Shape, Space and Measures Policy

May 2014

Purpose of Policy

Shape, Space and measures is a significant part of the Mathematics Primary Curriculum. This policy will form the basis upon which we map out the learning for Shape, Space and Measures in Mathematics. It will outline progression of across the stages of development, and will inform all teachers of expectations.

Our policy recognises Mathematics as a functional tool and a valuable key life skill. We want all students leaving St Hugh's School to not only be numerate, but to be able to transfer their mathematical skills to other curricular areas and into everyday life. We want to impart to our children that Mathematics is not confined to just acquiring mathematical skills, but most importantly it is about fostering inquiring minds, inciting enthusiasm and valuing curiosity.

The policy reflects the views of all the staff of the school. It has been drawn up following consultation with all staff and students, and has full agreement of the Governing Body.

Staff have access to the Policy via the *Staff Room,* and on the school's server via the *Teacher's Drive*. Parents are also able to access a copy of the policy upon request.

Aims and Outcomes

- To present Shape, Space and Measures in meaningful contexts and to embed a range of practical activities designed to enhance children's mathematical experiences.
- To ensure that common errors and misconceptions in Shape, Space and Measures are addressed.
- To provide staff with an outline of expectations in Shape, Space and Measures.
- To provide parents with an outline of expectations in Shape, Space and Measures.
- To ensure continuity and progression in the children's learning of Shape, Space and Measures, in relation to the following areas:

Shape and Space, including:

(i) Mathematical vocabulary
(ii) 2D shape
(iii) 3D shape
(iv) Patterns and Symmetry
(v) Angles
(vi) Co-ordinates and compass points

Measures, including:

(i) Mathematical vocabulary
(ii) Length and area
(iii) Time
(iv) Mass
(v) Capacity
(vi) Temperature

Shape and Space

In order for pupils to gain sound knowledge and understanding of Shape and Space in general, we must adhere to the following principles, in order to avoid creating general misconceptions:

a) Students are shown a wide range of varying examples to avoid creating any common misconceptions.
b) Links are always made to real life contexts to give the learning meaning.
c) Pupils are given opportunities to explore concepts, and discover links and patterns for themselves.
d) Students experience an equal balance of 2D shape, 3D shape, patterns and symmetry, angles and co-ordinates and compass points.
e) Pupils have the opportunity to carry out investigations involving shape and space.
f) Students have the opportunity to use ICT to support their understanding of shape and space.
g) Pupils progress through the steps outlined, and do not repeat the same learning.

(i) Mathematical Vocabulary

Students need to acquire appropriate vocabulary so that they can participate in the activities and lessons that are part of classroom life. There is, however, an even more important reason: mathematical language is crucial to pupil's development of thinking. If pupils don't have the vocabulary to talk about shape, space and measures, they cannot make progress in understanding these areas of mathematical knowledge.

Teachers need to plan the introduction of new words in a suitable context, for example, with relevant objects, apparatus, pictures or diagrams. Explain their meanings carefully and rehearse them several times. Encourage their use in context, particularly through questioning. Use every opportunity to draw attention to the new words in whole class, group and individual contexts. The final stages are learning to read and write new mathematical vocabulary in a range of circumstances, ultimately spelling the relevant words correctly.

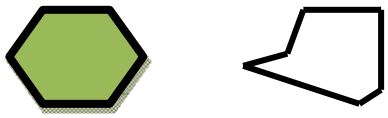
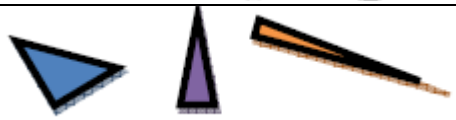
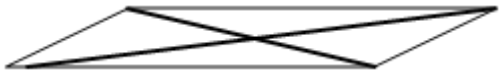
The following table outlines the progression of mathematical vocabulary in relation to Shape and Space.

	Step 1	Step 2	Step 3	Step 4
Generic	Shape, pattern Flat Curved, straight Round Hollow, solid Corner Face, side, edge, end Sort Make, build draw	**Step 1 words, plus:** Point, pointed Surface	**Step 1& 2 words, plus:** Right-angled Vertex, vertices Layer Diagram Line Construct, sketch Radius, diameter Net Angle Base Square-based Regular, irregular Concave, convex Open, closed	**Step 1, 2 & 3 words, plus:** Congruent Circumference Concentric Arc Intersecting, intersection Plane tangram
2D Shape	Circle Triangle Square Rectangle Star	**Step 1 words, plus:** Circular Triangular Rectangular Pentagon Hexagon Octagon	**Step 1& 2 words, plus:** Semi-circle Pentagonal Hexagonal Octagonal Quadrilateral Two-dimensional Equilateral, isosceles Oblong Heptagon Decagon Polygon	**Step 1, 2 & 3 words, plus:** Scalene Rhombus Kite Parallelogram trapezium (may also be represented as trapezoid within U.S. text)
3D Shape	Cube Pyramid Sphere Cone	**Step 1 words, plus:** Cuboid Cylinder	**Step 1& 2 words, plus:** Hemi-sphere Prism Three-dimensional Spherical Cylindrical Tetrahedron Polyhedron	**Step 1, 2 & 3 words, plus:** Octahedron dodecahedron
Patterns and Symmetry	Size Bigger, larger, smaller Symmetrical	**Step 1 words, plus:** Line of symmetry	**Step 1& 2 words, plus:** Reflect	**Step 1, 2 & 3 words, plus:**

