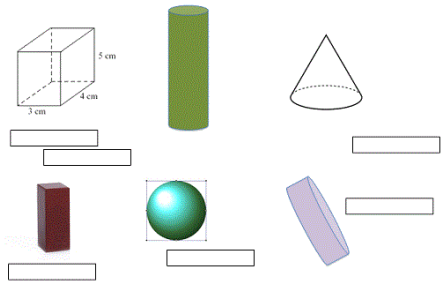
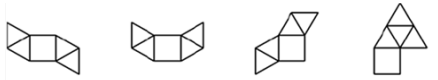
Unit Overview and Guidance

- The exemplification has been taken from the NCETM online 'Resource Toolkit', with additions in order to ensure full coverage.
- Links to the White Rose Maths hubs schemes of work (with questions categorised into the three aims of the national curriculum i.e. fluency, problem solving and reasoning) are hyperlinked to each of the objectives. Many thanks go to the White Rose Maths hub for permission to include their resources.
- The NCETM reasoning questions have also been incorporated into each unit and are identified in pale purple boxes underneath the group of the most relevant objectives.
- The 'big Ideas' sections from the NCETM 'Teaching for Mastery' documents have been included at the start of each unit. Hyperlinks to the full NCETM 'Teaching for Mastery' documents have also been included for easy reference.
- Hyperlinks to NRich activities have also been added to this version. These are found by clicking on the blue buttons like this one 1 at the bottom of relevant objective.
- Some additional content has been added in order to support mixed-aged planning. Any additional content is in *italics*. Occasionally ~~strikethrough~~ has been used to identify when an objective has been altered and this is primarily where an objective has been split between two units.
- Each unit is sub-divided into sections for ease of planning. Sub-categories in this unit are;
    1. Properties of shapes
    2. Angles
    3. Position, direction and movement

	Yr 3	Yr 4	Yr 5	Yr 6
NCETM Teaching for Mastery Questions, tasks and activities to support assessment	**The Big Ideas** During this year there is an increasing range of shapes that pupils are familiar with. The introduction of symmetrical and non-symmetrical polygons and the requirement that pupils should be able to draw them will give rise to discussions about lengths of sides and sizes of angles. Pupils need to appreciate these features as properties of shapes as well as the number of sides and vertices. Pupils recognise that angles are about the amount of turn – the lengths of the lines used to represent angles do not affect the size of the angle. Pupils recognise that relationships are at the heart of properties of shapes, not particular measurements. For example, the opposite sides of any rectangle will always be equal, not that rectangles have a pair of long sides and a pair of short sides.	**The Big Ideas** During this year, pupils increase the range of 2-D and 3-D shapes that they are familiar with. They know the correct names for these shapes, but, more importantly, they are able to say why certain shapes are what they are by referring to their properties, including lengths of sides, size of angles and number of lines of symmetry. The naming of shapes sometimes focuses on angle properties (e.g. a rectangle is right-angled), and sometimes on properties of sides (e.g. an equilateral triangle is an equal sided triangle). Shapes can belong to more than one classification. For example, a square is a rectangle, a parallelogram, a rhombus and a quadrilateral.	**The Big Ideas** During this year, pupils increase the range of 2-D and 3-D shapes that they are familiar with. With 3-D shapes they think about the faces as well as the number of vertices and through considering nets think about the 2-D shapes that define the 3-D shapes. Pupils learn about a range of angle facts and use them to describe certain shapes and derive facts about them. Regular shapes have to have all sides and all angles the same. Although non-square rectangles have four equal angles, the fact that they do not have four equal sides means that they are not regular. Some properties of shapes are dependent upon other properties. For example, a rectangle has opposite sides equal because it has four right angles. A rectangle is defined as a quadrilateral with four right angles. It does not have to be defined as a quadrilateral with four right angles and two pairs of equal sides.	**The Big Ideas** Variance and invariance are important ideas in mathematics, particularly in geometry. A set of quadrilaterals for example may vary in many ways in terms of area, length of sides and the size of individual angles. However there are a set of invariant properties which remain common to all quadrilaterals, namely they have four sides and their internal angles sum to 360^o. Some of these properties emerge from naturally occurring constraints, for example the sum of the internal angles will always sum to 360^o and they can do nothing else! The questions 'What's the same?' and 'What's different?' can draw pupils' attention to variance and invariance. Shapes can be alike in essentially two different ways: congruent and similar. Congruent shapes are alike in all ways: they could occupy exactly the same space. Similar shapes share identical geometrical properties but can differ in size. All equilateral triangles are similar, but only identically sized ones are congruent. Not all isosceles triangles are similar. Angle properties are a mix of necessary conditions and conventions. It is a necessary condition that angles on a straight line combine to a complete half turn. That we measure the half turn as 180^o is conventional.
	Teaching for Mastery Year 3	Teaching for Mastery Year 4	Teaching for Mastery Year 5	Teaching for Mastery Year 6

