Year Overview

Year 10 Foundation Tier

	Term 01	Term 02	Term 03	Term 04	Term 05	Term 06
Topic(s)	1. Numbers 2. Statistical Diagrams	1. Numbers 2. Ratio 3. Geometry	1. Algebra 2. Geometry	3. Probability 4. Algebra	1. Algebra 2. Geometry	1. Statistics
Marking & Assessment Points	Bi - termly modular assessments End of term assessments	Bi - termly modular assessments End of term assessments	Bi - termly modular assessments End of term assessments	Bi - termly modular assessments End of term assessments	Bi - termly modular assessments End of term assessments	Bi - termly modular assessments End of term assessments

Term 5 Year 10 [Foundation Tier Maths] | Algebra

Topic Overview: In this module, you will learn to speak the "language of algebra." Forming and Solving Equations is about taking a real-world scenario—like the cost of three coffees and a cake—and turning it into an equation like 3x + 2 = 11. You will master the inverse operations method to "undo" equations and find the value of the unknown variable.

We also introduce Linear Simultaneous Equations, where you deal with two different unknowns (usually x and y) at the same time. At the Foundation level, we focus on the elimination method, where you add or subtract the equations to "knock out" one of the variables, making the problem solvable.

Prior & Subsequent Knowledge:

1. Prior Knowledge (The Foundation)

- Four Operations: Fluency in adding, subtracting, multiplying, and dividing both positive and negative integers.
- Algebraic Notation: Understanding that 3x means 3 * x and x / 2 means x ÷ 2.
- Collecting Like Terms: Knowing that you can simplify 2x + 3x to 5x, but you cannot add 2x and 3y together.
- Function Machines: Using input/output diagrams to understand how numbers are transformed.

2. Related Knowledge (Current GCSE Context)

- One-Step and Two-Step Equations: Solving basic forms like x + 5 = 12 or 2x - 3 = 7.
- Equations with Brackets: Learning to expand 3(x + 4) = 18 before solving.
- Variables on Both Sides: Mastering the "letters on one side, numbers on the other" technique for equations like 5x + 2 = 3x + 10.
- Simultaneous Equations (Elimination): Solving pairs such as:
  3x + y = 13
  x + y = 7
- Geometric Algebra: Forming equations based on shape properties (e.g., setting the sum of angles in a triangle to 180 degrees to find x).

3. Subsequent Knowledge (The Next Steps)

- Quadratic Equations: Moving from x to x^2, which requires factorising to solve.
- Rearranging Harder Formulae: Applying these "solving" skills to change the subject of a formula where the letter appears twice.
- Real-world Modelling: Using simultaneous equations to solve "best buy" problems or find the cost of individual items in a shop.
- Graphical Solutions: Understanding that the solution to a simultaneous equation is the exact point (x, y) where two straight lines cross on a coordinate grid.

Lesson 01

Lesson Title	National Curriculum or Specification Link	Declarative Knowledge	Procedural Knowledge	Diagnostic questions for each phase of the lesson.	Push Yourself Activities	Resources Link	Literacy and Oracy	Cross Curricular
Forming and solving equations	**GCSE Mathematics:** A21 - Solve linear equations in one unknown algebraically... including those with the unknown on both sides of the equation. A17 - Formulate algebraic expressions of real-world contexts.	* **Expression:** A mathematical phrase without an equals sign (e.g., 3x + 5). * **Equation:** Two expressions set equal to each other (e.g., 3x + 5 = 20). * **Inverse Operations:** The "opposite" action used to move terms (e.g., + becomes -). * **Geometric Properties:** Angles in a triangle sum to 180°, angles on a straight line sum to 180°.	* **Assigning Variables:** Choosing a letter (usually x) for the unknown value. * **Translating Phrases:** Turning "twice as old" into 2x or "5 years younger" into x - 5. * **Balancing:** Performing the same operation on both sides of the '=' sign. * **Solving with Brackets:** Expanding first, then isolating the variable. * **Geometric Application:** Setting up equations based on perimeter or angle facts.	**Check Point 01:** "Write an expression for 'the sum of x and 10, then multiplied by 3'." **Check Point 02:** "I think of a number, double it, and add 7. The result is 19. What equation represents this?" **Check Out Questions** 1. Solve 4x - 12 = 28. 2. Solve 5(x + 3) = 2x + 21. 3. A rectangle has a length of 2x + 5 and a width of x. Its perimeter is 40 cm. Form an equation and solve for x. 4. The ages of three siblings are x, x+2, and 2x. Their total age is 34. How old is each sibling? 5. **Challenge:** An isosceles triangle has two base angles of 3x - 10 and a top angle of x. Find the value of x.	**Activity 01 (The Architect):** Design a floor plan for a room using only algebraic expressions for the lengths. If the total area must be 50 m^2, can you find the value of your variable? **Activity 02 (Variable Rates):** Create a "Choosing a Mobile Plan" problem where Plan A is a flat fee plus a cost per GB, and Plan B is a different flat fee plus a lower cost per GB. Form an equation to find the point where both plans cost the same.		**Key Terminology** • **Unknown:** The value we are trying to find (the variable). • **Term:** A single part of an expression (like 4x or -7). • **Expand:** To multiply out brackets. • **Isolate:** To get the variable by itself on one side of the equals sign. • **Verify:** Plugging your answer back into the original equation to see if it works. **Literacy:** "Algebraic Translation Guide." Create a dictionary that converts English words into math symbols (e.g., 'Product' $\to$ $\times$, 'Difference' $\to$ -). **Oracy:** "The Logic Debate." In pairs, one student solves an equation like 2(x-3) = 10 by expanding the brackets first. The other solves it by dividing by 2 first. Debate which method is more "elegant" and why.	**Business:** Calculating "Break-Even" points where Total Cost = Total Revenue. **Science:** Rearranging formulas like F = ma or V = IR to solve for a specific variable. **D&T:** Calculating the amount of material needed when dimensions are dependent on one another.

