MATHEMATICS DEPARTMENT HANDBOOK

ROCKWOOD
ACADEMY

Mathematics is, in its way, the poetry of logical ideas. –Albert Einstein

Introduction

Mathematics is the study of the science of numbers! We use mathematics to develop our understanding of abstract number (pure mathematics) or mathematics applied to the real world, for example in physics, engineering or physical education (applied mathematics).

At Rockwood Academy, we use maths lessons to develop students' reasoning and communication skills, as well as logic and critical thinking. Through hard work and determination, students will be able to frame problems using mathematics, and in so doing, find efficient and effective solutions to those problems.

*Our vision is to "Provide students with **core knowledge** and **deep learning** that **challenges** them with **ambition** and **aspirations** so that they can understand the world around them."*

Intent Why do we teach this? Why do we teach it in the way we do?

Mathematics is an important creative discipline that helps us to understand and change the world. We want all pupils at Rockwood Academy to experience the beauty, power and enjoyment of mathematics and develop a sense of curiosity about the subject with a clear understanding. At Rockwood Academy, we foster positive can-do attitudes, and we promote the fact that 'We can all do maths!' We believe all children can achieve in mathematics and teach for secure deep understanding of mathematical concepts through manageable steps. We use mistakes and misconceptions as an essential part of learning and provide challenge through rich and sophisticated problems.

We aim for all pupils to:

- become fluent in the fundamentals of mathematics so that they develop conceptual understanding and the ability to recall and apply knowledge rapidly and accurately.
- be able to solve problems by applying their mathematics to a variety of problems with increasing sophistication, including in unfamiliar contexts and to model real-life scenarios
- reason mathematically by following a line of enquiry and develop and present a justification, argument or proof using mathematical language.
- have an appreciation of number and number operations, which enables mental calculations and written procedures to be performed efficiently, fluently and accurately to be successful in mathematics.

Implementation What do we teach? What does this look like?

Our whole curriculum is shaped by our school vision which aims to enable all children, regardless of background, ability, additional needs, to flourish to become the very best version of themselves they can possibly be. We teach the National Curriculum, supported by a clear skills and knowledge progression. This ensures that skills and knowledge are built on year by year and sequenced appropriately to maximise learning for all children.

Impact What will this look like?

By the time children leave our school they will: By the end of KS4 we aim for children to be fluent in the fundamentals of mathematics with a conceptual understanding and the ability to recall and apply knowledge rapidly and accurately. They should have the skills to solve problems by applying their mathematics to a variety of situations with increasing sophistication, including in unfamiliar contexts and to model real-life scenarios. Children will be able to reason mathematically by following a line of enquiry and develop and present a justification, argument or proof using mathematical language.

COLLABORATION

"Alone we can do so little; together we can do so much"
– **Helen Keller**

Getting students to interact in the classroom is the call, and at the same time, it is a challenge for our lesson planning! Collaborative math activities in the classroom can help students developing skills for effective dialogue, an important life skill for all learners. Not only will pupils learn mutual understanding and respect for an increasingly globalised world, it also celebrates diversity of thought and experience. They can practice their social-emotional skills like:

- Self-awareness
- Self-management
- Social awareness
- Relationship skills
- Responsible decision-making

OPPORTUNITY

"Don't wait for the right opportunity: create it."
George Bernard Shaw

The wider student experience is central to our departmental ethos. We have embedded enrichment activities throughout the curriculum as well as numeracy activities during form time for students to move fluently between representations of mathematical ideas developing their mathematical reasoning in solving problems.

In addition, we train highly able students for entry into the UKMT and Kangaroo Maths Challenge. This further stimulates students' interest in the subject, as well as providing them with a prestigious and well recognised award.

RESPECT

"Respect for ourselves guides our morals; respect for others guides our manners"
— **Laurence Sterne**

How we promote mutual respect in the Maths classroom

1. Establish clear **classroom** expectations from the first day of school.
2. Have a discussion with your **class** about **respect** and why it is important.
3. Model respectful behavior always.
4. Role play situations in which students need help showing **respect**.
5. Provide students with consistency.

EXCELLENCE

"If I cannot do great things, I can do small things in a great way"
– **Martin Luther King Jr.**

Excellence in mathematics education requires equity — high expectations and strong **support** for all students. Becoming confident and competent as a problem solver is a complex process that requires a range of skills and experience. As teachers we can support this process in three principal ways:

