4.2 Transformations and co-ordinates

Outcome	3a G	4c F	4b F	4a F	5c E	5b E	5a E	6c D	6b D
4.2a Language and notation					understand and use the language and notation associated with reflections, translations and rotations				
4.2b Symmetry				recognise and visualise the symmetries of a 2-D shape		identify all the symmetries of 2-D shapes		identify rotational symmetry of 2D shapes	
4.2c Understanding transformations				reflect 2-D shapes in given, simple mirror lines	rotate 2-D shapes about a given point	translate 2-D shapes	transform 2-D shapes by rotation, reflection and translation, on paper and using ICT; reflect 2D shapes about a more difficult mirror line	recognise that translations, rotations and reflections preserve length and angle, and map objects on to congruent images	transform 2-D shapes by combinations of translations, rotations and reflections, on paper and using ICT; refect 2D shapes about a line given as a linear function
4.2d Representing transformations					explore these transformations and symmetries using ICT	try out mathematical representations of simple combinations of these transformations			explore and compare mathematical representations of combinations of translations, rotations and reflections of 2-D shapes, on paper and using ICT
4.2e Understanding vectors									devise instructions for a computer to generate and transform shapes
4.2f Using vectors									
4.2g Enlargement					understand and use the language and notation associated with enlargement		explore enlargement using ICT	enlarge 2-D shapes, given a centre of enlargement and a positive integer scale factor	identify the scale factor of an enlargement as the ratio of the lengths of any two corresponding line segments
4.2h Scale drawings							make scale drawings		use and interpret maps and scale drawings in the context of mathematics and other subjects
4.2i Co-ordinates			understand and use simple co-ordinate systems, including 4 and 6 figure grid references		use conventions and notation for 2-D coordinates in all four quadrants	find coordinates of points determined by geometric information	find the midpoint of the line segment AB, given the coordinates of points A and B		use the coordinate grid to solve problems involving translations, rotations, reflections and enlargements

4.2 Transformations and co-ordinates

Outcome	6a D	7c C	7b C	7a B	8c B	8b A	8a A	EP	A*
4.2a Language and notation									
4.2b Symmetry	identify reflection symmetry in 3-D shapes								
4.2c Understanding transformations	use congruence to show that translations, rotations and reflections preserve length and angle								
4.2d Representing transformations	use any point as the centre of rotation	measure the angle of rotation, using fractions of a turn or degrees		understand that translations are specified by a vector		understand and use vector notation to describe transformation of 2-D shapes by combinations of translations	calculate and represent graphically the sum of two vectors		calculate and represent graphically the difference of two vectors and a scalar multiple of a vector; calculate the resultant of two vectors
4.2e Understanding vectors									understand and use the commutative and associative properties of vector addition
4.2f Using vectors									solve simple geometrical problems in 2-D using vectors
4.2g Enlargement	recognise that enlargements preserve angle, but not length, and understand the implications of enlargement for perimeter		enlarge 2-D shapes using fractional scale factors, on paper and using ICT	understand the effect of enlargement on the area of a 2D shape	enlarge 2-D shapes using negative scale factors, on paper and using ICT; recognise the similarity of the resulting shapes	understand and use the effects of enlargement on perimeter	understand and use the effects of enlargement on areas and volumes of shapes and solids		
4.2h Scale drawings									
4.2i Co-ordinates	use 3D co-ordinate systems	find the points that divide a line in a given ratio, using the properties of similar triangles	calculate the length of AB, given the coordinates of points A and B						

4.3 Construction and loci

Outcome	3a G	4c F	4b F	4a F	5c E	5b E	5a E	6c D	6b D
4.3a Constructing shapes					use a ruler and protractor to measure and draw lines to the nearest millimetre and angles, including reflex angles, to the nearest degree		use a ruler and protractor to construct a triangle, given two sides and the included angle (SAS), or two angles and the included side (ASA)		use straight edge and compasses to construct the midpoint and perpendicular bisector of a line segment
4.3b Using ICT to explore constructions							use ICT to explore constructions		
4.3c Constructing loci								use ruler and protractor to construct simple nets of 3-D shapes, eg cuboid, regular tetrahedron, square-based pyramid, triangular prism	find simple loci, both by reasoning and by using ICT, to produce shapes and paths, eg an equilateral triangle