Lesson 02

Lesson Title	National Curriculum or Specification Link	Declarative Knowledge	Procedural Knowledge	Diagnostic questions for each phase of the lesson.	Push Yourself Activities	Resources Link	Literacy and Oracy	Cross Curricular
Linear simultaneous equations	**GCSE Mathematics:** A19 - Solve two simultaneous equations in two variables (linear/linear) algebraically; find approximate solutions using a graph.	* **Simultaneous Equations:** A set of equations that are all true at the same time for the same values of x and y. * **Elimination Method:** Adding or subtracting equations to "cancel out" one variable. * **Substitution Method:** Replacing one variable with an expression from the other equation. * **Graphical Solution:** The point of intersection (x, y) of two straight lines.	* Aligning equations vertically (stacking x, y, and constants). * Multiplying one or both equations to create matching coefficients. * Deciding whether to **Add** or **Subtract** (Rule: "Same Sign Subtract" / SSS). * Substituting the first found value back into the simplest original equation. * Checking the final (x, y) pair in the *other* equation to verify accuracy.	**Check Point 01:** "If 3x + y = 10 and x + y = 4, should you add or subtract the equations to eliminate y?" **Check Point 02:** "I have 2x + 3y = 12 and 4x - y = 5. What is the most efficient first step to make the x coefficients match?" **Check Out Questions** 1. Solve x + y = 15 and x - y = 3. 2. Solve 2x + 3y = 16 and 5x - 3y = 5. 3. Solve 3x + 2y = 19 and x + 4y = 23. 4. A coffee shop sells 2 lattes and 3 teas for £11. They sell 4 lattes and 1 tea for £12. Find the cost of a latte and a tea. 5. **Challenge:** Solve 4x + 3y = 1 and 3x - 5y = 23 (requires multiplying both equations).	**Activity 01 (The Graphical Link):** Draw the lines y = 2x + 1 and x + y = 7 on a coordinate grid. Identify the intersection point. Then, solve the same pair algebraically. Compare the results. **Activity 02 (Infinite or Zero?):** Create a pair of simultaneous equations that have **no solution** (parallel lines) and a pair that have **infinite solutions** (identical lines). Explain your logic.	Slides Worksheet Differentiated Worksheet Check Out | Google Form	**Key Terminology** • **Coefficient:** The number in front of the variable (e.g., in 5x, 5 is the coefficient). • **Variable:** The letter representing the unknown value. • **Intersection:** The physical point on a graph where the two lines cross. • **Consistent:** A system of equations that has at least one set of solutions. • **Elimination:** The process of removing one variable to make a solvable one-variable equation. **Literacy:** "The Language of Logic." Write a set of 'Step-by-Step' instructions for a Year 9 student. Use keywords: *Coefficient*, *Variable*, *Eliminate*, and *Substitute*. **Oracy:** "The Error Spotter." Present a pre-written "incorrect" solution to the class. Students must work in pairs to verbally explain exactly where the mistake happened (e.g., "They subtracted a negative	**Business/Economics:** Break-even analysis. Finding the point where the Cost function and Revenue function meet. **Chemistry:** Balancing chemical equations and determining concentrations in mixtures. **Geography:** Comparing population growth models of two different cities to find when they will be equal.

							instead of adding").	