GEOMETRY (GEO - 6 weeks)

Strand		Yr3	Yr4	Yr5	Yr6
Properties of Shapes	Properties of Shapes	**draw 2D shapes;** **Recognise and describe 2D shapes** **make 3D shapes using modelling materials;** **Construct 3D shapes** **recognise 3D shapes in different orientations and describe them** **Recognise and describe 3D shapes** use appropriate mathematical vocabulary to describe the features of 2D and 3D shapes including semicircles, hemispheres and prisms sort and classify collections of 2D shapes in different ways using a range of properties including: 'all sides are of equal length,' 'has at least one right angle' or 'has at least one line of symmetry' and record their classifications on Venn and Carroll diagrams, including diagrams involving more than one criterion How many triangles can you draw on a 3x3 pin board? How many quadrilaterals can you draw on a 3x3 pin board? In each case, how do you decide if the shapes are the same or different? Could you find different right angled triangles, or is there only one? Can you name the different quadrilaterals? **Identify horizontal and vertical lines and pairs of perpendicular and parallel lines** **Horizontal and vertical** **Parallel and Perpendicular** 1 2 3 4 5 6 7 8 9 X	**compare and classify geometric shapes, including quadrilaterals and triangles, based on their properties and sizes** **Triangles** **Quadrilaterals** Pupils should be able to complete this sentence: All equilateral triangles have … 1 2 3 4 5	**Identify 3D shapes, including cubes and other cuboids, from 2D representations** **Reasoning about 3D shapes**  These are pictures of 3D shapes. Which 3D shapes are pictured here? Put the names in the boxes.	**recognise, describe and build simple 3-D shapes, including making nets** **Nets of 3D shapes** Children should be able to identify, visualise and describe properties of rectangles, triangles, regular polygons and 3-D solids; use knowledge of properties to draw 2-D shapes and identify and draw nets of 3-D shapes Children should be able to respond accurately to questions such as - 'I am thinking of a 3D shape. It has a square base. It has four other faces which are triangles. What is the name of the 3D shape?' 'Which of these nets are of square based pyramids? How do you know?  1 2 **illustrate and name parts of circles, including radius, diameter and circumference and know that the diameter is twice the radius** **Circles** Children should know that: • The circumference is the distance round the circle • The radius is the distance from the centre to the circumference • The diameter is 2 x radius
	NCETM Reasoning	**What's the same, what's different?**  **Visualising** I am thinking of a 3-dimensional shape which has faces that are triangles and squares. What could my shape be? **Other possibilities** One face of a 3D shape is a square. What shape could it be? Are there any other possibilities?	**What's the same, what's different** about the diagonals of these 2-D shapes?  **Visualising** Imagine a square cut along the diagonal to make two triangles. Describe the triangles. Join the triangles on different sides to make new shapes. Describe them. (you could sketch them). Are any of the shapes symmetrical? Convince me.	**What's the same, what's different** about the net of a cube and the net of a cuboid? **Visualising** I look at a large cube which is made up of smaller cubes. If the larger cube is made up of between 50 and 200 smaller cubes what might it look like?	**What's the same, what's different** about the nets of a triangular prism and a square based pyramid? **Visualising** Jess has 24 cubes which she builds to make a cuboid. Write the dimensions of cuboids that she could make. List all the possibilities.

GEOMETRY (GEO - 6 weeks)

Angles

Drawing and Recognising Angles

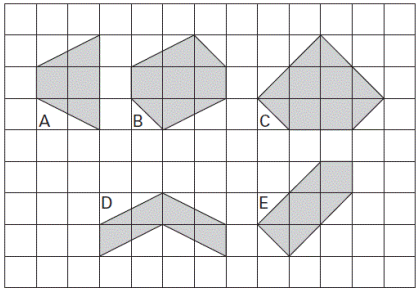
Recognise angles as a property of a shape or description of a turn

[Turns and angles]

Identify right angles, recognise that two right angles make a half turn, three make three quarters of a turn and a complete turn; identify whether angles are greater or less than a right angle

[Right angles in shapes]

[Compare angles]



Which of these shapes have right angles?