	Pattern Repeating match	Fold Mirror line Reflection	Translation	Axis Reflective symmetry
Position, Direction and Movement	Position Over, under Above, below Top, bottom, side On, in Outside, inside Around, In front, behind Front, back Before, after Beside, next to Opposite Apart Between Middle, edge Corner Direction Left, right Up, down Forwards, backwards, sideways Across Close, far, near Along Through To, from, towards, away from Movement Slide Roll Turn stretch	**Step 1 words, plus:** Underneath Centre Journey Whole turn Half turn Quarter turn Route Higher, lower Clockwise, anti-clockwise Right angle Straight line	**Step 1& 2 words, plus:** Map, plan Ascend, descend Grid Row, column Compass point North, East, South, West Horizontal, vertical Diagonal Angle Origin Co-ordinates North-east, north-west, south-east, south-west Rotate Degree Ruler, set square Angle measurer Compasses	**Step 1, 2 & 3 words, plus:** Parallel, perpendicular x-axis, y-axis quadrant rotation acute obtuse protractor reflex

(ii) 2D Shape

In order for pupils to gain sound knowledge and understanding of 2D shape, we must adhere to the following principles, in order to avoid creating general misconceptions:

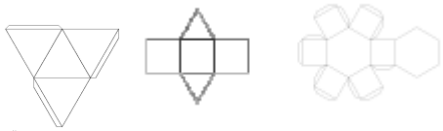
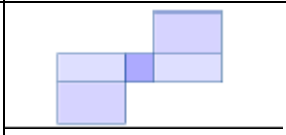
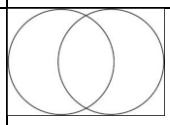
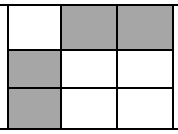
a) Pupils experience irregular, as well as regular shapes.	
b) Students experience shapes in varying orientations	
c) Students experience shapes and properties of shape (e.g. perpendicular lines) in real life examples, as well as in standard mathematical shapes	E.g. the clock is circular, the windows are rectangular etc.
d) Pupils have opportunities to draw and make shapes, as well as name them.	E.g. using pencil, straws, geo-boards and elastic bands, card and scissors, paint etc.
e) Students explore how shapes are used in art and design, and in religious and cultural symbols.	
f) Pupils experience a wide range of triangular shapes, so that we avoid the misconception that all triangles are equilateral.	
g) Pupils experience using a set of properties to match to a 2D shape, rather than just seeing a shape and describing its properties.	E.g. My shape has 4 sides and no parallel lines. What shape am I? (kite)
h) Pupils experience sorting shapes using comparisons of properties.	E.g. has parallel lines, does not have parallel lines
i) Pupils experience using a range of Venn and Caroll diagram as tools for sorting 2D shapes.	
j) Students understand that some shapes fit more than one criteria.	E.g. A triangle can be both isosceles and scalene. A square is a special type of rectangle.
k) Students experience shapes with concave edges, as well as convex.	
l) Students understand that diagonal lines are not always at 45º.	

There should be a clear progression in the teaching and learning of 2D shape. Pupils should progress through the following 6 steps, all the time keeping in mind the principles set out above.

	Step 1	Step 2	Step 3	Step 4	Step 5	Step 6
2D shape names	Name familiar 2-D shapes such as circle, square and triangle. Recognise and name shapes in the outdoor environment.	Names and properties of **2-D shapes** including pentagons, hexagons and octagons, both regular and irregular. Recognise shapes in different orientations.	Name quadrilaterals including rhombus, parallelogram, trapezium and kite.	Name equilateral triangle and isosceles triangles and heptagons, and know the term polygon and that polygons can be regular or irregular.	Name all types of triangle equilateral, isosceles, scalene, and right-angled.	
Properties and sorting	Use computer programmes to sort and match 2D shapes, using properties. Recognise how shapes fit together and why. Describe shapes.	Classify shapes according to their properties. Ask yes or no questions about a shape in order to identify it. Use simple Carroll diagrams	Choose a shape to match a property i.e. reversing the process.	Classify polygons, using Carroll or Venn diagrams and **justify their reasoning**.	Investigate properties such as the diagonals of shapes, and parallel and perpendicular lines.	Investigate relationships between properties and describe using generalisations and formulas.
Constructing	Use pictures to represent what they see. Use shapes to draw around to create pictures.	Use pin-boards to make shapes. Draw 2D shapes.	Combine 4 squares to make a new shape. Name the new shape by counting edges. Create shapes using a variety of equipment, e.g. folding cutting, constructions kits,	Draw polygons on triangular paper.	Draw different types of triangle using pencil and paper. Measure dimensions of shapes. Draw shapes with parallel and perpendicular lines.	Use knowledge of properties to draw shapes accurately using set squares and protractors. Draw shapes with specific areas and perimeters.
Problem Solving		Solve puzzles such as 'How many rectangles can you see in this diagram?' Visualise shapes to solve problems	Investigate ways of folding shapes into halves/quarters etc. Discuss properties problems such as 'can a triangle have 2 right angles?'.	Explore polygons that have equal sides but unequal angles and vice versa. Investigate the maximum number of right angles possible in all polygons.	Investigate shapes that can be made from placing squares/triangles edge to edge.	Investigate the angles inside quadrilaterals. Investigate which shapes have bisecting/ perpendicular diagonals. Make links and generalisations.

