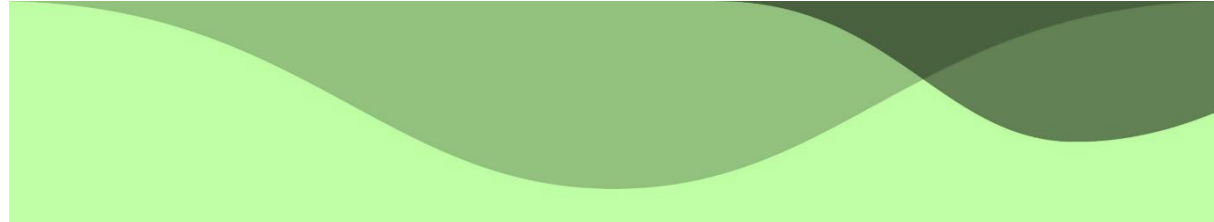


YEAR 9, DEVELOPING, GEOMETRY AND MEASURES, MATHS

Rationale and Context of Unit:	Core curriculum content:	Tier 2 & Tier 3 vocabulary explicitly taught:
<p>Prior Key Stage 3 content reviewed using pre-tests and whiteboard work at the start of each topic.</p> <p><u>VISUALISING AND CONSTRUCTING Geometric Notation</u></p> <p>You will learn to interpret and apply geometrical conventions and notation</p> <ul style="list-style-type: none"> • Know the meaning of faces, edges and vertices • Use notation for parallel lines • Know the meaning of ‘perpendicular’ and identify perpendicular lines • Know the meaning of ‘regular’ polygons • Identify line and rotational symmetry in polygons • Use AB notation for describing lengths • Use $\angle ABC$ notation for describing angles • Use ruler and protractor to construct triangles from written descriptions • Use ruler and compasses to construct triangles when all three sides known <p><u>INVESTIGATING PROPERTIES OF SHAPE Nets</u></p>	<p><u>ANGLES</u></p> <ul style="list-style-type: none"> • Use conventional terms and notations: <ul style="list-style-type: none"> • points, lines, vertices, edges, planes, parallel lines, perpendicular lines, right angles, polygons, regular polygons and polygons with reflection and/or rotation symmetries. • Use the standard conventions for labelling and referring to the sides and angles of triangles. • Draw diagrams from written descriptions • Apply the properties of: <ul style="list-style-type: none"> • angles at a point • angles at a point on a straight line • vertically opposite angles. • Understand and use alternate and corresponding angles on parallel lines. <p><u>SCALE DIAGRAMS AND BEARINGS</u></p> <ul style="list-style-type: none"> • Use scale factors, scale diagrams and maps. • Measure line segments and angles in geometric figures, including interpreting 	<p>Point, line, vertex, vertices, edge, plane, parallel, perpendicular, polygon, regular, reflection, rotation, angle, right angle, triangle, diagram, straight line, vertically opposite, alternate angle, scale, bearing, diagram, map, measure, line, segment, drawing, faces, surfaces, edges, cube, cuboid, prism, cylinder, pyramid, cone, sphere, perimeter, area, composite shape, triangle, parallelogram, trapezium, formula, circle, circumference, centre, radius, diameter, chord, arc, tangent, sector, segment, pi, perimeter, volume, composite shape, transformation, describe, translation, reflection, rotation, enlargement, congruent, similar, scale factor, vector, ruler, compass, construction, perpendicular, bisector, loci, locus, 2D, 3D, construct, interpret, plan, side elevation, front elevation.</p> <p>Highlighted words MUST be explicitly taught, defined and recorded in student books as they are first met. Other listed words may be introduced verbally or written in a similar format.</p>