If I face West and make a quarter turn anticlockwise, in which direction will I now face?

What about half turn?

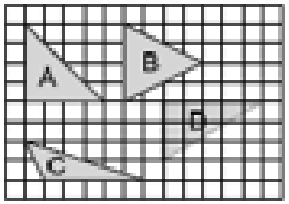
1

identify acute and obtuse angles; compare and order angles up to two right angles by size

[Identify angles]

[Compare and order angles]

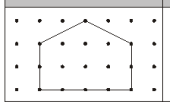
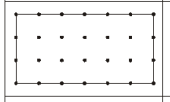
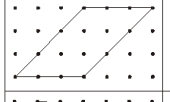
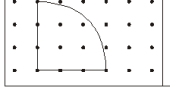
Here are four triangles drawn on a square grid



Write the letter for each triangle in the correct region of the sorting diagram. One has been done for you.

	has a right angle	has an obtuse angle	has an acute angle
is isosceles	A		
is not isosceles			

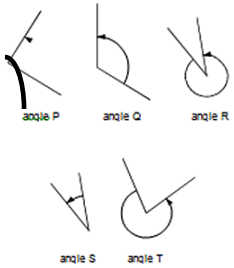
Put a tick or a cross in each box. The first one has been done for you.

Shape	It is a quadrilateral	It has one or more right angles
	×	✓
		
		
		

Know angles are measured in degrees: estimate and compare acute, obtuse and reflex angles

[Year 6 Introduce angles]

Look at these angles.



Label each angle acute, obtuse or reflex. List the 5 angles in order from smallest to largest.

Draw given angles, and measure them in degrees (°)

[Measuring angles in degrees]

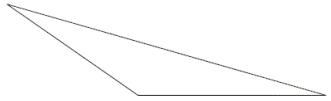
[Measure with a protractor (1)]

[Measure with a protractor (2)]

[Draw accurately]

Children become accurate in drawing lines with a ruler to the nearest millimetre and measuring with a protractor. Children use conventional markings for parallel lines and right angles.

Measure A accurately. Use a protractor
Here is a triangle.



Measure the shortest side in cm. Measure the largest angle in degrees

1 2 3 4

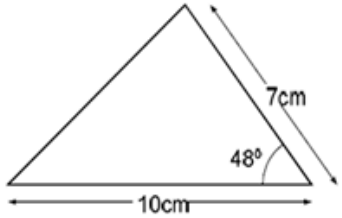
draw 2-D shapes using given dimensions and angles

[Measure with a protractor]

[Draw shapes accurately]

Children should be able to construct a triangle given two sides and the included angle

Here is a sketch of a triangle. (It is not drawn to scale).



Draw the full size triangle accurately, below. Use an angle measurer (protractor) and a ruler. One line has been drawn for you.

1 2 3

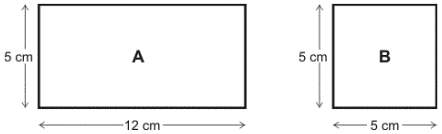
Angles

Geometrical Reasoning

Use the properties of rectangles to deduce related facts and find missing lengths and angles

Lengths and angles

Ben has two rectangles -



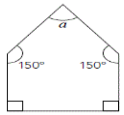
What is the special name for rectangle B? Ben puts the rectangles together

What is the length of the new rectangle?

Distinguish between regular and irregular polygons based on reasoning about equal sides and angles

Regular and irregular polygons

Here is a picture of a pentagon. Explain why this is not a regular pentagon

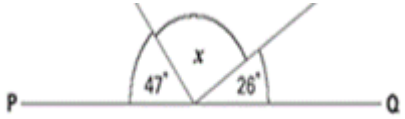


1 2

identify angles at a point and one whole turn (total 360°), angles at a point on a straight line and a half turn (total 180°) and other multiples of 90°

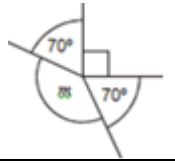
Angles on a straight line

Angles round a point



PQ is a straight line. Find x.

This diagram is not drawn accurately. Calculate the size of angle m.



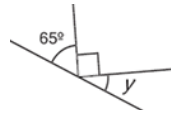
recognise angles where they meet at a point, are on a straight line, or are vertically opposite, and find missing angles

Calculate angles

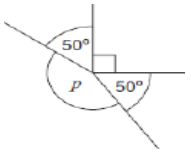
Vertically opposite angles

There are nine equal angles around a point. What is the size of each angle?'