Term 5 Year 10 [Foundation Tier Maths] | Shape

Topic Overview: This term is all about visualising and manipulating space. You will start by deconstructing 3D Solids, learning to identify their faces, edges, and vertices, and how to "unfold" them into 2D nets. This leads directly into Plans and Elevations, the standard method used by architects to draw 3D objects from 2D perspectives.

The core of the unit involves the four Transformations (Reflection, Rotation, Enlargement, and Translation), where you will learn the specific "instructions" needed to move a shape accurately. Finally, you will use a compass and ruler for Constructions and Loci, which is the geometry of "regions"—finding all the possible points that fit a specific rule, such as "exactly 3cm away from point A."

Prior & Subsequent Knowledge

1. Prior Knowledge (The Foundation)

- Naming 2D Shapes: Being able to instantly identify squares, rectangles, parallelograms, and various triangles.
- Coordinates: Reading and plotting points in all four quadrants (x, y).
- Measuring Angles: Using a protractor accurately to measure and draw angles up to 360 degrees.
- Basic Symmetry: Identifying lines of symmetry and the order of rotational symmetry in simple patterns.

2. Related Knowledge (Current GCSE Context)

- Properties of 3D Solids: Identifying prisms, pyramids, spheres, and cones.
  Key Rule (Euler's): For many solids, Faces + Vertices - Edges = 2.
- Plans and Elevations: Drawing the Plan (top view), Front Elevation, and Side Elevation of 3D shapes.
- Transformations:
  - Reflection: Using lines like $x = 2$, $y = -1$, or the axes.
  - Translation: Using vectors to slide shapes.
  - Rotation: Turning a shape using a centre, an angle (90 degrees or 180 degrees), and a direction.
  - Enlargement: Using a scale factor to make shapes bigger or smaller.
- Constructions & Loci: Creating perpendicular bisectors (halving a line) and angle bisectors (halving an angle).

3. Subsequent Knowledge (The Next Steps)

- Surface Area and Volume: Using your knowledge of 3D properties to calculate the total area of faces or the space inside a solid.
- Combined Transformations: Learning what happens when you reflect a shape and *then* rotate it (and why the order matters!).
- Similarity: Deepening enlargement knowledge to understand that while lengths double, areas quadruple (SF^2).
- Bearings and Map Work: Applying construction skills to navigate maps and find "exclusion zones" using loci.

Lesson 01

Lesson Title	National Curriculum or Specification Link	Declarative Knowledge	Procedural Knowledge	Diagnostic questions for each phase of the lesson.	Push Yourself Activities	Resources Link	Literacy and Oracy	Cross Curricular
Properties of 3D solids	**GCSE Mathematics:** G12 - Use the standard conventions and labelling for 2D and 3D shapes; identify and describe the properties of 3D shapes.	* **Vertices:** The "corners" where edges meet. * **Edges:** The lines where two faces meet. * **Faces:** The flat or curved surfaces of the solid. * **Polyhedron:** A 3D solid with flat faces (e.g., cube, pyramid). * **Prism:** A solid with a constant cross-section throughout its length. * **Pyramid:** A solid with a polygon base and triangular faces meeting at an apex.	* Counting faces, edges, and vertices accurately (Euler's Formula). * Identifying shapes from their mathematical descriptions. * Sketching 3D shapes using isometric paper or perspective. * Distinguishing between right prisms and oblique prisms.	**Check Point 01:** "How many faces does a triangular prism have?" (Careful: it's 5, not 3). **Check Point 02:** "Is a cylinder a polyhedron? Why or why not?" (No, it has curved surfaces). **Check Out Questions** 1. Name a 3D solid that has 6 faces, 12 edges, and 8 vertices. 2. How many vertices does a pentagonal prism have? 3. Describe the difference between a square-based pyramid and a tetrahedron. 4. A solid has 1 curved surface and 1 flat circular face. Name the solid. 5. **Challenge:** Use Euler's Formula ($F + V - E = 2$) to find the number of edges on a shape with 7 faces and 10 vertices.	**Activity 01 (The Platonic Solids):** There are only five regular polyhedra (where every face is the same regular polygon). Research them and list their names and the shape of their faces. **Activity 02 (Cross-Section Challenge):** Imagine slicing a cube diagonally. What 2D shapes can you create as a cross-section? (Hint: You can make a hexagon!)		**Key Terminology** • **Cross-section:** The shape you get by cutting straight through an object. • **Apex:** The top point of a pyramid or cone. • **Net:** A 2D pattern that can be folded to make a 3D solid. • **Surface Area:** The total area of all the faces of a 3D shape. • **Volume:** The amount of 3D space an object occupies. **Literacy:** "The Definition Duel." Write a formal definition for a *Prism* and a *Pyramid* that would allow someone to identify them without seeing a picture. Use the word 'cross-section'. **Oracy:** "Shape Mystery." In pairs, Student A thinks of a 3D solid.	**Chemistry:** Molecular structures (e.g., the tetrahedral structure of a diamond or methane molecule). **Architecture:** Using geodesic domes (icosahedrons) for strength and efficiency in buildings like the Eden Project. **Geology:** Crystal systems (cubic, monoclinic, etc.) defined by their geometric 3D properties.