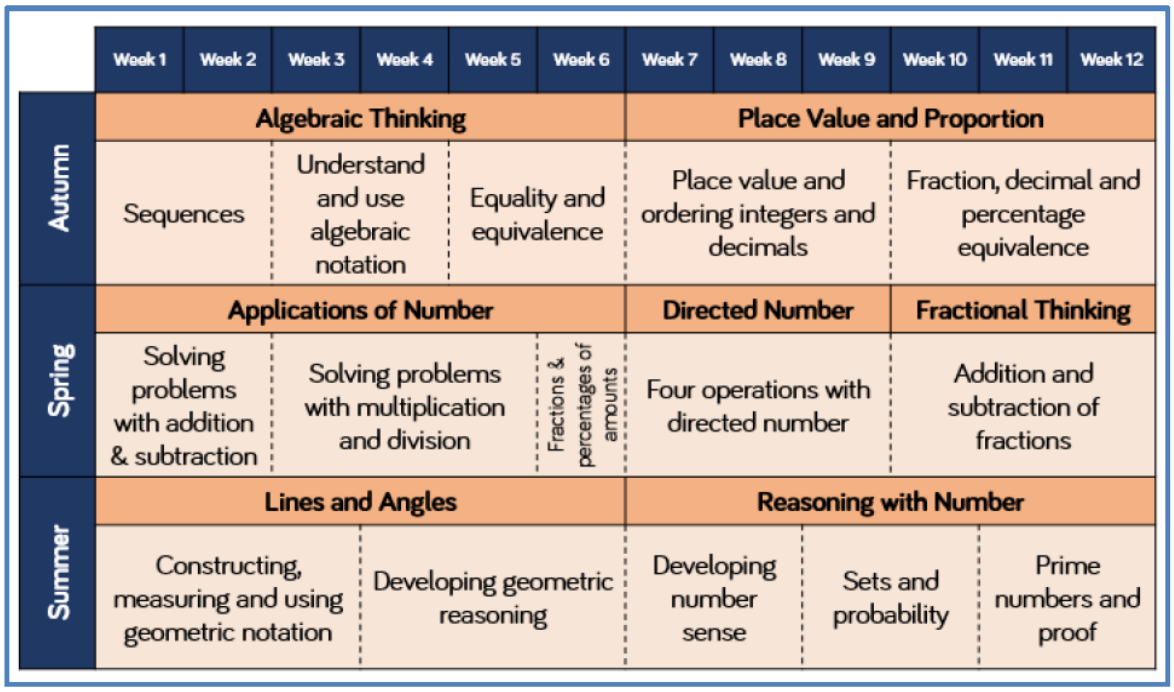
- Through our choice of task
- Through structuring the stages of the problem-solving process
- Through explicitly and repeatedly providing children with opportunities to develop key problem-solving skills.

Key stage 3

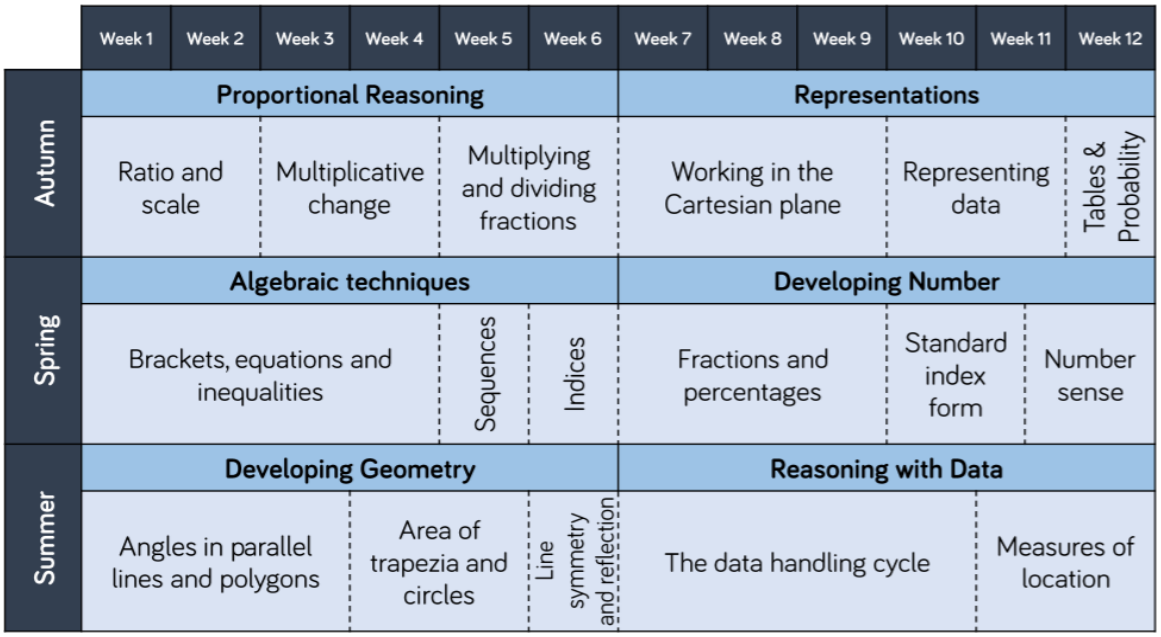
In years 7 and 8, pupils follow the White Rose Maths Scheme of Work.
This involves a mastery approach to mathematics, building upon the knowledge acquired at KS2 to enable fluency and retention. Pupils also undertake a variety of enrichment activities to promote critical thinking and problem solving to enrich their learning.

Years 7 and 8 take part in the UKMT Junior Mathematical Challenge and a team of 4 students from Years 8 and 9 represent the school in the UKMT Team Maths Challenge. Year 9 take part in the UKMT Intermediate Mathematical Challenge.