(iii) 3D Shape

In order for students to gain sound knowledge and understanding of 2D shape, we must adhere to the following principles, in order to avoid creating general misconceptions:

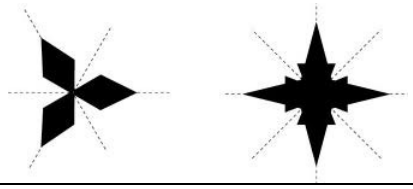
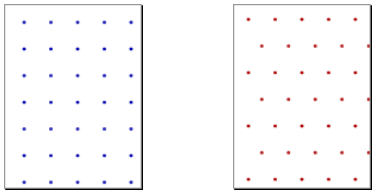
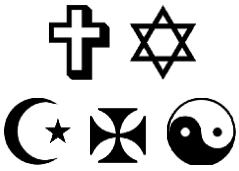
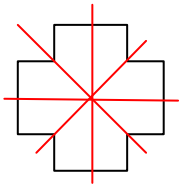
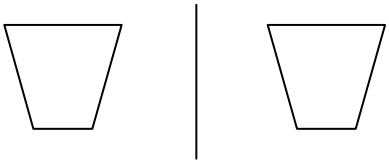
a) Students experience irregular, as well as regular shapes.	
b) Students experience shapes and properties of shape (e.g. perpendicular lines) in real life examples, as well as in standard mathematical shapes	E.g. pencil cases, Toblerone bars etc.
c) Students have opportunities to draw and make nets of shapes.	
d) Pupils explore how 3D shapes are used in art and design.	E.g. sculptures
e) Pupils experience nets of shapes that don't always create a complete 3d shape.	
f) Students experience different cross sections of 3D shapes, including diagonal cuts.	
g) Students experience using a set of properties to match to a 3D shape, rather than just seeing a shape and describing its properties.	E.g My shape has 4 identical triangular faces. What shape am I? (triangular based pyramid)
h) Students experience sorting shapes using comparisons of properties.	E.g Has perpendicular faces, does not have perpendicular faces.
i) Students experience using a range of Venn, Caroll and Tree diagrams as tools for sorting 3D shapes.	 
j) Pupils have opportunities to create 3D shapes as well as name them.	E.g. Using Plastercine, Lego, k'nex, straws etc.
k) Pupils experience making scale 3D models.	E.g. Students make models of their bedrooms.
l) Pupils experience unfolding packaging to explore their nets.	E.g. unfolding smarties tubes, cereal boxes and toblerone bars.
m) Pupils experience visualising 3D shapes from 2D shapes.	E.g. students re-create a 3D structure using multilink, from a photograph of the model.

There should be a clear progression in the teaching and learning of 3D shape. Pupils should progress through the following 6 steps, all the time keeping in mind the principles set out above.

	Step 1	Step 2	Step 3	Step 4	Step 5	Step 6
3D shape names	Name cones, cubes, cuboids and spheres	Name shapes in different orientations, and from 2D representations	Name various prisms	Name various pyramids		
Properties and sorting	Talk about shapes using corner, edge, side, flat, straight and round Identify similarities and differences Select a shape by listening to descriptions. Use simple Venn diagrams	Predict which 3D shapes will roll and which will slide. Sort using criteria such as 'has a triangular face, does not have a triangular face'. Use simple Carroll diagrams to develop understanding of 'not'	Know that prisms have the same cross section throughout its length and identical faces at both ends Sort shapes using criteria such as vertices, edges and corners Use Carroll diagrams with 2 criteria	Identify shapes in a feely bag. (This can begin within steps 2 & 3)	Know whether the amount of edges meeting at a vertex is the same for all vertices in a shape, or different Identify parallel and perpendicular edges	Identify parallel and perpendicular faces Describe the face created by cutting through a pyramid or prism at varying angles
Constructing	Use pictures to represent what they see Use shape blocks to build structures such as bridges.	Use construction kits to build models and count their faces Use interlocking cubes to create shapes shown in 2D pictures	Build an unseen shape from a description of properties	Understand and create nets Recreate 3D model from photographs	Draw accurate nets of a range of shapes including prisms and pyramids	Create a set of nesting boxes
Problem Solving			Investigate general statements e.g.' the number of edges of a prism is always a multiple of 3'	Explore different cuboids that can be made from a set numbers of cubes (set volume)	Explore finding all possible nets for a cube	Investigate relationships between properties e.g. the number of vertices plus the number of faces equals the number of edges

(iv) Patterns and Symmetry

In order for pupils to gain sound knowledge and understanding of patterns and symmetry, we must adhere to the following principles, in order to avoid creating general misconceptions:

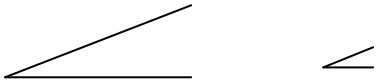
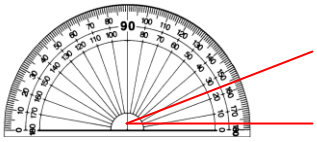
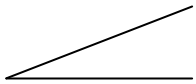
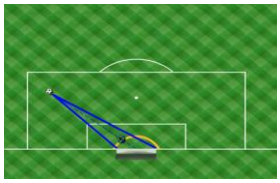
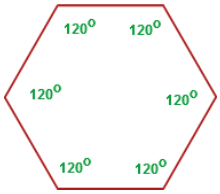
a) Students experience symmetry around non horizontal and vertical lines.	E.g. 
b) Students experience rotational symmetry, as well as lines of symmetry.	E.g. 
c) Pupils experience symmetry on isometric, as well as squared paper.	E.g. 
d) Students recognise the lines of symmetry in real life examples.	E.g. road signs, flags, insects, capital letters etc. 
e) Pupils explore how symmetry is used in art and design, and in religious and cultural symbols.	E.g. 
f) Pupils experience that often more than one line of symmetry is present.	E.g. 
g) Students experience identifying and drawing symmetry and reflections where the shape is located away from the reflection line, and where not all lines are parallel/perpendicular.	E.g. 

There should be a clear progression in the teaching and learning of patterns and symmetry. Pupils should progress through the following 6 steps, all the time keeping in mind the principles set out above.