<p>You will investigate the properties of 3D shapes</p> <ul style="list-style-type: none"> • Know the vocabulary of 3D shapes • Know the connection between faces, edges and vertices in 3D shapes • Visualise a 3D shape from its net <p><u>Properties of shapes</u></p> <p>You will explore triangles and quadrilaterals</p> <ul style="list-style-type: none"> • Recall the names and shapes of special triangles and quadrilaterals • Know the meaning of a diagonal of a polygon • Know the properties of the special quadrilaterals (including diagonals) • Apply the properties of triangles to solve problems • Apply the properties of quadrilaterals to solve problems <p><u>MEASURING SPACE</u></p> <p><u>Accurate measurements</u></p> <p>You will practice using rulers and protractors to measure accurately</p> <ul style="list-style-type: none"> • Use a ruler to accurately measure line segments to the nearest millimetre • Use a protractor to accurately measure angles to the nearest degree <p><u>Units</u></p>	<p>maps and scale drawings and use of bearings.</p> <p><u>INTRODUCTION TO PERIMETER AND AREA</u></p> <ul style="list-style-type: none"> • Identify properties of the faces, surfaces, edges and vertices of: cubes, cuboids, prisms, cylinders, pyramids, cones and spheres • Calculate the perimeter of a 2D shape and composite shapes • Calculate the area of composite shapes • Know and apply formulae to calculate area of: <ul style="list-style-type: none"> • triangles • parallelograms • trapezia <p><u>CIRCUMFERENCE AND AREA</u></p> <ul style="list-style-type: none"> • Identify and apply circle definitions and properties, including centre, radius, chord, diameter, circumference, tangent, arc, sector and segment • Know the formulae <ul style="list-style-type: none"> • circumference of a circle = $2\pi r = \pi d$ • area of a circle = πr^2 • Calculate: perimeters of 2D shapes, including circles and composite shapes • Calculate areas of circles and composite shapes 	
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You will learn to convert between measures and solve problems involving measurement

- Convert fluently between metric units of length
- Convert fluently between metric units of mass
- Convert fluently between metric units of volume / capacity
- Convert fluently between units of time
- Convert fluently between units of money
- Solve practical problems that involve converting between units
- State conclusions clearly using the units correctly

INVESTIGATING ANGLES

Calculating angles

You will Investigate angles

- Identify fluently angles at a point, angles at a point on a line and vertically opposite angles
- Identify known angle facts in more complex geometrical diagrams
- Use knowledge of angles to calculate missing angles in geometrical diagrams
- Know that angles in a triangles total 180°
- Find missing angles in triangles
- Find missing angles in isosceles triangles

TRANSFORMATIONS

- Identify, describe and construct congruent and similar shapes, on co-ordinate axes, by considering rotation, reflection, translation and enlargement (including fractional scale factors)
- Describe translations as 2D vectors

PYTHAGORAS' THEOREM

- Know the formula for Pythagoras' Theorem $a^2+b^2=c^2$
- Apply it to find length in right angled triangles in two dimensional figures

2D REPRESENTATIONS OF 3D SHAPES

- Construct and interpret plans and elevations of 3D shapes

- Explain reasoning using vocabulary of angles

CALCULATING SPACE

Area and perimeter

You will develop your knowledge of area

- Recognise that the value of the perimeter can equal the value of area
- Use standard formulae for area
- Find missing lengths in 2D shapes when the area is known
- Know that the area of a trapezium is given by the formula $\text{area} = \frac{1}{2} \times (a + b) \times h = \left(\frac{a+b}{2}\right) h = \frac{(a+b)h}{2}$
- Calculate the area of a trapezium

Surface area and volume

You will investigate surface area and explore volume

- Understand the meaning of surface area
- Find the surface area of cuboids (including cubes) when lengths are known

Find missing lengths in 3D shapes when the volume or surface area is known.

Challenge and Support:

World wide learning/ links to 21st century:

Cultural capital/ Industry/ Enrichment:

GEOMETRY AND MEASURES

Properties and constructions

1. use conventional terms and notations: points, lines, vertices, edges, planes, parallel lines, perpendicular lines, right angles, polygons, regular polygons and polygons with reflection and/or rotation symmetries; use the standard conventions for labelling and referring to the sides and angles of triangles; draw diagrams from written description
2. use the standard ruler and compass constructions (perpendicular bisector of a line segment, constructing a perpendicular to a given line from/at a given point, bisecting a given angle); use these to construct given figures and solve loci problems; know that the perpendicular distance from a point to a line is the shortest distance to the line
3. apply the properties of angles at a point, angles at a point on a straight line, vertically opposite angles; understand and use alternate and corresponding angles on parallel lines; derive and use the sum of angles in a triangle (e.g. to deduce and use the angle sum in any polygon, and to derive properties of regular polygons)
4. derive and apply the properties and definitions of: special types of quadrilaterals, including square, rectangle, parallelogram, trapezium, kite and rhombus; and triangles

- Many people rely on an understanding of angles and spatial relationships in their daily work. These include designers, architects, opticians and tree surgeons.
- A cartographer uses accurate measurements to work out the scale when he draws maps. The people who use maps need to understand the scale so that they can make sense of map distances.
- When designing a new building, an architect uses graphs to help identify and describe the structural properties the building needs to have.
- Working out the amount of fencing needed for a field, or the number of tiles needed to edge a swimming pool, or the number of perimeter cameras needed to secure an area all require the calculations of a perimeter.
- Ordering the right quantity of turf for a sports field, preparing detailed floor plans and determining how much fertiliser is needed to treat a field crop all require knowledge and calculation of areas.
- You can see examples of reflections, rotations and translations all around you. Patterns in wallpaper and fabric are often translations, images reflected