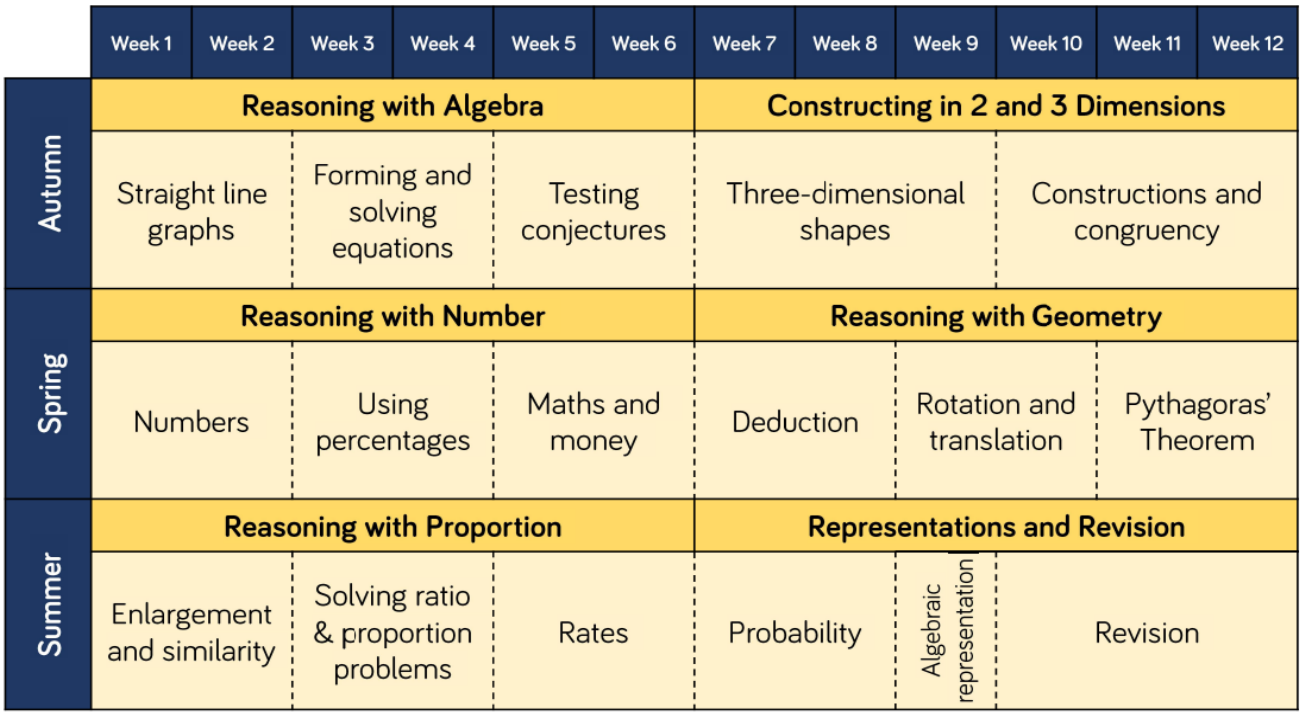
Year 7



Year 8



Year 9



Key Stage 4

At key stage 4 pupils follow the Edexcel SOW at either foundation or higher tier.
The aims of the GCSE in Mathematics are to enable students to:

- develop fluent knowledge, skills and understanding of mathematical methods and concepts
- acquire, select, and apply mathematical techniques to solve problems
- reason mathematically, make deductions and inferences, and draw conclusions
- comprehend, interpret, and communicate mathematical information in a variety of forms appropriate to the information and context
- build up essential skills that are used daily

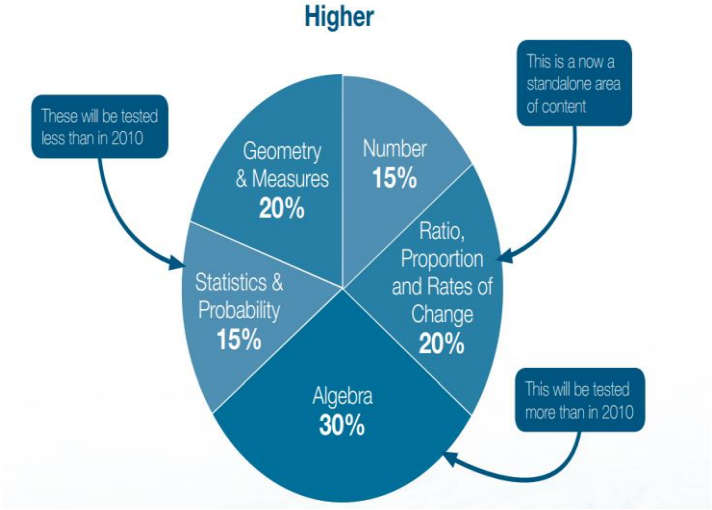
Years 10 and 11 enter the UKMT Intermediate Mathematical Challenge and a team of 4 students represent the school in the Maths Feast competition organised by the AMSP