	Step 1	Step 2	Step 3	Step 4	Step 5	Step 6
Patterns	Create patterns using familiar objects Use computer programmes to create patterns	Create patterns using several shapes Describe and discuss patterns	Create symmetrical patterns using shapes or peg boards	Generate complex patterns	Create patterns and shapes with 2 lines of symmetry	
Symmetry		Create symmetrical patterns or peg boards Recognise symmetry in objects and pictures	Use a mirror or folding to check symmetry Complete symmetrical pictures Identify 2D shapes that are symmetrical	Identify and create shapes that are not symmetrical Understand that shapes can have multiple lines of symmetry	To create shapes with multiple lines of symmetry	Measure the angles between lines of symmetry
Reflection			Understand that shapes can be reflected e.g in water	Predict where a shape will be after a reflection along one of its sides Use ICT to reflect shapes	Reflect shapes where not all sides of the shape are parallel or perpendicular to the mirror line	Reflect shapes on both sides of the mirror line and where the mirror line not horizontal or vertical
Problem solving	Use patterns to solve problems e.g. what will be the next shape in the pattern?	Explain how to continue a pattern	Create all possible symmetrical patterns out of a prescribed set of shapes	Investigate symmetry of 2D shapes e.g. 'Is there a link between the number of sides and the number of lines of symmetry?'	Solve problems such as 'place 8 squares together to make a shape with 2 lines of symmetry. How many different ways can you do it?'	Create general statements about the angles between lines of symmetry

h) Angles

In order for pupils to gain sound knowledge and understanding of angles, we must adhere to the following principles, in order to avoid creating general misconceptions:

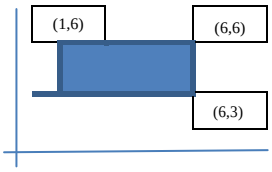
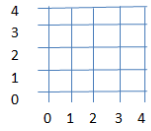
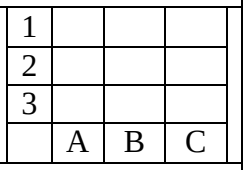
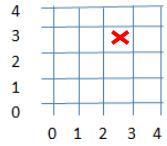
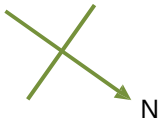
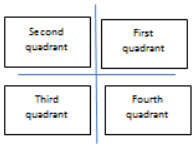
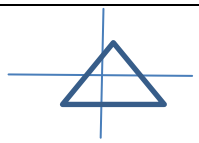
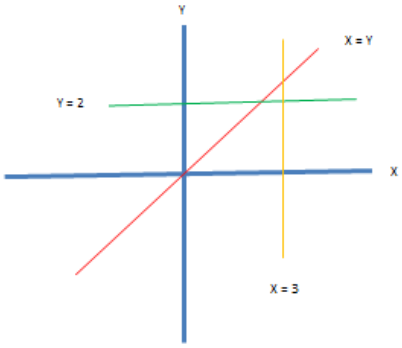
a) Pupils know that an angle is a measure of turn.	E.g. Half a turn is equal to 180°
b) Students know that the size of the angle does not relate to the size of the picture.	E.g.  The angles are the same size even though one picture is bigger than the other
c) Students experience angles in various orientations, not just on a horizontal plane.	E.g. 
d) Students know when to use the inner and outer scales on a protractor.	E.g.  20° or 160°?
e) Pupils routinely estimate the size of an angle before measuring it, using their knowledge of acute, obtuse and reflex angles.	E.g. this angle is acute, so I know it is going to measure less than 90° 
f) Children make links the angles in real life contexts.	E.g. sport, architecture. 
g) Children have the opportunity to draw as well as measure angles.	 E.g. To construct a regular shape.

There should be a clear progression in the teaching and learning of angles. Pupils should progress through the following 5 steps, all the time keeping in mind the principles set out above.

	Step 1	Step 2	Step 3	Step 4	Step 5
Angle knowledge	Understand that an angle is a measure of turn Know that a quarter turn is equal to 90° which is a right angle Know that 2 quarter turns are equivalent to a half turn	Place 2 right angles together and know that they form a straight line Know that a whole turn is 360° or four right angles Order angles from smallest to largest Recognise angles that are less than 180°	Know whether an angle is acute, obtuse, reflex or a right angle.	Calculate missing angles on a straight line by subtracting from 180°	Know that angles in triangle equal 180°, and angles in a quadrilateral and about a point equal 360° Use these facts to calculate missing angles
Angles in shapes	Describe angles in shapes as being smaller than, equal to, or bigger than a right angle. Use a set square to compare angles inside a shape	Use set squares to identify angles of angles of 90°, 60°, 45° and 30° inside shapes	Establish that all of the angles in a regular shape are the same/congruent.. Discover that opposite angles of a parallelogram are equal	Measure angles inside irregular shapes and recognise that they are different/not congruent.	Investigate the angles inside quadrilaterals to establish which are the same/congruent.
Angles in real life	Give and follow directions using half turns Know that by completing a half turn you end up facing the opposite direction	Give and follow directions using whole, half and quarter turns	Use compass points to explore how many right angles are needed to turn from East to West	Use compass points to explore how many degrees are needed to turn from one point to another	Calculate how many degrees there are between clock hands
Constructing angles	Use strips of card to create an angle maker to show angles smaller than, equal to, or bigger than a right angle.	Use set squares to draw angles of angles of 90°, 60°, 45° and 30°	Use a set square to draw regular shapes	Draw angles using a protractor to the nearest 5 degrees.	Draw shapes accurately using a protractor
Measuring angles		Estimate angles of 90°, 60°, 45° and 30°, Use set squares to check and measure	Use a protractor to measure angles in regular shapes	Make sensible estimates of angles less than 180°, and measure them within 5° of accuracy using a protractor	Measure angles between lines of symmetry Record angles in regular polygons against the number of sides and describe the relationship they discover

In order for pupils to gain sound knowledge and understanding of co-ordinates and compass points, we must adhere to the following principles, in order to avoid creating general misconceptions:

a) Pupils experience a wide variety of scales, other than steps of 1.	E.g. scales increasing in multiples 2, 3, 5, 10, 0.5, 0.1 etc.