							Student B can only ask "Yes/No" questions about its properties (e.g., "Does it have more than 5 vertices?") to guess the shape.	

Lesson 02

Lesson Title	National Curriculum or Specification Link	Declarative Knowledge	Procedural Knowledge	Diagnostic questions for each phase of the lesson.	Push Yourself Activities	Resources Link	Literacy and Oracy	Cross Curricular
Plans and Elevation	G13	Plans and Elevation are two-dimensional representations of three-dimensional objects. They involve looking at a three dimensional object from the top, the front and the side. The faces and edges that are seen from the top, front or side, are then drawn as seen.	Draw plans and elevations	**Check Point 01:** **Check Point 02:** **Check Out Questions (05 questions):** Which view of an object shows its length and width from above? a) Front Elevation b) Side Elevation c) Plan View d) Isometric View If you are looking at the front of a house, which dimensions are you typically seeing in its front elevation? a) Length and Depth b) Width and Height c) Depth and Height d) Overall Volume A standard brick has dimensions of 21.5 cm (length) × 10.25 cm (width) × 6.5 cm (height). What would its plan view look like, including dimensions? A right circular cone has a base diameter of 8 cm and a perpendicular height of 10 cm. If you view the cone directly from its side, what shape and dimensions would its front elevation be? A square-based pyramid has a base side length of 6 cm and a slant height of 8	**Activity 01:** • **Task:** Provide students with two or three *orthographic projections* (a *plan view* and two *elevations*) of a moderately complex 3D object (e.g., a step block, an L-shaped prism, an object with a cut-out). • **Instructions:** "Given these *plan* and *elevation* views, sketch an *isometric view* or a 3D perspective drawing of the object. You must label the *front*, *side*, and *top* views on your initial drawings and ensure your 3D sketch accurately reflects all visible and implied *dimensions* from the given views." **Activity 02:** • **Task:** "Design a small, multi-level structure (e.g., a two-story shed, a complex birdhouse, a futuristic living pod). It must have at least two distinct levels or sections." • **Challenge:** If possible, build a small physical model of your structure based purely on your drawn plans and elevations, or have a	Slides Worksheet Differentiated Worksheet Check Out | Google Form	**Key Terminology:** Plan Elevation Front Elevation Side Elevation Top View Orthographic Projection 2D Representation 3D Object Viewpoint Scale Dimensions (Length, Width, Height) Perpendicular Parallel Isometric View (for comparison/contrast) Hidden Lines (Advanced) **Literacy:** **Title: "Blueprint Basics: Communicating 3D in 2D"** **Task:** Imagine you are writing a simple guide for a "Young Builders' Club" newsletter. Your task is to explain what *plans* and *elevations* are and why they are essential tools for anyone designing or building objects, from a simple toy house to a complex building. Your article should be	**Design & Technology (D&T) / Engineering:** • **Architecture & Product Design:** Fundamental for designing, communicating, and manufacturing any physical product or structure. Engineers and designers constantly use plans and elevations. • **CAD (Computer-Aided Design):** The digital representation of objects in CAD software directly uses the principles of orthographic projection to generate various views. • **Construction:** Builders read and interpret plans and elevations to construct buildings accurately. **Art & Design:** • **Technical Drawing:** Orthographic projections are a core skill in technical drawing, used to precisely represent objects. • **Sculpture/3D Art:** Artists sometimes use similar principles to

				cm. What shape and dimensions would its side elevation be? An object has a plan view that is a circle and a front elevation that is a rectangle. What kind of 3D solid is it most likely to be? A scale on a map is given as 1:500. If a swimming pool measures 10 cm by 5 cm on the map, what are its actual dimensions in meters?	peer try to build it from your drawings to test their accuracy.		200-250 words. **Oracy:** **Title: "Build It with Words: Explaining a 3D Object"** **Task:** Work in pairs. You have a simple 3D object (e.g., a small block model, a stacked set of cubes, a simple carton) that your partner cannot see. Your task is to describe its *plan* and *elevations* verbally so your partner can sketch it. **Presentation:** Conduct a structured verbal description and sketching session (3-4 minutes). Student A describes, and Student B sketches and asks clarifying questions. Afterwards, compare the sketch to the actual object.	plan their 3D creations from different angles. ● **Perspective Drawing:** While different, understanding orthographic views enhances the comprehension of spatial relationships for perspective.