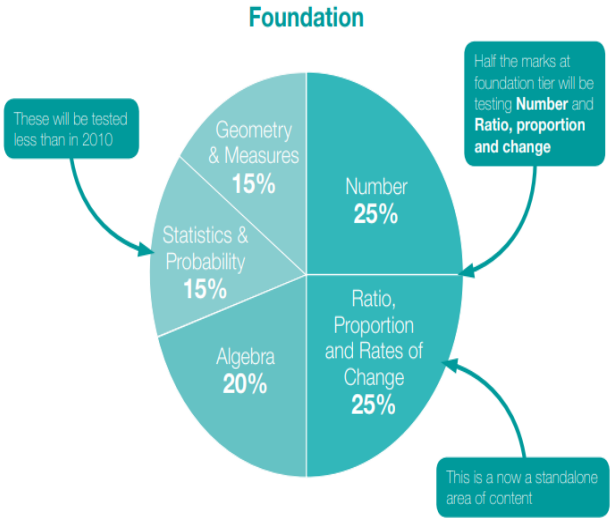
GCSE (9 – 1) Mathematics Two Year Scheme of Work **Higher Tier**

Unit		Title	Estimated hours
1	a	Calculations, checking and rounding	4
	b	Indices, roots, reciprocals and hierarchy of operations	4
	c	Factors, multiples, primes, standard form and surds	7
2	a	Algebra: the basics, setting up, rearranging and solving equations	10
	b	Sequences	4
3	a	Averages and range	4
	b	Representing and interpreting data and scatter graphs	5
4	a	Fractions and percentages	12
	b	Ratio and proportion	6
5	a	Polygons, angles and parallel lines	6
	b	Pythagoras' Theorem and trigonometry	6
6	a	Graphs: the basics and real-life graphs	6
	b	Linear graphs and coordinate geometry	8
	c	Quadratic, cubic and other graphs	6
7	a	Perimeter, area and circles	5
	b	3D forms and volume, cylinders, cones and spheres	7
	c	Accuracy and bounds	5
8	a	Transformations	6
	b	Constructions, loci and bearings	7
9	a	Solving quadratic and simultaneous equations	7
	b	Inequalities	6
10		Probability	8
11		Multiplicative reasoning	8
12		Similarity and congruence in 2D and 3D	6
13	a	Graphs of trigonometric functions	6
	b	Further trigonometry	9
14	a	Collecting data	4
	b	Cumulative frequency, box plots and histograms	6
15		Quadratics, expanding more than two brackets, sketching graphs, graphs of circles, cubes and quadratics	7
16	a	Circle theorems	5
	b	Circle geometry	5
17		Changing the subject of formulae (more complex), algebraic fractions, solving equations arising from algebraic fractions, rationalising surds, proof	7
18		Vectors and geometric proof	9
19	a	Reciprocal and exponential graphs; Gradient and area under graphs	7
	b	Direct and inverse proportion	7

GCSE (9 – 1) Mathematics Two Year Scheme of Work **Foundation Tier**

Unit		Title	Estimated hours
1	a	Integers and place value	4
	b	Decimals	3
	c	Indices, powers and roots	5
	d	Factors, multiples and primes	4
2	a	Algebra: the basics	6
	b	Expressions and substitution into formulae	5
3	a	Tables, charts and graphs	11
	b	Pie charts	3
	c	Scatter graphs	4
4	a	Fractions, decimals and percentages	7
	b	Percentages	6
5	a	Equations and inequalities	9
	b	Sequences	5
6	a	Properties of shapes, parallel lines and angle facts	7
	b	Interior and exterior angles of polygons	4
7		Statistics, sampling and the averages	7
8		Perimeter, area and volume	10
9	a	Real-life graphs	8
	b	Straight-line graphs	6
10		Transformations	11
11	a	Ratio	4
	b	Proportion	5
12		Right-angled triangles: Pythagoras and trigonometry	5
13		Probability	12
14		Multiplicative reasoning	7
15	a	Plans and elevations	5
	b	Constructions, loci and bearings	7
16	a	Quadratic equations: expanding and factorising	5
	b	Quadratic equations: graphs	4
17		Circles, cylinders, cones and spheres	6
18	a	Fractions and reciprocals	5
	b	Indices and standard form	5
19	a	Similarity and congruence in 2D	7
	b	Vectors	7
20		Rearranging equations, graphs of cubic and reciprocal functions and simultaneous equations	5





Assessment

Assessment is fundamental to the process of teaching and learning in Mathematics and forms an important part in the lives of pupils and teachers. The purpose of assessment are as follows:

- To provide feedback that helps teachers plan their teaching effectively and pupils to further develop their mathematical skills (formative assessments).
- To enable the teacher to monitor pupils' progress in understanding mathematical concepts (summative assessment).

How understanding is assessed

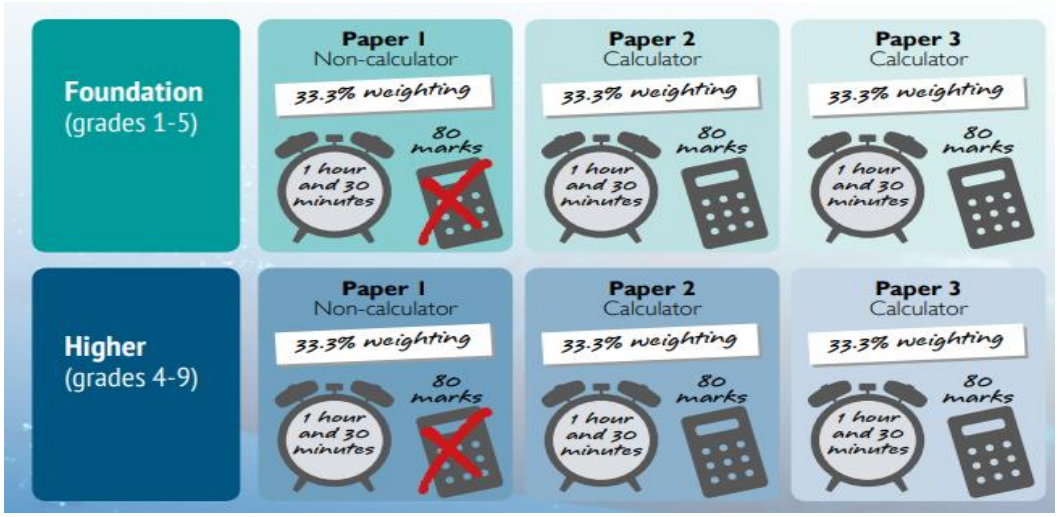
- by applying the theory to a range of questions and increasingly more complex situations
- discussion in lessons, sample problems
- homework and tests