'There are a number of equal angles around a point. The size of each angle is 24°. How many equal angles are there?'



Children should be able to calculate the size of angle 'y' in this diagram without using a protractor



Calculate the size of angle p

compare and classify geometric shapes based on their properties and sizes and find unknown angles in any triangles, quadrilaterals, and regular polygons

Angles in a triangle (1)

Angles in a triangle (2)

Angles in a triangle (3)

Angles in quadrilaterals

Angles in polygons

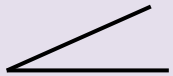
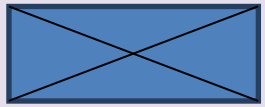
Children should be able to make and draw shapes with increasing accuracy and knowledge of their properties. They should be able to carry out activities such as -

'Give me instructions to get me to draw a rhombus using my ruler and a protractor'

'On squared paper, use a ruler to draw a pentagon that has three right angles'

1 2 3

GEOMETRY (GEO - 6 weeks)

Angles	NCETM Reasoning	**Always, sometimes, never** Is it always, sometimes or never that all sides of a hexagon are the same length? **Other possibilities** Can you find shapes that can go with the set with this label? “Have straight sides that are different lengths.” **Convince me** Which capital letters have perpendicular and / or parallel lines? Convince me.	**Always, sometimes, never** Is it always, sometimes or never true that the two diagonals of a rectangle meet at right angles? **Other possibilities** Can you show or draw a polygon that fits both of these criteria? What do you look for? ”Has exactly two equal sides.” ”Has exactly two parallel sides.”	**Always, sometimes, never** Is it always, sometimes or never true that the number of lines of reflective symmetry in a regular polygon is equal to the number of its sides n? **Other possibilities** A rectangular field has a perimeter between 14 and 20 metres . What could its dimensions be? **Other possibilities** Here is one angle of an isosceles triangle. You will need to measure the angle accurately. What could the other angles of the triangle be? Are there any other possibilities?  **Convince me** What is the angle between the hands of a clock at four o clock? At what other times is the angle between the hands the same? Convince me	**Always, sometimes, never** Is it always, sometimes or never true that, in a polyhedron, the number of vertices plus the number of faces equals the number of edges? **Other possibilities** Not to scale  The angle at the top of this isosceles triangle is 110 degrees. What are the other angles in the triangle? **Convince me**  One angle at the point where the diagonals of a rectangle meet is 36 degrees. What could the other angles be? Convince me

GEOMETRY (GEO - 6 weeks)

Position, direction, movement

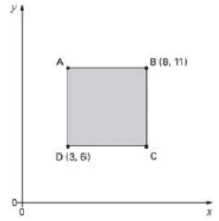
Coordinates and translation

describe positions on a 2-D grid as coordinates in the first quadrant

Describe position

Draw on a grid

Here is a shaded square. Write the coordinates for point A



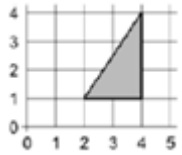
1 2

describe movements between positions as translations of a given unit to the left/right and up/down

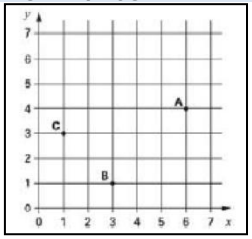
Move on a grid

Describe movement

This triangle is translated two squares to the left and one square down. Give the coordinates of its vertices in the new position.



plot specified points and draw sides to complete a given polygon



A, B and C are three corners of a rectangle. What are the coordinates of the fourth corner?

1

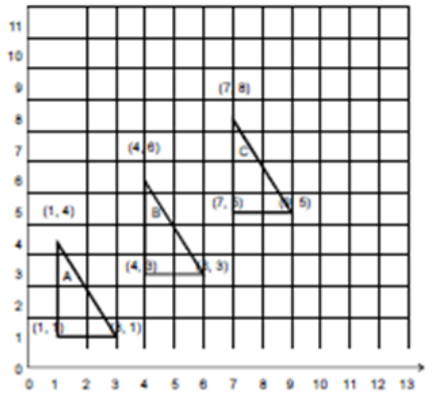
identify, describe and represent the position of a shape following ~~a reflection~~ or translation, using the appropriate language, and know that the shape has not changed

Position in the first quadrant

Translation

Translation with coordinates

Write the co-ordinates of the next triangle in this sequence.