Lesson 03

Lesson Title	National Curriculum or Specification Link	Declarative Knowledge	Procedural Knowledge	Diagnostic questions for each phase of the lesson.	Push Yourself Activities	Resources Link	Literacy and Oracy	Cross Curricular
Reflection	**GCSE Mathematics:** G7 - Describe, sketch and draw using conventional terms and notations: reflections... including using a line of reflection (mirror line) given by an equation.	* **Reflection:** A transformation where every point is mapped to a point the same distance from the mirror line on the opposite side. * **Mirror Line Equations:** x=a (vertical), y=b (horizontal), y=x (diagonal), and y=-x (negative diagonal). * **Object vs. Image:** The original shape is the object; the result is the image. * **Invariant Points:** Points that lie exactly on the mirror line do not move.	* Drawing mirror lines from their algebraic equations. * Counting squares perpendicular to the mirror line to find the position of the image. * Describing a reflection fully by identifying the equation of the mirror line. * Using a "perpendicular bisector" logic for diagonal reflections.	**Check Point 01:** "What is the equation of the line that passes through (3, 0), (3, 5), and (3, -10)?" **Check Point 02:** "If a point at (2, 4) is reflected in the line y=x, where does it land?" **Check Out Questions** 1. Reflect Triangle A in the line y = 2. 2. Reflect Shape B in the line x = -1. 3. Describe fully the transformation that maps Shape C onto Shape D if the mirror line passes through (0,0) and (5,5). 4. A point at (a, b) is reflected in the x-axis. What are the new coordinates? 5. **Challenge:** Reflect the curve y = x^2 in the line y = 0. What is the equation of the new curve?	**Activity 01 (Double Reflection):** Reflect a shape in the line x=2, and then reflect that image in the line x=5. What single transformation (translation) would have moved the shape from start to finish? Can you find a rule for the distance? **Activity 02 (The y=mx+c Challenge):** Reflect a simple point in a line that isn't horizontal, vertical, or y=x (e.g., y = 2x + 1). How do gradients and perpendicular lines help here?	Slides Worksheet Differentiated Worksheet Check Out | Google Form	**Key Terminology** • **Perpendicular:** At a 90 o angle to the mirror line. • **Congruent:** The object and image are the same size and shape (reflection is an isometric transformation). • **Orientation:** The "direction" the shape faces (this changes in a reflection). • **Vector:** While usually for translations, a reflection can be thought of as a series of movements perpendicular to the mirror. **Literacy:** "The Anatomy of Symmetry." Write a guide for a younger student explaining the difference between x=3 and y=3. Why is x=3 a vertical line even though the x-axis is horizontal? **Oracy:** "Describe the Flip." In pairs, Student A describes a reflection (e.g., "Reflect the square in the line y=-x") while Student B, who	**Art & Design:** Using "Reflectional Symmetry" in logo design (e.g., Starbucks or Apple) and Islamic geometric patterns. **Physics (Optics):** Law of Reflection: The angle of incidence equals the angle of reflection (i=r). **Biology:** Bilateral symmetry in organisms (humans, butterflies, etc.).

							cannot see the grid, must predict the final coordinates of the vertices.	

Lesson 04

Lesson Title	National Curriculum or Specification Link	Declarative Knowledge	Procedural Knowledge	Diagnostic questions for each phase of the lesson.	Push Yourself Activities	Resources Link	Literacy and Oracy	Cross Curricular
Enlargement	G7	An enlargement increases or decreases the size of the shape (object). The new shape (image) is a similar shape. The increase in size from one shape to another is called a scale factor. The position of the enlarged shape is determined by a point called the centre of enlargement.	Enlarge shapes by fractional and negative scale factors	**Check Point 01:** **Check Point 02:** **Check Out Questions (05 questions):**	**Activity 01:** **Problem Solving:** A rectangle ABCD has vertices A(1, 2), B(4, 2), C(4, 4), and D(1, 4). • Enlarge the rectangle by a scale factor of 2 with the centre of enlargement at (0, 0). State the coordinates of the image A'B'C'D'. • Enlarge the *original* rectangle ABCD by a scale factor of 21 with the centre of enlargement at (1, 2). State the coordinates of the image A''B''C''D''. • What relationship exists between the area of A'B'C'D' and the area of ABCD? **Activity 02:** Research and explain the effects of a **negative scale factor** in an enlargement. How does it affect the position and orientation of the image relative to the object and the centre of enlargement? Provide a clear example on a coordinate grid (described in words) to illustrate your explanation.	Slides Worksheet Differentiated Worksheet Check Out | Google Form	**Key Terminology:** Transformation Enlargement Object (Pre-image) Image Centre of Enlargement Scale Factor Positive Scale Factor Negative Scale Factor Invariant Point Congruent Similar Ratio Area Scale Factor Volume Scale Factor Coordinates Origin **Literacy:** You are writing a helpful guide for a fellow student on how to perform an **enlargement** of a shape on a coordinate grid. Explain what an enlargement is, how it differs from other transformations like translation, reflection, and rotation. Detail the two crucial pieces of information needed for an enlargement: the **centre of enlargement** and the **scale factor**. Provide a clear, step-by-step example using a simple polygon, demonstrating how to find the coordinates of	• **Art & Design:** Artists use enlargement to scale up **sketches for murals, paintings**, or **sculptures** . Designers enlarge logos, blueprints, and patterns for various applications. • • **Architecture & Engineering:** Architects and engineers create **scale drawings and models** of buildings, bridges, and machines. Understandi ng enlargement is critical for accurately translating these designs to real-world dimensions and for anticipating