Skills

- understanding of the concepts
- numerical skills

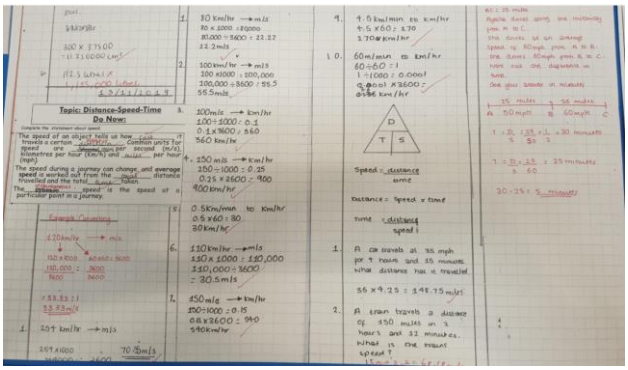
- algebraic skills
- problem solving skills

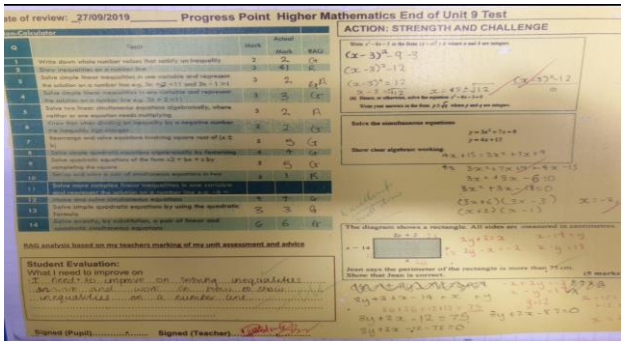
Internal assessments take place at the end of each unit of work, which is every half term.
Exams will be assessed at two levels; foundation tier to achieve grades 5 to 1 and higher tier for targeting grades 9 to 4.
In Year 11, pupils complete three external written exam papers which forms 100% of their GCSE grade for Mathematics at the end of the year. There is one non-calculator and there are two calculator papers. Each exam paper will last 1 hour 30 minutes and will be scored out of 80 marks.



Models of Excellence

In Maths department, pupils always strive for excellence. Expectations are high for both staff and pupils. Students are encouraged to be proactive and take pride in their work.





In Mathematics students are encouraged to analyse questions and pick out key facts. This skill empowers our students to effectively solve problems in a manner that maximises their understanding and marks gained per question. Students are also encouraged to read and explain in their own words what they think a question is asking them. As a department we identify misconceptions and students are encouraged to listen through constructive verbal feedback. As a follow up, students are encouraged to make condensed notes about verbal feedback next to an error in a question, note cards or Progress Points.

Homework

Rationale

Homework is work that is set to be done outside the timetabled curriculum. It contains an element of independent study in that it is not usually directly supervised by a teacher. It is important in raising student achievement.

Homework enhances pupil learning, improves achievement and develops students' study skills and as such is an integral part of the curriculum. It requires careful planning and integration into the scheme of work of each curriculum area.

Aims

Homework enables students to:

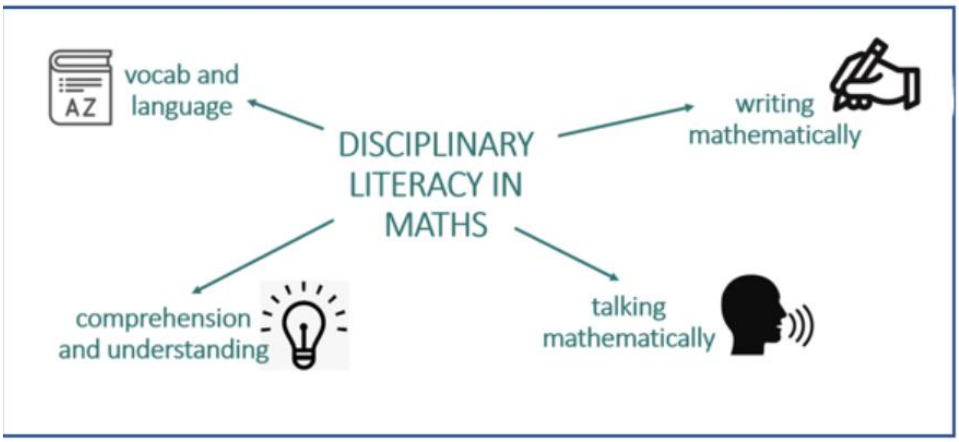
- Consolidate and extend work covered in class or prepare for new learning activities
- Access resources not available in the classroom
- Develop research skills
- Have an opportunity for independent work
- Show progress and understanding
- Provide feedback in the evaluation of teaching
- To enhance their study skills e.g. planning, time management and self-discipline
- To take ownership and responsibility for learning
- Engage parental co-operation and support
- Create channels for home school dialogue

Expectations: By whom and how much?

