Framework for developing schemes of work for the geometry curriculum for ages 14 -16

		CURRICULUM CONTENT		TOPIC		TEACHING OPPORTUNITIES		
GRADES G - F	GRADES E - D	GRADES C - B	GRADES A – A*		INVESTIGATION AND ILLUSTRATION	DEDUCTION AND PROOF	USE OF ICT	CONTEXT AND APPLICATION
Distinguish between, acute, right, obtuse and reflex angles.	Know and use angle, side, diagonal and symmetry properties of quadrilaterals and classify quadrilaterals by their geometric properties.	Construct hierarchical classification of 2-D and 3-D shapes.		**EUCLIDEAN PLANE GEOMETRY**	Exploring properties of quadrilaterals.		Use of dynamic geometry to investigate and illustrate Use of Logo to investigate polygons and stars.	History of Euclidean geometry. Tessellations. Fabric and graphic design.
Know and use the angle sum of a triangle, the sum of angles at a point, and the sum of angles at a point on a line.	Understand proofs that the angle sum of a triangle is 180°. Know and use angle properties of equilateral, isosceles and right angled triangles.	Understand proofs that the exterior angle of a triangle is equal to the sum of the interior angles at the other two vertices.			Angle sum of a triangle by practical demonstration. Angle sum of polygons by practical demonstration.	Angle sum of a triangle using parallel lines. Angle sum of polygons using triangles.	Use of dynamic geometry to investigate and illustrate.	
Understand why the angle sum of any quadrilateral is 360°.	Know and use angle properties of intersecting and parallel lines and the consequent properties of parallelograms.		Use formal arguments to verify standard ruler and compass constructions.		Angle sum of a quadrilateral. Angle properties of intersecting and parallel lines and parallelograms.	Angle sum of a quadrilateral. Angle properties of intersecting and parallel lines and parallelograms.	Use of dynamic geometry to investigate and illustrate.	
Know and use the sum of the exterior angles of polygons.	Calculate and use the angles of regular polygons.	Know and use angle and symmetry properties of polygons.			Angle sums of polygons.	Angle sums of polygons.	Use of dynamic geometry to investigate and illustrate.	

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	Know and use the fact that the angle between a tangent and a radius is a right angle.	Understand and use tangent and chord properties of circles. Know and use the facts that the angle subtended by an arc at the centre of a circle is twice the angle subtended at any point on the circumference, including the special case of a semicircle, and that angles in the same segment are equal. Know and use angle properties of cyclic quadrilaterals.	Know and use the alternate segment theorem. Understand the proofs of the facts that the angle subtended by an arc at the centre of a circle is twice the angle subtended at any point on the circumference, that angles in the same segment are equal and that opposite angles of a cyclic quadrilateral are equal.		Angle properties relating to circles.	Angle properties relating to circles.	Use of dynamic geometry to investigate and illustrate.	Tangent/chord theorem and the distance o f the horizon from different heights above the sea.
Recognise congruence of shapes in different orientations.	Understand the concept of similarity and be able to identify similar shapes.	Use knowledge of similarity to solve problems involving plane shapes.	Understand and use SSS, SAS, ASA and RHS conditions to prove the congruence of triangles.		Relationships between lengths in similar shapes.		Use of dynamic geometry to investigate and illustrate.	
		Understand various proofs of Pythagoras's theorem, and use Pythagoras's theorem to solve problems in 2D.	Use Pythagoras's theorem to solve problems in 2D and 3D.		Pythagoras's theorem. Pythagorean triples.	Various proofs of Pythagoras's theorem. Derivation of the formula for the distance between two points.	Use of a spreadsheet to assist with investigation.	History of the relationship between the sides of right angled triangles (Babylonians, Chinese and Greeks).
		Use trigonometry to solve 2D problems including bearings and angles of elevation and depression.	Use right angled triangle trigonometry to solve problems in 2D and 3D including finding the angle between a line and a plane.		Similar triangles leading to trigonometrical ratios. Solve problems involving intersecting planes, pyramids etc.			Bearings. Using angles of elevation and depression to determine heights and distances. Astronomy.