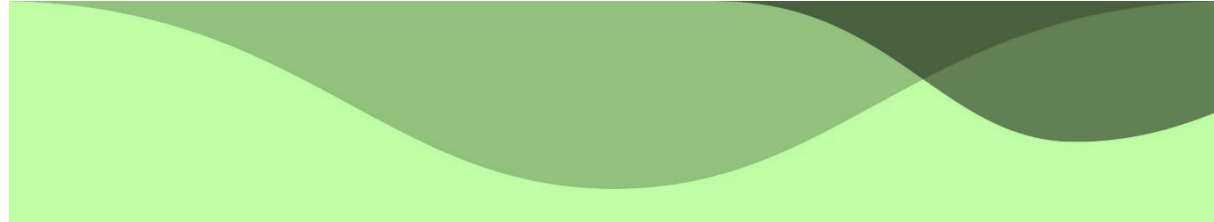


Search Algebra for all ages

NRICH website – access current articles and enrichment activities.

- NRICH provides thousands of free online mathematics resources for ages 3 to 18 - completely free and available to all via their website (nrich.maths.org/). These resources aim to:
 - Enrich and enhance the experience of the mathematics curriculum for all learners
 - Develop mathematical thinking and problem-solving skills
 - Offer challenging, inspiring and engaging activities
- Problem solving opportunities – Applied Mathematics.
- Challenge problems.
- Extension work.
- Assessment sections in texts

<p>and other plane figures using appropriate language</p> <p>5. use the basic congruence criteria for triangles (SSS, SAS, ASA, RHS)</p> <p>6. apply angle facts, triangle congruence, similarity and properties of quadrilaterals to conjecture and derive results about angles and sides, including Pythagoras' Theorem and the fact that the base angles of an isosceles triangle are equal, and use known results to obtain simple proofs</p> <p>7. identify, describe and construct congruent and similar shapes, including on coordinate axes, by considering rotation, reflection, translation and enlargement (including fractional and negative scale factors)</p> <p>10</p> <p>8. describe the changes and invariance achieved by combinations of rotations, reflections and translations</p> <p>9. identify and apply circle definitions and properties, including: centre, radius, chord, diameter, circumference, tangent, arc, sector and segment</p> <p>10. apply and prove the standard circle theorems concerning angles, radii, tangents and chords, and use them to prove related results</p> <p>11. solve geometrical problems on coordinate axes</p>	<p>in the water are reflections and the blades of a wind turbine are a good example of rotation.</p> <ul style="list-style-type: none"> • Builders, carpenters, garden designers and navigators all use Pythagoras' Theorem. It is a method based on right-angled triangles which helps them to work out unknown lengths and to test that angles are right angles. • Buildings, engine parts, vehicles and packaging are all carefully planned and designed before they are built or made. Most design work starts on paper or screen using two-dimensional images to represent the final three-dimensional objects. 	
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<p>12. identify properties of the faces, surfaces, edges and vertices of: cubes, cuboids, prisms, cylinders, pyramids, cones and spheres</p> <p>13. construct and interpret plans and elevations of 3D shapes.</p> <p>Mensuration and calculation</p> <p>14. use standard units of measure and related concepts (length, area, volume/capacity, mass, time, money, etc.)</p> <p>15. measure line segments and angles in geometric figures, including interpreting maps and scale drawings and use of bearings</p> <p>16. know and apply formulae to calculate: area of triangles, parallelograms, trapezia; volume of cuboids and other right prisms (including cylinders)</p> <p>17. know the formulae: circumference of a circle = $2\pi r = \pi d$, area of a circle = πr^2; calculate: perimeters of 2D shapes, including circles; areas of circles and composite shapes; surface area and volume of spheres, pyramids, cones and composite solids</p> <p>18. calculate arc lengths, angles and areas of sectors of circles</p> <p>19. apply the concepts of congruence and similarity, including the relationships between lengths, areas and volumes in similar figures</p> <p>20. know the formulae for: Pythagoras' theorem, $a^2 + b^2 = c^2$, and the trigonometric ratios, $\sin\theta = \frac{\textit{opposite}}{\textit{hypotenuse}}$, $\cos\theta = \frac{\textit{adjacent}}{\textit{hypotenuse}}$, and</p>		
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<p>$\tan\theta = \frac{\textit{opposite}}{\textit{adjacent}}$; apply them to find angles and lengths in right-angled triangles and, where possible, general triangles in two and three dimensional figures</p> <p>21. know the exact values of $\sin\theta$ and $\cos\theta$ for $\theta = 0^\circ, 30^\circ, 45^\circ, 60^\circ$ and 90°; know the exact value of $\tan\theta$ for $\theta = 0^\circ, 30^\circ, 45^\circ$ and 60°</p> <p>22. know and apply the sine rule, $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$, and cosine rule, $a^2 = b^2 + c^2 - 2bc \cos A$, to find unknown lengths and angles</p> <p>23. know and apply</p> <p>$\text{Area} = \frac{1}{2} ab \sin C$</p> <p>to calculate the area, sides or angles of any triangle.</p> <p>11 Vectors</p> <p>24. describe translations as 2D vectors</p> <p>25. apply addition and subtraction of vectors, multiplication of vectors by a scalar, and diagrammatic and column representations of vectors; use vectors to construct geometric arguments and proofs</p>		
<p>Historical, Social, Moral, Spiritual, Cultural context:</p>	<p>Cross curricular links/ literacy/numeracy:</p>	<p>Common misconceptions:</p>
<ul style="list-style-type: none"> Explore key mathematicians and links to Geometry e.g Euclid on you tube 	<ul style="list-style-type: none"> Textiles: finding area of materials Geography coordinate units 	<ul style="list-style-type: none"> Two line segments that do not touch are perpendicular if they would meet at right angles when extended