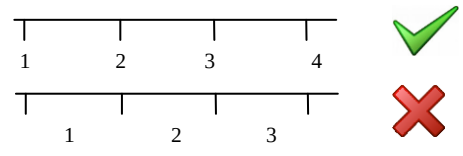
b) Pupils experience problems using unlabelled axis.	E.g. 
c) Students understand the difference co-ordinates of line intersections, compared to co-ordinates of spaces.	E.g.  
d) Students experience co-ordinates in real life contexts.	E.g maps, A-Z etc.
e) Pupils experience co-ordinates of points which are not always at intersections.	E.g. 
f) Pupils experience compass points where North is not necessarily positioned vertically.	E.g. 
g) Pupils recognise that (4,1) and (1,4) have different positions.	E.g. Along the corridor and up the stairs! Babies crawl, then walk Planes X the runway, then flY away
h) Pupils make links between co-ordinates and compass points.	E.g. moving one step west from point (5,2) will get you to point (4,2).
i) Students experience all 4 quadrants and know that they are named in a specific order.	E.g. 
j) Students experience locating missing points of shapes on grids, and calculating their co-ordinates.	E.g. See example (b)
k) Pupils experience shapes that cross into more than one quadrant.	E.g. 
l) Students understand that you can create and name lines on a co-ordinate grid.	E.g. 

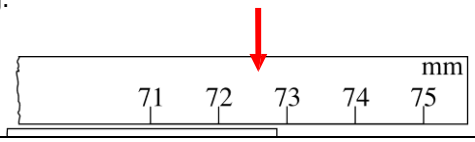
There should be a clear progression in the teaching and learning of co-ordinates and compass points. Pupils should progress through the following 6 steps, all the time keeping in mind the principles set out above.

	Step 1	Step 2	Step 3	Step 4	Step 5	Step 6
Position	Describe the position of objects Follow instructions to place people in a scene	Read and record descriptions of position Describe where a hidden object is	In literacy use prepositions to describe where things are in a setting Describe position on square grids, e.g. by playing battleships, or by describing a coloured shape for a friend to draw	To describe position in terms of horizontal and vertical rows and columns Read and plot co-ordinates in the first quadrant	Read and plot co-ordinates in the first and second quadrant Plot missing co-ordinates of shapes on a grid	Read and plot co-ordinates in all 4 quadrants
Direction	Visualise how to get from point to another Describe a route through a simple maze Programme a toy to move about the room Estimate how many steps are needed to move a robot from one place to another Follow instructions to move in PE	Give and follow instructions to get through a maze on squared paper Evaluate the accuracy of their instructions Use quarter and half turns when programming movement	Read and record instructions of directions Use 4 compass points to describe a route	Describe horizontal and vertical movement Use 8 compass points to describe a route Use weather forecasts to track changes in wind direction Investigate all possible routes and record findings systematically	Translate shapes on a grid, giving the co-ordinates of the new position	Move shapes on a grid by translating and reflecting and rotating

Measures

In order for students to gain sound knowledge and understanding of measures in general, we must adhere to the following principles, in order to avoid creating general misconceptions:

a) Pupils understand that the point of measure is the line, not the space.	E.g. 
b) Pupils experience a wide variety of scales, not just increases of 1s and 10s.	E.g. scales increasing in multiples 2, 3, 5, 10, 25 0.5, 0.1 etc.
c) Pupils experience both imperial and metric units of measure.	E.g. both Kilometres and Miles etc.

d) Pupils routinely estimate before measuring and develop a keen sense of reasonableness.	E.g. If ruler is 30cm, then it is unreasonable to measure a book as 250cm.
e) Pupils understand the difference between estimating and approximating.	E.g. Estimating is sensibly guessing the size of something. "I think it will be about 3m." Approximating is rounding an exact measurement. "The table measures 1.8m, which is approximately 2m"
f) Pupils experience measures in real life contexts, using appropriate apparatus and equipment.	E.g. cooking, measuring long jump distances etc.
g) Students develop a set of real life benchmarks to help them understand and compare measures.	E.g. An apple weighs approximately 150g A swimming is 25m long A can of coke holds 330ml
h) Pupils know the unit of measure that 'best fits' any given object, and can also reverse the process, suggesting things that would be measured in a given unit.	E.g. Suggest the units that you would use to measure a football pitch. Suggest something that you would measure using millimetres.
i) Students understand that in a problem solving context, the same unit of measure must be used to calculate.	E.g. To find the total distance of 5km and 3miles, you would need to convert 3miles into km before adding.
j) Pupils experience an equal balance of learning opportunities across length, capacity, time and mass.	The emphasis should not be on length.
k) Pupils experience the link between measures and fractions.	E.g. 1 and 1/4 m = 1.25m
l) Pupils must always be taught to write the unit, or abbreviation of the unit, after each recorded measurement and NOT just for the answer.	E.g. 3g + 8g = 11g
m) Pupils experience scales of varying shapes and directions.	E.g. 
n) Students experience identifying measures that lie between the marked divisions.	E.g. 

(i) Mathematical Vocabulary

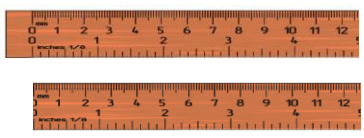
The following table outlines the progression of mathematical vocabulary in relation to Measures:

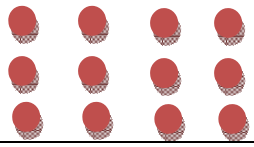
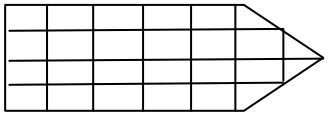
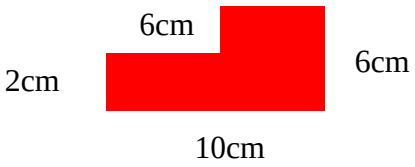
	Step 1	Step 2	Step 3	Step 4
Generic	Measure Size Compare Guess, estimate Enough, not enough Too much, too little Too many, too few Nearly, close to, about the same as Just over, just under	**Step 1 words, plus:** Measuring scale About roughly	**Step 1& 2 words, plus:** Division Approximately Measurement Unit Standard unit Metric, imperial	**Step 1, 2 & 3 words, plus:**
Length and Area	Length, width, height, depth Long, short, tall	**Step 1 words, plus:**	**Step 1& 2 words, plus:** Distance	**Step 1, 2 & 3 words, plus:**