							the enlarged image when the centre is the origin and when it is not. **Oracy:** Prepare a short, interactive presentation (2-3 minutes) for a group of young aspiring artists or designers. Explain the concept of **enlargement** and why it's more than just "making something bigger." Use a physical object (e.g., a small toy or a drawing) and demonstrate how choosing a different **centre of enlargement** changes the position of the enlarged image, even with the same **scale factor**. Discuss how artists might use enlargement to scale sketches for murals, or how designers might scale logos for different applications (e.g., business card vs. billboard).	material requirements. • • **Photography:** The process of **zooming in or out** on a camera lens is an application of enlargement. Understanding scale factors helps photographers compose shots and interpret the perspective. Printing photos at different sizes also involves enlargement. • • **Biology (Microscopy):** When viewing specimens under a **microscope** , the magnification power is essentially a scale factor, enlarging the object

								for detailed observation. • • **Mapping/Cartography:** Maps are **scaled-down representations** of real-world areas. Understanding scale factors is essential for interpreting distances and areas on maps and for creating accurate cartographic representations. •

Lesson 05

Lesson Title	National Curriculum or Specification Link	Declarative Knowledge	Procedural Knowledge	Diagnostic questions for each phase of the lesson.	Push Yourself Activities	Resources Link	Literacy and Oracy	Cross Curricular
Translations	G7	A translation moves a shape from one location to another. The new shape is congruent to the original shape. The size of the shape does not change, and the shape is not reflected or rotated	Translate by a vector	**Check Point 01:** **Check Point 02:** **Check Out Questions (05 questions):** A point P has coordinates $(5, 3)$. It is translated by the vector $\begin{pmatrix} -2 \\ 4 \end{pmatrix}$. What are the coordinates of the image point P'? Point Q has coordinates $(-1, -7)$. It is translated by the vector $\begin{pmatrix} 6 \\ 2 \end{pmatrix}$. What are the coordinates of the image point Q'? A point R at $(2, 8)$ is translated to its image R' at $(-3, 5)$. What is the translation vector? A rectangle has a vertex at B$(4, -1)$. If the rectangle is translated by the vector $\begin{pmatrix} -5 \\ -3 \end{pmatrix}$, what are the coordinates of the translated vertex B'? A point Y' has coordinates $(-1, 9)$. It is the image of point Y after a translation by the vector $\begin{pmatrix} -4 \\ 5 \end{pmatrix}$. What are the coordinates of the original point Y? Which of the following properties is **always** preserved during a translation? a) Size of the shape b) Orientation of the shape c) Position of the shape d) Both a and b A point N has coordinates $(0, 0)$. It undergoes two consecutive translations: first by $\mathbf{t_1} = \begin{pmatrix} 3 \\ -2 \end{pmatrix}$, and then by $\mathbf{t_2} = \begin{pmatrix} -1 \\ 5 \end{pmatrix}$. What are the final coordinates of the image point N''?	**Activity 01:** **Problem Solving:** A quadrilateral has vertices at P(2, 1), Q(5, 1), R(6, 4), and S(3, 4). • Translate the quadrilateral by the vector $\begin{pmatrix} -4 \\ 2 \end{pmatrix}$. Write down the coordinates of the image P'Q'R'S'. • Describe the single translation that would map the image P'Q'R'S' back onto the original quadrilateral PQRS. • If the original quadrilateral PQRS is translated by vector a and then by vector b, what single vector represents the combined translation? **Activity 02:** **Investigation:** Research and explain how **translations** are used in **computer programming** to move objects on a screen. Discuss how game engines or graphics libraries implement translations using coordinate transformations. Provide a conceptual example of how a character's position might be updated in a simple 2D game	Slides Worksheet Differentiated Worksheet Check Out | Google Form	• **Key Terminology:** • Transformation • Translation • Object (Pre-image) • Image • Vector • Column Vector • Horizontal Movement • Vertical Movement • Direction • Magnitude • Invariant Point (though no points are invariant in a non-zero translation) • Congruent • Coordinates • Origin • • **Literacy:** • You are writing a simple instruction guide for a robot that can move objects on a grid. Write a clear and concise explanation of what a **translation** is. Explain how a **column vector** is used to describe	• **Computer Science/Game Development:** Translations are fundamental in **2D and 3D computer graphics** . Game characters move, objects slide, and camera views shift using translation vectors. • • **Physics:** In **kinematics**, translation describes the **linear motion** of objects (e.g., a car moving along a straight road, a ball rolling without spinning). Vectors are used to represent displacement, velocity, and acceleration. • • **Robotics:** Programming