4.3 Construction and loci

Outcome	6a D	7c C	7b C	7a B	8c B	8b A	8a A	EP	A*
4.3a Constructing shapes	use straight edge and compasses to construct the bisector of an angle, the perpendicular from a point on a line, and the perpendicular from a point to a line; use straight edge and compasses to construct a triangle, given three sides (SSS)	use straight edge and compasses to construct triangles, given right angle, hypotenuse and side (RHS); construct angles of 60° and 90°, using straight edge and compasses	understand from experience of constructing them that triangles given SSS, SAS, ASA, or RHS are unique, but that triangles given SSA or AAA are not						
4.3b Using ICT to explore constructions	use ICT to explore these constructions	use ICT to explore constructions of triangles and other 2-D shapes							
4.3c Constructing loci		find the locus of a point that moves according to a simple rule, both by reasoning and by using ICT		find the locus of a point that moves according to a more complex rule, both by reasoning and by using ICT					

4.4 Measures and mensuration

Outcome	3a G	4c F	4b F	4a F	5c E	5b E	5a E	6c D	6b D
4.4a Selecting units of measurement			choose and use units of measurement to measure, estimate, calculate and solve problems in everyday contexts	read and interpret scales on a range of measuring instruments	convert one metric unit to another, eg grams to kilograms	know rough metric equivalents of imperial measures in common use, such as miles, pounds and pints	solve problems involving measurements in a variety of contexts		convert between area measures, and between volume measures
4.4b Bearings	know and use the points of the compass			distinguish between and estimate the size of acute, obtuse and reflex angles			use bearings to specify direction		
4.4c Real-life situations									
4.4d Area & Perimeter		be able to evaluate the area of a rectangle by counting squares	be able to evaluate the perimeter of a rectangle	be able to evaluate the area of a triangle by counting squares	know and use the formula for the area of a rectangle	calculate the perimeter and area of shapes made from rectangles		derive and use formulae for the area of a triangle, parallelogram and trapezium	calculate areas of compound shapes
4.4e Surface area							calculate the surface area of cubes and cuboids	know and use the formula for the volume of a cuboid	calculate volumes and surface areas of cuboids and shapes made from cuboids
4.4f Dimensions of formulae									

4.4 Measures and mensuration

Outcome	6a D	7c C	7b C	7a B	8c B	8b A	8a A	EP	A*
4.4a Selecting units of measurement		understand and use measures of speed (and other compound measures such as density or pressure)	solve problems involving constant or average rates of change			apply knowledge that measurements given to the nearest whole unit may be inaccurate by up to one half of the unit in either direction and use this to understand how errors can be compounded in calculations	recognise limitations in the accuracy of measurements and judge the proportional effect on solutions		
4.4b Bearings		use bearings to locate objects, given two bearings or one bearing and a distance							
4.4c Real-life situations									
4.4d Area & Perimeter	know and use the formulae for the circumference and area of a circle	solve problems involving lengths of circular arcs and areas of sectors			understand and use the formulae for the length of a circular arc and area and perimeter of a sector				
4.4e Surface area		solve problems involving surface areas and volumes of cylinders	calculate the surface area and volume of right prisms		solve problems involving surface areas and volumes of cylinders, pyramids, cones and spheres			solve problems involving more complex shapes and solids, including segments of circles and frustums of cones	
4.4f Dimensions of formulae							consider the dimensions of a formula and begin to recognise the difference between formulae for perimeter, area and volume in simple contexts	understand the difference between formulae for perimeter, area and volume by considering dimensions	