<ul style="list-style-type: none"> • History of imperial Measures- google search images. 	<ul style="list-style-type: none"> • History measures/storming castle trip 	<ul style="list-style-type: none"> • Pupils may believe, incorrectly, that: <ul style="list-style-type: none"> - perpendicular lines have to be horizontal / vertical - only straight lines can be parallel - all triangles have rotational symmetry of order 3 • Some pupils may think that all trapezia are isosceles • Some pupils may think that a diagonal cannot be horizontal or vertical • Two line segments that do not touch are perpendicular if they would meet at right angles when extended. Therefore, the diagonals of an arrowhead (delta) are perpendicular despite what some pupils may think • Some pupils may write amounts of money incorrectly; e.g. £3.5 for £3.50, especially if a calculator is used at any point • Some pupils may apply an incorrect understanding that there are 100 minutes in a hour when solving problems • Some pupils may struggle when converting between 12- and 24-hour clock notation; e.g. thinking that 15:00 is 5 o' clock • Some pupils may use the wrong scale of a protractor. For example, they measure an obtuse angle as 60° rather than 120°. • Some pupils may think it's the 'base' angles of an isosceles that are always equal. For
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		<p>example, they may think that $a = b$ rather than $a = c$.</p> <ul style="list-style-type: none">• Some pupils may use the sloping height when finding the areas of parallelograms, triangles and trapezia• Some pupils may think that the area of a triangle is found using $\text{area} = \text{base} \times \text{height}$• Some pupils may think that you multiply all the numbers to find the area of a shape• Some pupils may confuse the concepts of surface area and volume <p>Some pupils may only find the area of the three 'distinct' faces when finding surface area</p> <ul style="list-style-type: none">• Some pupils will wrestle with the idea that a line $x = a$ is parallel to the y-axis• When describing or carrying out a translation, some pupils may count the squares between the two shapes rather than the squares that describe the movement between the two shapes.• When reflecting a shape in a diagonal mirror line some students may draw a translation• Some pupils may think that the centre of rotation is always in the centre of the shape• Some pupils will confuse the order of x- and y-coordinates <p>When constructing axes, some pupils may not realise the importance of equal divisions on the axes.</p>
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Assessment timeline:

- Topic test assessments are conducted at the end of each topic. These are roughly after 2 weeks per topic, but this may vary.
- Pre-checks are conducted at the start of the topic to test student prior knowledge. This informs lesson planning and delivery.
- Tracking assessments are conducted once a term with end of year formal exams, for reporting and checking cumulative knowledge.
- Testing data leads to discussions about setting, intervention groups and individual in-class intervention.
- All students have access to a wide range of resources to develop their understanding.

Home learning

- Homework is set weekly for each group. This will often be via interactive websites with immediate feedback and support.
- Teachers have the autonomy to use whichever resource they wish within the criteria set for the topic.
- Students have access to lots of resources at home, including: Kerboodle, MyMaths, Mathswatch, PiXL Maths APP, PiXL Tmes Table App.

Feedback

- Feedback is given after each topic test, tracking assessment and end of year exams. After tracking and end of year exams, this will include “Formative Marking” sheets which give feedback question by question to help support the students with priorities for further work.

Length of unit (duration indicated in lessons)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Unit:																													