					using translation vectors.		a translation, detailing what the top and bottom numbers represent. Provide a step-by-step example using a simple shape (e.g., a triangle) on a coordinate grid (which you can describe in words) and show how to find the coordinates of the translated image using a given translation vector. ● ● **Oracy:** ● ● Prepare a short, interactive demonstration (2-3 minutes) for a group of younger students to illustrate the concept of translation. Use a physical object (e.g., a toy car, a block) on a large grid drawn on the floor or a table. Demonstrate how to move the object a specific number	robots to move from one point to another in a workspace involves precise **translations**. Engineers use translation vectors to command robotic arms or mobile robots to reach specific locations. ● ● **Art & Design (Pattern Making):** In textile design, wallpaper design, or creating repeating patterns, **translations** are used to shift a basic motif across a surface to create a continuous design without rotation or reflection. ● ● **Logistics/Supply Chain Management:** Understanding translation (movement of

							of units horizontally and vertically without rotating or reflecting it. Explain that the object's size and orientation remain the same. Ask the audience to describe the "move" using simple directional language (e.g., "3 steps right, 2 steps up"). •	goods) is essential for optimizing **delivery routes**, **warehouse layouts**, and the efficient flow of materials from one point to another. •

Lesson 06

Lesson Title	National Curriculum or Specification Link	Declarative Knowledge	Procedural Knowledge	Diagnostic questions for each phase of the lesson.	Push Yourself Activities	Resources Link	Literacy and Oracy	Cross Curricular
Rotation	**GCSE Mathematics:** G7 - Identify, describe and construct rotations, including identifying the center, angle, and direction of rotation.	* **Center of Rotation:** The fixed point around which a shape turns (given as a coordinate). * **Angle:** Usually 90 o, 180 o, or 270 o. * **Direction:** Clockwise or Anticlockwise (180 o does not require a direction). * **Congruence:** The image remains the same size and shape as the object.	* Using tracing paper to perform rotations: trace shape, pin the center, and turn. * Describing a rotation fully by finding the center, angle, and direction. * Rotating a shape algebraically (e.g., 90 o clockwise around the origin maps (x, y) \to (y, -x)). * Identifying the center of rotation using perpendicular bisectors of lines joining corresponding points.	**Check Point 01:** "If you rotate a shape 90 o clockwise, which other rotation would land it in the exact same place?" (270 o anticlockwise). **Check Point 02:** "A point at (0, 4) is rotated 180 o around the origin (0, 0). Where does it land?" **Check Out Questions** 1. Rotate Shape A 90 o clockwise about the point (1, 2). 2. Rotate Shape B 180 o about the origin (0, 0). 3. Describe fully the transformation that maps Shape C to Shape D (identify all three components). 4. A square is rotated 90 o around its own center. How many invariant points are there? 5. **Challenge:** A point (x, y) is rotated 90 o anticlockwise about the origin. Write its new coordinates in terms of x and y.	**Activity 01 (Rotational Symmetry):** Create a shape that has rotational symmetry of order 4 but no lines of reflectional symmetry. Explain why these two properties are independent. **Activity 02 (The Composite Spin):** Rotate a shape 90 o about (0,0), then rotate that *image* 90 o about the point (2,2). Is the result the same as a single 180 o rotation? Prove it with a sketch.	Slides Worksheet Differentiated Worksheet Check Out | Google Form	**Literacy:** "The Manual." Write a set of instructions for a student who has lost their tracing paper. How can they use a ruler and a compass (or just coordinates) to rotate a point 90 o? **Oracy:** "The Navigator." One student closes their eyes. The other student must guide them to rotate a physical object on a desk by giving precise instructions: "Rotate 90 degrees clockwise around the bottom-left corner."	**Engineering:** Gears and cogs. Understanding how a 90 o turn in one gear affects the rotation of another. **Geography:** Compass bearings and navigation. A bearing of 090 o is a 90 o clockwise rotation from North. **Astronomy:** The rotation of planets on their axes and their orbits around the sun. 0