1 2

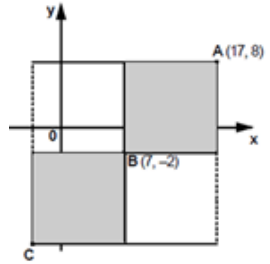
describe positions on the full coordinate grid (all four quadrants)

The first quadrant

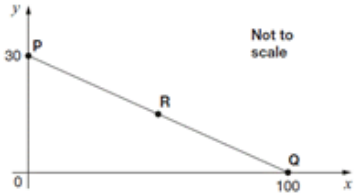
Plotting coordinates

Children should be able to draw and label rectangles, parallelograms and rhombuses, specified by co-ordinates in the four quadrants, predicting missing co-ordinates using the properties of shapes

The two shaded squares below are the same size. A is the point (17,8), B is the point (7, -2). What are the co-ordinates of point C?



In this diagram R is an equal distance from P and Q



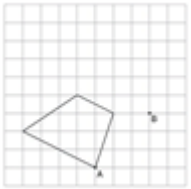
What are the co-ordinates of R?

1 2 3

draw and translate simple shapes on the coordinate plane, ~~and reflect them~~ in the axes

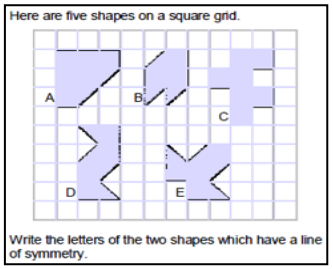
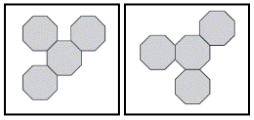
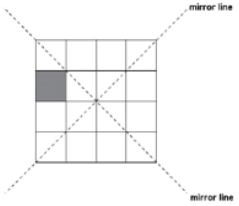
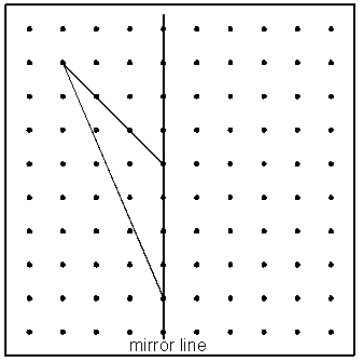
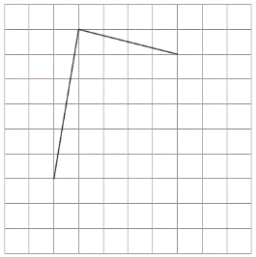
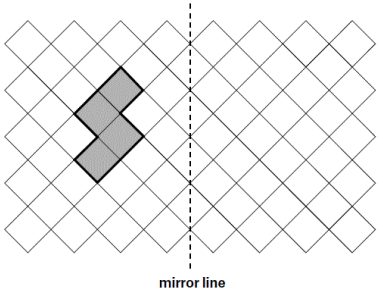
Translation

Here is a quadrilateral. The shape is translated so that point A is now at point B. Complete the shape in its new position. Use a ruler.



1 2

GEOMETRY (GEO - 6 weeks)

Position, direction, movement	Symmetry and reflection	***(Year 4 objective) identify lines of symmetry in 2-D shapes presented in different orientations*** ***(Year 4 objective) complete a simple symmetric figure with respect to a specific line of symmetry*** Horizontal and vertical lines of symmetry only	**identify lines of symmetry in 2-D shapes presented in different orientations** **Lines of symmetry**  Draw a line of symmetry on each diagram below. Use a ruler.  1 2 3 **complete a simple symmetric figure with respect to a specific line of symmetry** **Symmetric figures** Here is a shaded square on a grid. Shade in 3 more squares so that the design is symmetrical in both mirror lines.  1 2	**identify, describe and represent the position of a shape following a reflection ~~or translation~~, using the appropriate language, and know that the shape has not changed** **Reflection** **Reflection with coordinates** Draw the reflection of this triangle in the mirror line.  *(moved from Y4) Two sides of a kite are drawn on the grid.*  *Complete the shape. Use a ruler.*	**draw ~~and translate simple~~ shapes on the coordinate plane, and reflect them in the axes** **Reflections** Children should be able to draw a shape with corners at given vertices, and describe the properties of the shape. Can they create the same shape where all of the coordinates will be positive? Negative? Children should be able to sketch the reflection of a simple shape in two mirror lines at right angles and find the coordinates of selected points. Complete the diagram by reflecting the shape in the mirror line – 
	NCETM Reasoning		**Other possibilities** Can you draw a non-right angled triangle with a line of symmetry? Are there other possibilities? **Convince me** Ayub says that he can draw a right angled triangle which has another angle which is obtuse. Is he right? Explain why.		