	High, low Wide, narrow Deep, shallow Thick, thin Longer, shorter, taller, higher Longest, shortest, tallest, highest Far, near, close	Further, furthest Centimetre Tape measure Metre Ruler, metre stick	apart/between Distance to/from Kilometre Mile Breadth Edge, perimeter Millimetre Area, Covers Square centimetre	Square meter Square millimetre Circumference Yard, feet, foot, inch
Time	Time Days of the week Monday, Tuesday … Day, week Birthday, holiday Morning, afternoon, evening, night Bedtime, dinnertime, playtime Today, yesterday, tomorrow Before, after, Next, last Now, soon, Early, late Quick, quicker, quickest, quickly Slow, slower, slowest, slowly Old, older, oldest New, newer, newest Takes longer, takes less time than Hour, o'clock Clock, watch, hands	**Step 1 words, plus:** Months of the year: January, February .. Fortnight Minute, second Quarter to, quarter past Digital, anolgue timer Seasons, Spring, Summer, Autumn, Winter Month, year Weekend Fast, faster, fastest How long ago? How long until? How long will it take? How often? Always, never, often, sometimes, usually, once, twice	**Step 1& 2 words, plus:** Decade Century Calendar Date am, pm earliest, latest leap year millennium date of birth noon timetable arrive depart	**Step 1, 2 & 3 words, plus:** 12-hour clock 24-hour clock Greenwich Mean Time British Summer Time International Date Line Daylight saving
Mass	Weigh, weighs, balances Heavy, light Heavier, lighter Heaviest, lightest Balance, scales Weight, mass	**Step 1 words, plus:** Kilogram Half a kilogram gram	**Step 1& 2 words, plus:** Mass Big, bigger Small, smaller	**Step 1, 2 & 3 words, plus:** Gallon Tonne Pound Ounce
Capacity	Full Half full Empty Holds Container	**Step 1 words, plus**: Capacity Contains Litre millilitre	**Step 1& 2 words, plus**: Pint Measuring cylinder	**Step 1, 2 & 3 words, plus:** centilitre

(ii) Length and Area

In order for pupils to gain sound knowledge and understanding of length and area, we must adhere to the following principles, in order to avoid creating general misconceptions:

a) Pupils understand that measuring tools do not always start at '0'.	E.g. 
b) Students experience measuring curved as well as straight lines.	E.g. Using string to measure the circumference of a clock.
c) Students routinely estimate before measuring and develop a keen sense of reasonableness.	E.g. I think the pencil case is 15cm long, so if I get a measurement of 135cm, I know

	something is not right!
d) Pupils understand the difference between estimating and approximating.	E.g. Estimating is sensibly guessing the size of something. "I think it will be about 3m." Approximating is rounding an exact measurement. "The table measures 1.8m, which is approximately 2m"
e) Pupils experience measures in real life contexts, using appropriate apparatus and equipment.	E.g. Measuring distances for long jumps etc.
f) Students link area to arrays in multiplication.	E.g. 3m x 4m = 
g) Students find the area of a range of compound shapes.	E.g. 
h) Students understand that counting squares and fractions of squares also calculates the area.	E.g. 
i) Pupils calculate perimeters when not all sides are labelled.	E.g. 

There should be a clear progression in the teaching and learning of length and area. Pupils should progress through the following 6 steps, all the time keeping in mind the principles set out above.

	Step 1	Step 2	Step 3	Step 4	Step 5
Size, estimation and construction	Talk about relative size using bigger and smaller Recognise when something is too big or too small to fit Order objects according to size Estimate whether objects are taller or shorter than one metre. Sort objects using size criteria	Draw lines to the nearest half centimetre Create their own 'tape measure' marked every 10cm and use it to measure objects Explain why they think an estimate is reasonable using comparisons	Learn the meanings of prefixes such as 'centi' and 'kilo' and the relationships between them To suggest lengths that would be measured in different units Draw lines to the nearest millimetre	Estimate to reasonable accuracy and explain their reasoning	Construct shapes with specific areas or perimeters
Measuring length	Measure by direct comparison Measure using non-standard units such as straws or foot steps Explore draw-backs of using non-standard units Measure using standard units	Record measurements for a purpose (link to data handling) Measure to the nearest centimetre, and read scales to the nearest divisions	Suggest suitable units of measure and measuring instruments Record length using decimal notations Measure the perimeter of shapes	Read unnumbered division on scales	Measure using imperial units
Area		Find area by counting squares	Calculate area of rectangular shapes	Derive a formula for finding the area rectangles. Calculate the area of compound shapes	Use formulas to find the area of triangles and circles
Calculation	Solve word problems involving measures including finding the difference between measurements	Solve word problems Know the relationship between units of measure Calculate the value divisions on scales	Solve two-step word problems	Calculate perimeter of irregular shapes Solve multi-step word problems	Calculate distance using speed and time, link to milometers in cars Convert between metric and imperial units
Problem Solving	Solve problems such as how tall will the bridge need to be to fit the truck under? And find things in the room bigger than your hand. Explore the relationship between the size of the unit and the number of units needed	Enter measurements into databases and use it to answer questions Investigate lengths of feet which fit into the same shoe size	Explore hypothesis such as the taller the person the larger the hand-span Organise measurements by tabulating them Given the perimeter of a rectangle, investigate what its sides could be	Explore the relationship between area and perimeter Find as many shapes as you can with the same area or perimeter.	Explore scale on maps and how they are used to represent distances Investigate how they could measure/estimate the thickness of one sheet of paper