Year group	**Time -** per week (minutes)	**Type**
7	50	Mathswatch task with extended project every half term
8	50	Mathswatch task with extended project every half term
9	60	Mathswatch task with extended project every half term
10 and 11	90	Mathswatch task and worksheet with Exam questions

Disciplinary literacy

By teaching mathematical vocabulary as well as mathematical concepts, you are promoting conceptual understanding amongst learners. By supporting their acquisition of mathematical language, you are helping them to read and interpret problems successfully and as Cobb (1998) suggests, as children develop mathematics language, they learn to communicate and share universal mathematical concepts and operations with their peers and others.



So what are the key things to think about when teaching new maths terms?

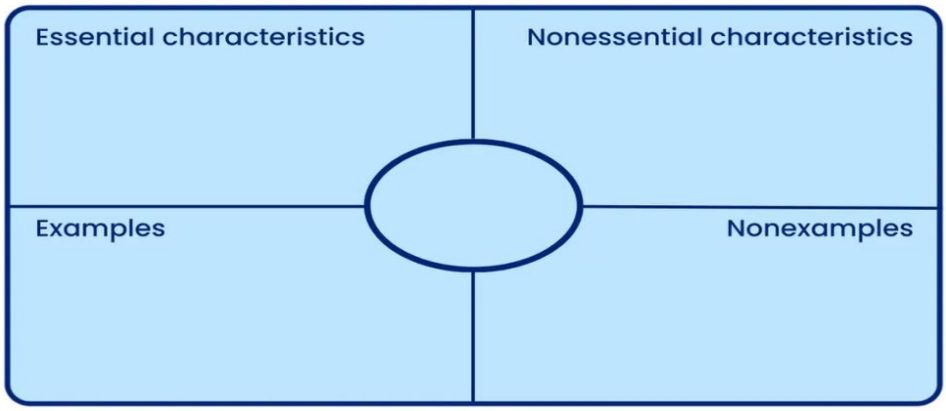
1. Pre-teaching new language

Introduce learners to new language before you introduce them to new procedures.
When you teach a new word at point-of-use, the word can be lost or misunderstood as learners struggle with a new concept. To take 'probability' as an example, start learners off by explaining that the new word is a noun and it is the name we give to the likelihood of something happening.

2. Develop nuanced understanding

If you want to help learners develop a more nuanced understanding of terms and their characteristics, here are some ideas to try:

The Frayer model: When defining an abstract concept, it is useful to think about what that idea IS and IS NOT. The Frayer model encourages learners to think about the defining characteristics of a concept.



So, to take 'Prime Numbers' as an example, essential characteristics include the fact that a prime number has exactly two positive divisors, 1 and the number itself. Non-essential characteristics include the observation that prime numbers are usually odd.
Once you've introduced the new word and the new concept, try using this step-by-step guide to improving understanding.

- **Step 1: Explain**
    - This should be in language the students are familiar with. Providing examples from their own lives will help. Research has shown that when students learn a teacher's definition of a word, learning is less effective. Don't get them to record anything at this stage. Wait until…
- **Step 2: Reinstate**
    - Ask learners (in pairs or groups) to explain to each other what the word means and create examples of the word in use. Take feedback and correct where necessary, then ask learners to make a note of their understanding of the word.
    - (This would be a good point to introduce the concept behind the new term. After which, you can use the following steps to assess learners' comprehension and to encourage them to develop a more nuanced understanding).
- **Step 3: Show**
    - This is the bit that really deepens understanding and for you as a teacher, quickly highlights which learners haven't quite understood. Ask learners to draw a picture, a symbol or some form of graphic representation of the term. Encourage learners to explain why they have depicted the term in that way.

- **Step 4: Discuss**
    - Try using a structured discussion to 'flesh out' learners' understanding of the new term. Ask learners in groups to come up with synonyms and antonyms of the word. For example, a synonym for probability might be 'likelihood' or 'chance.' Then, ask learners to devise metaphors or analogies for that word. So, for example if the word was 'evaluate,' a metaphor might be 'evaluate is an estate agent telling you how much your house is worth.'
- **Step 5: Refine and reflect**
    - Go back to their exercise book and look at their original note (Step 2). Ask learners to see if they want to make any changes to their original idea. Encourage learners to share revisions with the class and explain why they made the changes they did.
- **Step 6: Play!**
    - By now, learners should have a pretty nuanced understanding of the new mathematical terms so it's time for the games to begin! Charades, taboo, bullseye, jeopardy, anything goes. These games are all designed to encourage students to think about the qualities of words and it should be really interesting to see how students interpret the abstract concepts.

