, find the product without the decimal point and return after the calculation has been completed. i.e. "since, 5.36 had two decimal places when we started, 5.36 × 8 will also have two decimal places in its answer"
Division	Preferred method is bus stop division. This may involve the writing out of a times table as part of the working out to support the method.		Bus stop – referring to the shape of the diagram in which the division is placed.

Addition and subtraction of fractions	Equivalent fractions with the lowest common denominator should be sought, and then add/subtract the numerators as appropriate. Mixed numbers to be turned into improper fractions first. Do not rely on 'gimmicks' such as kiss and a smile as a relied upon teaching method.		Common denominators can be found but finding the LCM should be promoted so as no further simplification would be needed. LCM – Lowest Common Multiple. In many cases the common denominator can be found by multiplying the two denominators together. However, finding the lowest common denominator must always be taught as in example 2 on the left. 3x9 = 27 will work but should be discouraged where possible.
Multiplication of Fractions	Multiply the numerators together and multiply the denominators.		HCF – Highest Common Factor to be referred to when looking to see if a fraction will simplify as in example 2 on the left.

Division of Fractions	Multiply by the reciprocal.	$\frac{3}{4} \div \frac{2}{7}$ Reciprocal of $\frac{2}{7}$ is $\frac{7}{2}$ $\frac{3}{4} \times \frac{7}{2} = \frac{21}{8}$ or $2\frac{5}{8}$	Reciprocal – A good understanding of this word should be encouraged from the start. Use of this vocabulary is important, moving away from "Keep, Change, Flip" although the method is essentially the same.
Order of Operations	Moving away from use of BIDMAS. Refer to Brackets and Indices to be done first, followed by Multiplication and Division and the addition and subtraction to be done last.		Avoid the misconception that division must be done before multiplication etc.
Working with Ratio	Use of bar modelling to demonstrate pictorially the make-up of ratio, to transition from primary tuition. This can be used for all aspects, such as ratio to fractions, simplifying ratio and dividing in a given ratio.	Divide £84 in the ratio 1:5 14 14 14 14 14 14 £14 : 5 x £14 £14 : £70 Penny : Rob 10 : 7 P R Penny gets 3 more shares which = £36 so 1 share must be £12 Penny gets £120 Rob gets £84	Stacking the ratio one above the other helps visualize in questions where part of the information is given. E.g. penny gets £36 more than Rob…what do each receive? Teachers should be discouraged from using the method of add up the shares and then divide as their initial approach to

			dividing in a given ratio
Solving Linear Equations	Balance method to be introduced from the start, even 1 step equations to consolidate the importance of the setting out from the start.		Flow charts may be used as further scaffold for the lowest attainers – this builds on knowledge of function machines
Expanding Quadratics	There are many approaches out there for expanding 2 brackets. Initial approach should be the method of partitioning the first bracket and multiplying the second bracket by each term in turn.		Grid method is a viable alternative where students are struggling. Partitioning helps students understand how to reverse the process when factorising a quadratic.
Area and Volume	When working out for any of these questions full modelling should be followed, always beginning with writing out of the formula first.		A supporting mnemonic may be FNAU i.e. Formula Numbers Answer Units
Volume of a Cuboid	Volume of a cube/cuboid should be done as cross sectional area multiplied by length rather than length x width x height.		The volume of a cuboid is often treated differently to any other 3D shape due to its simplicity. However, this can lead to a misconception when finding volume that all shapes involve multiplying all sides together.