(iii) Time

In order for students to gain sound knowledge and understanding of time, we must adhere to the following principles, in order to avoid creating general misconceptions:

a) Pupils understand that time is in base 60, not base 100.	E.g. there are 60 minutes in an hour, as oppose to 100.
b) Students know and can instantly recall facts about time.	E.g. There are 60 seconds in a minute There are 60 minutes in an hour There are 24 hours in a day There are 7 days in a week There are 12 months in a year There are 4 seasons in a year etc.
c) Students experience telling and managing time throughout the day, in context.	E.g. How long is it until lunch? How much time do we get for play? What time is home time?
d) Pupils experience a wide range of timetables, presented in a variety of ways.	E.g. Train/bus timetables Lesson timetables TV guides.
e) Pupils make the link between time and fractions in both analogue and digital contexts.	E.g. ¼ of an hour = 15 minutes ½ an hour = 30 minutes etc.
f) Pupils experience a balance of analogue and digital times, and can convert between the two.	E.g.  
g) Students link time to their 5 times tables.	E.g. If the big hand is pointing to the 4, that means 4 x 5 minutes, so it is 20 minutes past the hour.

There should be a clear progression in the teaching and learning of time. Students should progress through the following 4 steps, all the time keeping in mind the principles set out above.

	Step 1	Step 2	Step 3	Step 4
Years and seasons	Discuss what it would be suitable to wear at different times of year	Know that there are 52 weeks in a year	Know that there are 365 days in a year	Understand the significance of a leap year
Months and weeks	Know that we don't come to school on weekends and that weekends are Saturday and Sunday Order the months of the year Talk about which months are significant to them e.g. birthdays, festivals etc.	Use a calendar to work out what day of the week a particular date is on	Use a calendar to work out the time difference between 2 dates	To rehearse how many days there are in each month
Days	Learn about daily routines and the order of events Note changes from day to night, morning to afternoon	Know that there are 24 hours in day Know there are 7 days in a week	Know that there are 14 days in a fortnight	
Time and timetables	Measure time using sand timers. Use these to see if they can complete tasks before the timer runs out, estimate what they can and can't do within this time. Recognise some familiar times on a clock face, e.g. when it's home time. Listen to songs about time Read time to the nearest hour and half hour on both analogue and digital clocks	Become familiar with minutes and seconds Estimate how long activities take in minutes Count how long activities take in seconds Know that there are 60 seconds in one minute. Read time to the nearest quarter of an hour on both analogue and digital clocks Count in steps of 5 minutes	Know the relationships between seconds, minutes, hours and days Read time to the nearest 5 minutes on both analogue and digital clocks Record time using am and pm Find information in timetables and calculate duration	Read time to the nearest minute on both analogue and digital clocks Know time in 24 hour clock format Complete simple conversion tables Interpret bus, plane and train timetables
Problem solving	Solve problems such as 'which takes longer?'	Use time lines to work out time intervals	Use counting strategies to work out time differences Practice making pairs with a total of 60 and discuss how this is helpful	Work out time differences that bridge the hour Problem solve using the 24 hour clock

(iv) Mass

In order for pupils to gain sound knowledge and understanding of mass, we must adhere to the following principles, in order to avoid creating general misconceptions:

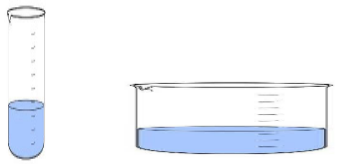
a) Pupils understand that the biggest is not always the heaviest object, and mass is in no way linked to size or shape.	E.g. a large empty cardboard box is lighter than a small bucket of sand.
b) Students routinely estimate before measuring and develop a keen sense of reasonableness.	E.g. If an apple weighs 150g, then I estimate a banana to be about 100g. If I measure it to be 10g, I know something is not right!
c) Students understand the difference between estimating and approximating.	E.g. Estimating is sensibly guessing the size of something. "I think it will be about 3Kg." Approximating is rounding an exact measurement. "The bag of sugar weighs 987g, which is approximately 1kg."
d) Pupils experience measures in real life contexts, using appropriate apparatus and equipment.	E.g. weighing out ingredients when cooking.
e) Pupils link mass to science topics involving mass, weight and gravity.	E.g. Discussing the fact that our mass will stay the same wherever we are in the universe, but our weight will change depending on how much gravity is acting on our mass. Therefore on the moon, our mass is the same, but our weight will change.
f) Pupils understand the difference between mass and weight.	E.g As above.
g) Pupils experience a range of scales, including balances.	E.g. 

There should be a clear progression in the teaching and learning of mass. Students should progress through the following 6 steps, all the time keeping in mind the principles set out above.

	Step 1	Step 2	Step 3	Step 4	Step 5	Step 6
Comparisons and ordering	Use the language of size Compare masses by holding them in their hand and placing them on balances Sort objects using one criterion	Carry out measuring activities to order objects by mass	Compare 100g of various materials.			
Measuring	Measure by direct comparisons Use non-standard units such as bricks to measure and sort Begin to use standard units of mass such as heavier or lighter than 1kg Make realistic estimates Suggest appropriate units To understand the relationship between the size of the unit and the number of units needed for the measurement	Use standard units of measure to follow an enquiry. Carry out practical measuring activities, estimating first, e.g. 'how many pencils weigh the same as 100g? Read scale to the nearest division. Suggest appropriate units and measuring instruments.	Know the relationship between standard units of measure, e.g. 1kg is 1000g. Increase practical experience such as finding objects that weigh 1kg. Explain why an estimate is reasonable.	Recognise that different scales are used to measure different masses. convert between various units of measure.	Weigh to a suitable degree of accuracy depending on what the object is. Estimate and comment on the degree of accuracy of their estimate.	Weigh the same object on different scales and decide which is more accurate, explaining their reasoning Measure using imperial units Convert between imperial and metric units
Calculating		Apply their skills to one step word problems.	Apply their skills to word problems. Calculate the value of each division on a scale. Understand that finding the difference between measurements is the same as asking how much heavier one is.	Calculate the difference in grams. Calculate divisions on un-numbered scales Apply their skills to one and two step word problems.	Solve word problems to give their work real life meaning	Solve multi-step word problems Use decimal notation when calculating with measures
Problem solving		Solve problems such as 'which of these are heavier than a bag of sand?	Solve problems such as 'which are heavier?' or 'how many pencils weight the same as this book?	Devise their own lines of enquiry to follow	Investigate the cost of sending various objects by post	Investigate how to calculate the mass of one grain of sand.