What are Literacies within the Disciplines? The following lists for each of the major content areas, while not comprehensive, can act as starting points through which communities of teachers can begin to think in terms of disciplinary literacy (Lent, 2016).

Math	*When mathematicians read, they*	*When Mathematicians write, they*	*When Mathematicians think, they*
	• Use information to piece together a solution • Look for patterns and relationships • Decipher symbols and abstract ideas • Ask questions • Apply mathematical reasoning	• Explain, justify, describe, estimate or analyze • Favor calculations over words • Use precise vocabulary • Include reasons and examples • Utilize real-word situations	• Consider patterns • Utilize previous understandings • Find connections • Estimate, generalize, and find exceptions • Employ mathematical principles

What professional development opportunities will you provide for teachers within your team?

Regularly share good practice – lesson resources, marking and feedback examples, teaching for SEN, etc.
Open door policy – any staff can walk into Maths leadership team lessons to observe and get ideas on developing their own practice
Department time to be robust and focused on key areas of development
Use of key books to support pedagogy e.g., 'Teaching Walkthroughs'
Use of key books to support subject knowledge e.g., 'Maths Dictionary'
Updates on the GCSE curriculum
Support with reading and literacy from whole school CPDs
Working collaboratively with other schools in the trust on curriculum and schema building
Pixl Leadership programme
Mentoring programme
NPQLT

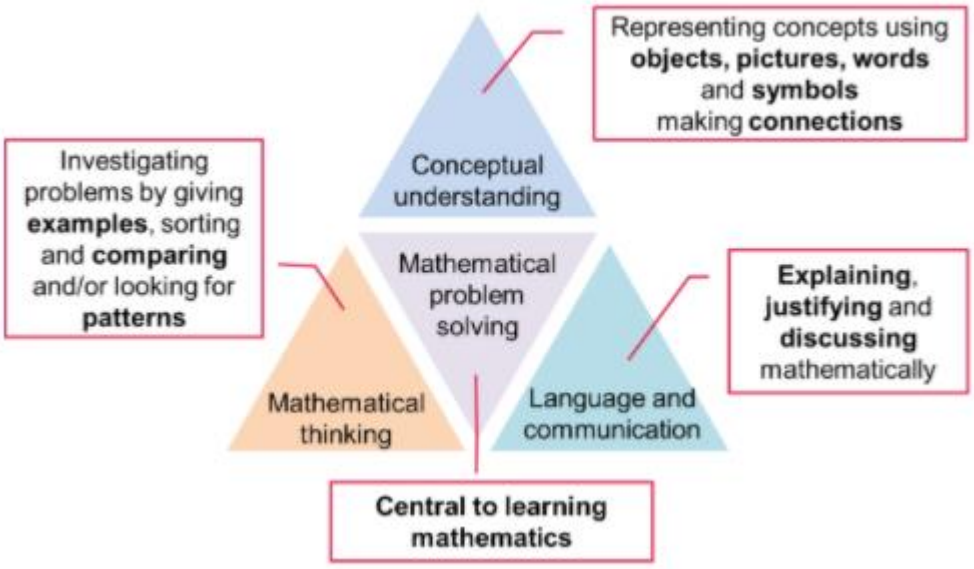
How will you as a subject leader monitor and evaluate the impact?

Regular departmental drop-ins and learning walks with key focus area feedback will be shared each time this happens
Half termly book reviews
Student voice every term

Mastery:

The mastery approach in Maths involves breaking down larger, complex learning goals into smaller, more manageable steps. Teaching maths for mastery offers all pupils access to the full maths curriculum. This inclusive approach, and its emphasis on promoting multiple methods of solving a problem, builds self-confidence and resilience in pupils.

We believe the 'mastery approach' to teaching is the underlying principle of securing a deep understanding. At Rockwood, we use Mathematics Mastery to equip every child with the mathematical thinking and problem-solving skills necessary to succeed in all areas of their lives, as children and as adults. Instead of learning mathematical procedures by rote, we want pupils to build a deep conceptual understanding of concepts, which will enable them to apply their learning in different situations. To achieve this, we ensure that each lesson is based around three key principles of learning, **Conceptual Understanding, Mathematical Thinking and Language and Communication**. These principles underpin maths learning at Ridgeway and enable all children to communicate their understanding clearly using a wide range of mathematical vocabulary, reason, challenge and explain their learning in order to solve problems and create a well-rounded, deep understanding of mathematical concepts.



Impact of Mastery approach:

Whole class moves through content at the same pace

When teaching for mastery, the whole class moves through topics at broadly the same pace. Each topic is studied in depth and the teacher does not move to the next stage until all children demonstrate that they have a secure understanding of mathematical concepts.

Time to think deeply about the maths

Students are given time to think deeply about the maths and really understand concepts at a relational level rather than as a set of rules or procedures. This slower pace leads to greater progress because it ensures that students are secure in their understanding and teachers do not need to revisit topics once they have been covered in depth.

Builds self-confidence in learners

In a traditional maths lesson, children are put in different groups and given different content based on their anticipated ability. This means that from an early age child are classed as those who can and cannot “do maths”. Teaching maths for mastery is different because it offers all pupils access to the full maths curriculum. This inclusive approach, and its emphasis on promoting multiple methods of solving a problem, builds self-confidence and resilience in pupils.