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		Calculate the area of a triangle using $A = \frac{1}{2} ab\sin C$.	Use the sine and cosine rules to solve 2-D and 3-D problems.		Areas of triangles using $A = \frac{1}{2}ab\sin C$ and $A = \frac{1}{2}bh$. Investigate close packing of spheres, crystal lattices etc.	Proof of sine and cosine rules. Derivation of the formula for the area of a triangle.		Calculation of the tetrahedral bond angle in the diamond crystal lattice. Navigation problems involving bearings.
Use coordinates in the first quadrant.	Use coordinates in all four quadrants. Find the coordinates of the midpoint of the line segment AB, given points A and B.	Calculate the length of a line segment in 2-D given the coordinates of the end points. Understand the concept of gradient and use triangles to calculate gradient.		**COORDINATE GEOMETRY**	Investigation of the distance between two points on a coordinate grid. Investigation of gradients.	Derivation of a general result for the distance between two points on a coordinate grid.	Use of a graph plotting program. Use of dynamic geometry and graph plotters , including graphic calculators to investigate and illustrate.	Locating positions on a map or grid. Link with algebra and $y = mx + c$. Gradients of roads and slopes.
Use distances to locate objects in 3D space.		Understand and use 3D coordinates.	Calculate the length of a line segment in 3D given the coordinates of the end points. Understand simple properties of points, lines and planes in 3D space. E.g. $y = 4$ is a plane, two planes generally intersect in a line.				CAD	Locating positions on a map or grid. Air traffic control. Computer images in medicine and engineering.

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Construct nets of cuboids. Recognise nets of, prisms, pyramids cylinders and cones	Construct nets of pyramids, prisms cones and cylinders from given information. Understand and use 2D representations of 3D objects including isometric drawings of shapes made from cuboids, simple sections, plans and elevations	Explore polyhedra whose faces are regular polygons. Euler's rule F + V = E + 2.	More difficult sections of solid shapes.	**3D GEOMETRY**	Use of equipment to make and handle models. Investigation. Euler's rule. Existence of only 5 Platonic solids linked to regular tessellations.	Existence of only 5 Platonic solids.	CAD.	Design of packaging. Crystal structures. Cross curricular links with design technology. Polyhedral forms in the natural world – pollen grains, viruses etc.
Carry out reflections of simple shapes in given mirror lines on Cartesian axes. Identify all lines of symmetry for 2D shapes.	Reflect and describe reflections of simple shapes in a range of mirror lines on Cartesian axes and use computer packages to reflect shapes.			**SYMMETRY, TRANSFORMATIONS AND VECTORS**	Investigate two reflections being equivalent to a rotation.	Use rotations to prove Pythagoras's theorem.		Kaleidoscopes. Symmetry in art. Islamic design & architecture.

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Understand and use vertical and horizontal displacement for location and movement.	Understand and use vector notation for translation. And use computer packages to translate shapes. Describe combinations of translations as a single vector.	Understand and use vectors in the context of translation including inverse translation, repeated translations and combinations of translations.	Calculate and represent graphically the sum and difference of two vectors and a scalar multiple of a vector. Calculate the resultant of two vectors. Understand and use the commutative and associative properties of vector addition. Solve problems in 2D using vector methods.		Investigate repeated translations and associated vector arithmetic.			Transformations of graphs of algebraic and trigonometrical functions. Translations and tesselations.
Enlarge shapes using any positive whole number scale factor.	Enlarge shapes using a centre of enlargement and any positive whole number scale factor. Solve simple problems involving enlargement of 3-D shapes.	Enlarge shapes using a centre of enlargement and any scale factor and describe enlargements.	Enlarge 3D shapes.		Investigate enlargement of shapes.			Combinations of rotations and enlargements to generate spirals. Photographs. Desk top publishing.
Identify order of rotational symmetry.	Rotate a shape about the origin through multiples of 90°.	Rotate shapes using any centre of rotation and any specified angle and determine the centre and angle of rotation.						

