Year 11F Term 4 - Congruence, Similarity, Vectors, Non-linear graphs, Simultaneous Equations, Rearranging Formulae and Proof

Year group	Subject: Congruence, Similarity, Vectors, Non-linear graphs, Simultaneous Equations, Rearranging Formulae and Proof
Prior learning- linked to National curriculum	In KS3, students begin to develop their understanding of Congruence, Similarity, Vectors, Non-linear graphs, Simultaneous Equations, Rearranging Formulae and Proof. They cover the following topics related to these concepts: **Congruence and similarity:** Students learn about the properties of congruent and similar shapes, including angle and side relationships. They use these properties to solve problems involving congruence and similarity. **Vectors:** Students learn about vectors as quantities that have both magnitude and direction. They learn how to add and subtract vectors, and how to use vectors to represent translations and other transformations. **Non-linear graphs:** Students learn about graphs of functions that are not linear, including quadratic functions and exponential functions. **Simultaneous Equations:** Students learn how to solve pairs of linear equations simultaneously using elimination, substitution and graphical methods. **Rearranging Formulae:** Students learn how to rearrange formulae to find a specific variable, including using the distributive law and factorising. **Proof:** Students begin to develop their understanding of geometric proof by investigating the properties of shapes and using deductive reasoning to prove statements. Having a solid understanding of these concepts is essential for success in GCSE mathematics and is built upon in later years.
Rationale	**Congruence and similarity:** Teaching congruence and similarity in GCSE mathematics allows students to deepen their understanding of geometric concepts and develop problem-solving skills by applying these concepts to real-world scenarios.

	Vectors: Teaching vectors in GCSE mathematics provides students with a useful mathematical tool for modelling and analysing physical phenomena, such as velocity, acceleration, and force. **Non-linear graphs:** Teaching non-linear graphs in GCSE mathematics helps students to understand the behaviour of more complex functions and develop skills in graphing and interpreting these functions. **Simultaneous equations:** Teaching simultaneous equations in GCSE mathematics provides students with powerful tools for solving systems of equations that arise in many real-world situations, such as engineering, physics, and economics. **Rearranging formulae:** Teaching rearranging formulae in GCSE mathematics helps students to develop algebraic skills that are essential for further study in mathematics, science, and engineering. **Proof:** Teaching proof in GCSE mathematics helps students to develop logical reasoning skills and to deepen their understanding of mathematical concepts. Additionally, proof is an important aspect of many careers in mathematics, science, and engineering. Overall, these topics provide students with the foundational knowledge and skills needed to succeed in higher-level mathematics courses and in a variety of careers that require mathematical proficiency.
Vocabulary:	**Congruence:** sides, angles, triangles, transformations, corresponding parts, congruent figures, similarity ratios, geometric proofs. **Similarity:** proportional sides, angles, scale factors, dilation, similarity transformations, similar figures, indirect measurement, geometric proofs. **Vectors:** magnitude, direction, components, position vectors, vector addition and subtraction, scalar multiplication. **Non-linear graphs:** quadratic functions, cubic functions, exponential functions, transformations.

	Simultaneous Equations: systems of linear equations, elimination method, substitution method, graphical solution, word problems. **Rearranging Formulae:** equations, algebraic manipulation, solving for a specific variable, inverse operations, substitution. **Proof:** logical reasoning, conjectures, postulates, theorems, deductive reasoning, counterexamples, direct and indirect proofs, proof by contradiction, conditional statements.
Cultural Capital:	**Congruence, Similarity and Vectors:** 1. Understanding the world: Congruence, similarity and vectors are fundamental concepts that help us understand the world around us. They are essential in fields such as architecture, engineering, and physics, and understanding them can provide a deeper appreciation of how the world works. 2. Real-world applications: The concepts and principles taught in congruence, similarity and vectors and similarity have real-world applications, such as in engineering, architecture, and computer graphics. Understanding these concepts can provide students with a deeper appreciation of how mathematics is applied in the real world. **Non-linear graphs, simultaneous equations, rearranging formulae, and proof:** 1. Understanding the world: These concepts are fundamental to understanding how mathematical models can be used to describe and predict real-world phenomena. They are essential in fields such as economics, physics, and engineering, and understanding them can provide a deeper appreciation of how mathematics can be applied in the real world. 2. Historical context: The study of non-linear graphs, simultaneous equations, rearranging formulae, and proof has played a significant role in the history of mathematics and science. Understanding the work of famous mathematicians and scientists in these areas can provide a sense of cultural context and appreciation for mathematics. 3. Critical thinking skills: The study of non-linear graphs, simultaneous equations, rearranging formulae, and proof requires students to analyse complex problems and develop logical reasoning skills. These skills are valuable beyond the classroom and are essential for many careers, including finance, science, and engineering. 4. College and career readiness: Knowledge of non-linear graphs, simultaneous equations, rearranging formulae, and proof is often a prerequisite for some college courses and high-demand careers, including finance, science, and engineering.

	5. Real-world applications: The concepts and principles taught in non-linear graphs, simultaneous equations, rearranging formulae, and proof have real-world applications, such as in designing experiments, optimising manufacturing processes, and modelling financial markets. Understanding these concepts can provide students with a deeper appreciation of how mathematics is applied in the real world.
Key assessments- name the assessments	**<u>Congruence and Similarity:</u>** Congruence and Similarity **<u>Vectors:</u>** Vectors **<u>Non-Linear graphs:</u>** Quadratic graphs Cubic and exponential graphs **<u>Simultaneous Equations:</u>** Solving simultaneous equations - algebraically Solving simultaneous equations - graphically **<u>Rearranging Formulae:</u>** Rearranging Formulae **<u>Proof:</u>** Proof using algebra Unit wrapper covering the above topics
What do children know/ can do now (EDSM)	As previously mentioned, students would have seen the basics of these topics, therefore Emerging students will still only be familiar with the basics of calculating Congruence, Similarity, Vectors, Non-linear graphs, Simultaneous Equations, Rearranging Formulae and Proof. Mastered students will be able to calculate Congruence, Similarity, Vectors, Non-linear graphs, Simultaneous Equations, Rearranging Formulae and Proof fluently as well as interpret and analyse the results. Furthermore in Congruence, Similarity, Vectors, Non-linear graphs, Simultaneous Equations, Rearranging Formulae and Proof, they will be able to solve problems involving each of these topics.