4.1 Geometrical reasoning

Outcome	3a G	4c F	4b F	4a F	5c E	5b E	5a E	6c D	6b D
4.1a Conventions		use correctly the vocabulary, notation and labelling conventions for lines, angles and shapes					distinguish between conventions, definitions and derived properties		
4.1b Identifying angles			recognise vertically opposite angles	identify parallel and perpendicular lines	know the sum of angles at a point, on a straight line and in a triangle			identify alternate angles and corresponding angles	explain how to find, calculate and use the sums of the interior and exterior angles of quadrilaterals, pentagons and hexagons; understand a proof that the exterior angle of a triangle is equal to the sum of the two interior opposite angles
4.1c Properties of the circle						know the definition of a circle and the names of its parts			explain why inscribed regular polygons can be constructed by equal divisions of a circle
4.1d Properties of polygons					identify and use angle, side and symmetry properties of triangles and quadrilaterals	explore geometrical problems involving these properties, explaining reasoning orally, using step-by-step deduction supported by diagrams	solve geometrical problems using side and angle properties of equilateral, isosceles and right-angled triangles and special quadrilaterals, explaining reasoning with diagrams and text	classify quadrilaterals by their geometrical properties	solve problems using properties of angles, of parallel and intersecting lines, and of triangles and other polygons, justifying inferences and explaining reasoning with diagrams and text
4.1e Congruence								know that if two 2-D shapes are congruent, corresponding sides and angles are equal	
4.1f Investigate Pythagoras' Theorem									
4.1g 3D shapes						use 2-D representations to visualise 3-D shapes and deduce some of their properties	visualise 3-D shapes from their nets	use geometric properties of cuboids and shapes made from cuboids	use simple plans and elevations; create nets of 3D shapes
4.1h Trigonometry									
4.1i Sine and cosine rules									
4.1j Area of a triangle									

4.1 Geometrical reasoning

6a D	7c C	7b C	7a B	8c B	8b A	8a A	EP A*
distinguish between practical demonstration and proof in a geometrical context		show step-by-step deduction in solving more complex geometrical problems					understand the necessary and sufficient conditions under which generalisations, inferences and solutions to geometrical problems remain valid
understand a proof that the angle sum of a triangle is 180 and of a quadrilateral is 360; explain how to find, calculate and use the interior and exterior angles of regular polygons							
	know that the tangent at any point on a circle is perpendicular to the radius at that point	explain why the perpendicular from the centre to the chord bisects the chord	use the facts that angles in the same segment are equal and opposite angles in a cyclic quadrilateral sum to 180	use the facts that the angle subtended at the circumference by a semicircle is a right angle and the angle subtended by an arc at the centre of a circle is twice the angle subtended at any point on the circumference	prove the facts that angles in the same segment are equal and opposite angles in a cyclic quadrilateral sum to 180	prove the facts that the angle subtended at the circumference by a semicircle is a right angle and the angle subtended by an arc at the centre of a circle is twice the angle subtended at any point on the circumference	prove and use the alternate segment theorem
	solve multi-step problems using properties of angles, of parallel lines, and of triangles and other polygons, justifying inferences and explaining reasoning with diagrams and text						
understand congruence and explore similarity			know that if two 2-D shapes are similar, corresponding angles are equal and corresponding sides are in the same ratio	understand from this that any two circles and any two squares are mathematically similar, while in general any two rectangles are not			prove the congruence of triangles and verify standard ruler and compass constructions using formal arguments
investigate Pythagoras' theorem, using a variety of media, through its historical and cultural roots, including 'picture' proofs	use Pythagoras' Theorem to find the hypotenuse of a right-angled triangle, given the other two sides	use Pythagoras' Theorem to find the remaining side of a right-angled triangle, given the hypotenuse and a second side					
visualise and use 2-D representations of 3-D objects	analyse 3-D shapes through 2-D projections, including plans and elevations	understand and apply Pythagoras' theorem when solving problems in 2-D and simple problems in 3-D					understand and use Pythagoras' theorem to solve 3-D problems
				understand and use trigonometric relationships in right-angled triangles, and use these to solve problems, including those involving bearings		use trigonometric relationships in right-angled triangles to solve 3-D problems, including finding the angles between a line and a plane	draw, sketch and describe the graphs of trigonometric functions for angles of any size, including transformations involving scaling in either or both of the x and y directions
					understand and use the sine and cosine rules in 2-D		use the sine and cosine rules to solve 2-D and 3-D problems
							calculate the area of a triangle using the formula 1/2 ab sin C