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Use practical equipment to investigate simple tiling patterns.		Demonstrate that any triangle will tessellate. Determine which regular polygons will tessellate either singly (regular) or in combination with others (semi-regular).			Investigate polygons and combinations of polygons that will and will not tessellate.			Tessellations.
		Devise instructions for a computer to generate and transform shapes. Apply simple combinations of transformations and describe the results using a single transformation. Distinguish properties that are preserved under particular transformations.	Apply more complex combinations of transformations and describe the results using a single transformation. Stretch shapes using an invariant horizontal or vertical line and a scale factor.	**SYMMETRY, TRANSFORMATIONS AND VECTORS (CONTINUED)**	Investigate combinations of transformations.		Use of Logo and dynamic geometry packages.	Pattern design.
Estimate lengths.				**DRAWING, CONSTRUCTION AND LOCI**				

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Choose and use appropriate instruments and units for measuring length.	Use geometrical equipment to construct 2D shapes. Use computer packages to construct shapes.	Understand through experience of constructing that triangles satisfying SSS, SAS, ASA and RHS are unique but SSA triangles are not.	Construct the circumscribed and inscribe circles of triangles using geometrical equipment or computer packages.				Use of dynamic geometry for drawing loci. Use of Logo for construction of shapes.	DIY retail. Graphic design.
	Find and sketch loci from practical examples.	Construct standard loci using geometrical equipment and computer packages.			Construct circumcircles, incircles, centroids, exscribed circles. Construct unknown centres	Prove the validity of standard constructions using congruence.	Carry out standard constructions using dynamic geometry.	Construct polygons.
	Interpret and use scale drawing including maps and plans.							Maps, plans and elevations. Templates for DIY. Garment making Use of CAD Scale diagrams, maps, blueprints and models Room planning
Estimate the size of an angle in degrees.							Use of software packages on estimating angles.	Snooker problems.

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Use a 360° angle measurer to draw and measure angles.	Understand, measure and use simple bearings.							Orienteering.
Find perimeters of simple shapes Understand the concept of area and find areas by counting squares.	Derive and use the formula for the area of a rectangle. Understand the derivation of and use the formulae for the areas of parallelograms and triangles.			**MENSURATION**	Investigate areas of rectangles. Investigate the relationships between areas of triangles, rectangles and parallelograms.	Derivation of the formula for the area of a rectangle. Derivation of the formulae for the areas of parallelograms and triangles. Prove that parallelograms with the same base and heights have the same area.		
	Calculate the areas of plane compound shapes.	Solve problems involving lengths, areas and volumes in plane shapes and right prisms.			Investigate relationships between perimeters and areas and surface areas and volumes. Investigate volumes of parallelepipeds.		Use of spreadsheets for trial and improvement.	Practical measurement of real objects. Calculations from plans or blueprints. Fencing problems. Maximum box problems Calculation of the discharge of a river.

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	Know and use formulae for finding circumferences and areas of circles. Understand the concept of volume and find the volume of cuboids by counting cubes. Derive and use the formula for the volume of cuboids.	Calculate lengths of simple arcs and areas of simple sectors of circles. Find the surface areas of prisms including cylinders. Understand the relationships between lengths, areas and volumes of similar figures with whole number scale factors. Distinguish between formulae for length, area and volume by considering dimensions.	Calculate the lengths of arcs and areas of sectors and segments of circles. Solve problems involving volume and surface areas of pyramids, cones, spheres, composite shapes and frustums. Understand the relationships between lengths, areas and volumes of similar figures with any scale factors.		Circumference-area relationship for circles.	Prove the formula for the area of a circle by considering any polygon [A=0.5r x perimeter] circumscribing a circle and taking the limit as the polygon tends to a circle.		Latitude problems.

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Use network diagrams to represent information on simple maps.	Understand and use the terms arcs, nodes and regions as they relate to simple networks and traversability.	Understand and use Euler's rule R + N = A + 2.	Represent solids as networks.	**NETWORKS**	Investigation of traversability of networks.			Topological maps. Bridges of Konigsberg. Four Colour Theorem.