Lesson 07

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Constructions and Loci	G2	Loci are a set of points with the same property. Loci can be used to accurately construct lines and shapes.	Use loci to solve problems Construct triangles Bisect a line Construct the shortest distance from a point to a line using a ruler and compass Bisect an angle using a ruler and compass only Construct angles and triangles using a ruler and compass	**Check Point 01:** **Check Point 02:** **Check Out Questions (05 questions):** What is the locus of all points that are exactly 5 cm away from a point X? Describe the path traced by a point that moves so that it is always equidistant from two fixed points A and B. If you have two straight lines, L1 and L2, that intersect, what is the locus of all points that are equidistant from L1 and L2? You are asked to construct a line that passes through the midpoint of a line segment AB and is perpendicular to AB. What is the common name for this construction? A builder needs to place a security camera so that it covers an equal viewing angle on two walls that meet at a corner. Which geometric construction would help determine the best position for the camera? A goat is tethered by a 3-meter rope to a post located at the corner of a square garden with 5-meter sides. Draw or describe	**Activity 01:** **Problem Solving:** A triangular plot of land has vertices A, B, and C. A well is to be dug on this plot such that it is **equidistant from sides AB and AC**, and also **equidistant from points B and C**. ● Describe the construction lines you would draw on a map to locate the exact position of the well. ● Explain which two loci would need to be found to pinpoint the well's location. **Check Point 01** Bisect an 8cm straight line **Activity 02:** 1. **Investigation:** Research and explain how to construct an **equilateral triangle** and a **regular hexagon** using only a compass and a straightedge. Explain the underlying geometric principles that make these constructions possible, relating them to fixed points	Slides Worksheet Differentiated Worksheet Check Out | Google Form	**Key Terminology:** Construction Locus (Loci - plural) Perpendicular Bisector Angle Bisector Equidistant Fixed Point Fixed Line Compass Ruler (Straightedge) Arc Intersect Region Inscribed Circumscribed **Literacy:** You are preparing a step-by-step instruction manual for a new student learning geometric constructions. Choose two fundamental constructions: the perpendicular bisector of a line segment and the angle bisector of an angle. For each, write clear, precise, and numbered instructions, detailing how to perform the construction using only a compass and a straightedge. You should also explain *why* each construction works (e.g., in terms of being equidistant from	● **Architecture & Urban Planning:** Loci are crucial for **site planning**, **zoning regulations** , and determining optimal locations for facilities (e.g., emergency services, public parks) that need to be equidistant from certain areas or avoid others. Constructions are used in precise drawing. ● ● **Geography:** Geographers use loci concepts for defining **catchment areas**, **service areas** (e.g., nearest fire station), or **safe zones** around natural hazards. They use

				the boundary of the area the goat can graze within the garden. You have performed a construction where you opened your compass to a certain radius, placed the compass point at the vertex of an angle, drew an arc intersecting both arms, then from these intersection points, drew two more arcs that intersect inside the angle. Finally, you drew a line from the vertex through this intersection point. What construction did you complete?	and distances. **Check Point 02:** Construct a 15 degree angle.		points/lines). **Oracy:** Prepare a short, interactive presentation (2-3 minutes) for a group of urban planners or architects, explaining the practical applications of **loci** in real-world planning and design. Use a large piece of paper or a whiteboard to draw simple scenarios. For example, demonstrate finding the ideal location for a new hospital equidistant from three towns, or the safe zone around a hazardous building. Explain how understanding loci helps in defining regions, optimizing placement, and ensuring safety or fairness.	construction techniques for creating accurate maps and overlays. ● ● **Engineering (Civil & Mechanical):** Engineers use constructions for precise **technical drawings** and understanding **tolerances** in designs. Loci help in determining the range of motion for mechanical parts or safe operating zones for machinery. ● ● **Computer Science (Computational Geometry):** Algorithms for tasks like **pathfinding**, **nearest neighbor searches**, and **Voronoi diagrams** (which define regions based on proximity to points) are based on the mathematical principles of

								loci. • • **Sports (Strategy & Rules):** In sports like football or basketball, rules defining areas (e.g., penalty box in soccer, free-throw line in basketball) are effectively loci – regions defined by distances from points or lines. Strategic positioning often involves understanding being "equidistant" from defenders or goals.