(v) Capacity

In order for pupils to gain sound knowledge and understanding of capacity, we must adhere to the following principles, in order to avoid creating general misconceptions:

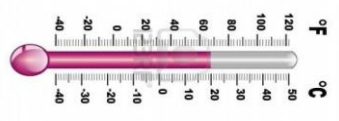
a) Pupils understand that the tallest container is not always the one with the largest capacity.	E.g. 
b) Pupils routinely estimate before measuring and develop a keen sense of reasonableness.	E.g. If a can of coke holds 330ml, then I estimate a small bottle to be about 500ml. If I measure it to be 50g, I know something is not right!
c) Pupils understand the difference between estimating and approximating.	E.g. Estimating is sensibly guessing the size of something. "I think it will be about 500ml." Approximating is rounding an exact measurement. "The bottle holds 994ml, which is approximately 1l."
d) Pupils experience measures in real life contexts, using appropriate apparatus and equipment.	E.g. measuring milk and water when cooking.
e) Students understand the link and difference between capacity and volume.	E.g. Capacity is the amount that an empty container is able to hold. Volume is the amount of space an object occupies. You can measure the volume of a solid object.
f) Students experience both imperial and metric units of measure.	E.g. Pupils measure in litres and pints.

There should be a clear progression in the teaching and learning of capacity. Pupils should progress through the following 5 steps, all the time keeping in mind the principles set out above.

	Step 1	Step 2	Step 3	Step 4	Step 5
Comparisons and ordering	Use the language of size Order containers by how much they will hold Sort objects using one criterion	Sort objects using two criterion Carry out measuring activities to order containers by capacity	Order containers based on estimates of their capacity, then measure to see how accurate they were		
Measuring	Engage in activities such as filling and emptying bags and containers Measure by making direct comparisons Use non-standard units such as an egg cup to fill a container To begin to use standard unit e.g. will this container hold a litre or not? Make realistic estimates Suggests suitable units	Use standard units to estimate and measure Understand the relationship between the size of the units and the numbers of units needed for the measurement Carry out practical measuring activities, estimating first, e.g. how many yoghurt pots can be filled from 1 litre of water? Read scale to the nearest division Know the relationships between standard units of measure. Suggest appropriate units of measure Explain why an estimate is reasonable	Understand that milli means one thousandth Make statements such as: 'This container will hold about half as many small cubes as this one Read and record measurements Estimate, measure and compare the capacity of different containers Convert between different units	Decide what measurements need to be taken to test a hypothesis Discuss how accurate their estimates are, explaining their reasoning Read unnumbered divisions	Discuss the accuracy of their measurements, explaining their reasoning Justify their estimates for amounts that fall between divisions Read the same amount off of various scales and decide which is most accurate, explaining their reasoning Convert between units Measure in imperial units Convert between metric and imperial units
Calculating	Solve one step word problems	Solve word problems Calculate the value of each division on a scale	Solve one and two step word problems	Solve multi step word problems	Create their own multi step word problems
Problem solving	Solve problems such as ‘which of the three bears would want which container?’	Follow a line of enquiry	Suggest their own lines of enquiry	Test a hypothesis such as ‘each child in our class uses over 100l of water each day	Set up experiments to measure rainfall and compare it to other cities

(vi) Temperature

In order for pupils to gain sound knowledge and understanding of temperature, we must adhere to the following principles, in order to avoid creating general misconceptions:

a) Students experience a range of positive a negative temperatures.	E.g. 
b) Pupils experience temperature scales in varying shapes and orientations.	E.g. 
c) Pupils experience a wide variety of scales, not just increases of 1s and 10s.	E.g. increments of 0.5°, 2°, 5° etc.
d) Students have the opportunity to look at the differences in temperature of real places around the world.	E.g. The temperature in the UK compared to Countries in Africa.
e) Pupils know benchmark temperatures to use as comparisons and to develop a sense of reasonableness.	E.g. knowing that room temperature is approximately 18°, water boils at 100°, water freezes at 0° etc.
f) Pupils experience temperature in degrees Celsius, degrees Fahrenheit, and in some contexts, kelvin.	E.g. Temperatures in Antarctica are likely to be measured in Kelvin as they are so low.

There should be a clear progression in the teaching and learning of temperature. Pupils should progress through the following 3 steps, all the time keeping in mind the principles set out above.

	Step 1	Step 2	Step 3
Measure	Use their experience of number lines to read scales Measure outside temperature at the same time each day	Read unnumbered division on scales	To read scales accurately in a variety of contexts Decide which degree of accuracy is appropriate for the context, giving reasons for their choice Interpret information given by a data logger, recognising that the temperatures given are approximations
Calculating	Comment on which temperature is the hottest/coldest and by how much?	Calculate the value of each division on a scale Calculate the difference between temperatures	Solve one and two step problems

Review

This policy is monitored through:

- Regular scrutiny of children's books
- Regular monitoring of teaching plans
- Evaluation and review of assessment data
- Lesson observations to monitor the quality of teaching and implementation of teaching plans
- Pupil interviews

This policy is reviewed by staff and governors every two years. The next review is due May 2015. Parents are most welcome to request copies of this document and comments are invited from anyone involved in the life of the school.