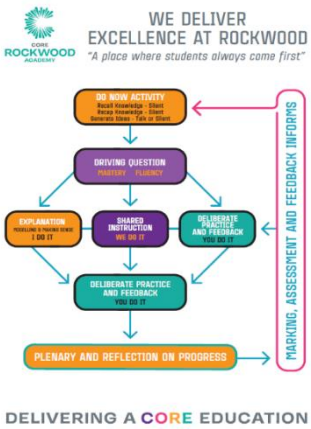
Differentiates through depth rather than acceleration

Though the whole class goes through the same content at the same pace, there is still plenty of opportunity for differentiation. Unlike the old model, where advanced learners are accelerated through new content, those pupils who grasp concepts quickly are challenged with rich and sophisticated problems within the topic. Those children who are not sufficiently fluent are provided additional support to consolidate their understanding before moving on.

Teaching Model:

It is important to have a classroom routine pupil can count on every day. Having the same procedures everyday cuts down wasted learning time significantly.
Our classroom routines promote a positive environment where all pupils can learn.
Our daily routines include:

- High classroom expectations.
- Meeting and greeting pupils at the door.
- Having the date, title, driving question and “**DO NOW**” activity on the interactive whiteboard as pupils walk in and settle.
- Well planned and sequenced lessons which promote positive engagement from all pupils and lead to clear progress.



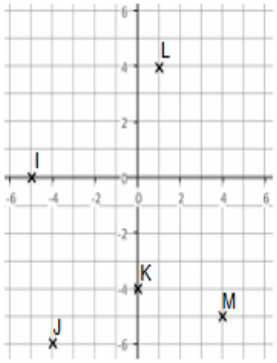
Example of what a typical science lesson would look like at Rockwood:

Pupils settle into a silent DO NOW activity at the beginning of the lesson which assess prior knowledge or involves consolidation:

Pupils transition into an "I DO/ WE DO" part to the lesson where the teacher delivers new instruction/theory or ideas. At this stage, teachers use different AFL techniques to challenge the thinking of the students

I Do

Examples



Write down the coordinates of the points marked I, J, K, L and M.

Then plot and label the following points:

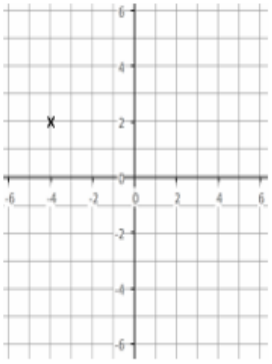
N at (-3, 2)

O at (3, 0)

P at (-2, -3)

We Do

Diagnostic



The point marked with a cross is given by the coordinates:

(a) (2, -4)

(b) (-2, -4)

(c) (-4, 2)

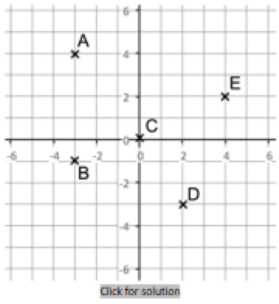
(d) (-4, -2)

Pupils will then apply the skills they have acquired to a (YOU DO) mini plenary/ progress task and deliberate practice independently (if instructed) or with their work partner. This is usually time restricted and instant feedback is provided where pupils will then self/peer assess in red pen.

Finally, pupils will end the lesson with a plenary task which allows them to test their newly learned skills in exam style questions. This helps further strengthen and develop knowledge, understanding and application.

You do

Deliberate Practice 2



Write down the coordinates of the points marked A, B, C, D and E.

Answer

Then plot and label the following points:

F at (-5, 6)

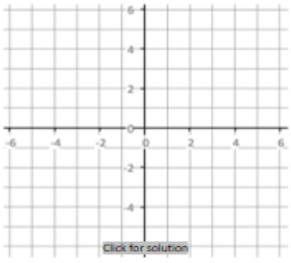
G at (0, -6)

H at (-4, -2)

Plenary

5 minutes

Exam-style question



Plot the points with the following coordinates and join them up to form a quadrilateral:

(-4, 1)
(-2, 4)
(4, 0)
(2, -3)

Write down the name of the quadrilateral you have drawn.

Answer

Roles and Responsibilities:

Mr. Badmos (ABS)
Head of Mathematics
General oversight of all departmental policies and procedures
Teaching and Learning
Data and Reporting
Y11 Lead

Mrs. Rai (BRI)
2nd in department
Year 7 and 8 Lead
SEND Lead
Home Learning Lead

Miss. Darr (MDR)
KS3 Coordinator
Year 9 and 10 Lead
Marking, Feedback & Assessment Lead
Lead on Training PCGE and ECT students

Mr. Das (ADS)
Lead on producing intervention resources for year 11 and Whole school numeracy

Mr. Zaman (NZN)
Lead on rewards and Whole school numeracy

Mr. Haroon (MHN)
Lead on KS4 resources and Year 11 intervention

Miss. Kara (OKA)
Lead on Most Able and Maths social media profile.

Mr. Touray (AYT)
Support with rewards, enrichment and year 11 intervention

Appendices:
www.vlemathswatch.co.uk
www.justmaths.co.uk
www.corbettmaths.com
www.whiterosemaths.com
www.pearsonactiveteach.com
www.edexcel.com