

Unit 8 Shape and space

Five daily lessons

*National
Numeracy Strategy*

Year 5
Summer term

Unit Objectives

Year 5

- Make shapes with increasing accuracy.
- Recognise reflective symmetry in regular polygons: for example, know that a square has four axes of symmetry and an equilateral triangle has three;
- Complete symmetrical patterns with two lines of symmetry at right angles (using squared paper or peg board);
- Recognise where a shape will be after reflection in a mirror line parallel to one side (sides not all parallel or perpendicular to the mirror line); Recognise where a shape will be after a translation.
- Make and investigate a general statement about familiar numbers or shapes by finding examples that satisfy it.
- Suggest extensions asking 'What if...?'

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This Unit Plan is designed to guide your teaching. You will need to adapt it to meet the needs of your class.

Resources needed to teach this unit:

- Activity sheet 8.1
- Activity sheet 8.2
- Activity sheet 8.3
- Activity sheet 8.4
- Activity sheet 8.5
- OHT 8.1
- OHT 8.2
- OHT 8.3
- Self-assessment sheet 8.1
- Whiteboards
- Set of 2-D shapes
- Large paper square
- Large paper equilateral triangle
- Mirrors
- Rulers

Link Objectives

Year 4

- Make shapes: for example, construct polygons by paper folding or using pinboard, and discuss properties such as lines of symmetry.
- Sketch the reflection of a simple shape in a mirror line parallel to one side (all sides parallel or perpendicular to the mirror line).
- **Classify polygons using criteria such as number of right angles, whether or not they are regular, symmetry properties.**
- Make and investigate a general statement about familiar numbers or shapes by finding examples that satisfy it.
- Suggest extensions by asking 'What if...?'

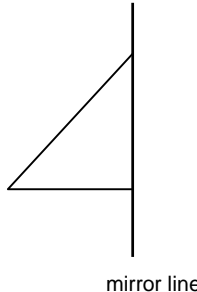
Year 6

- Make shapes with increasing accuracy.
- Recognise where a shape will be after reflection: in a mirror line touching the shape at a point (sides of shape not necessarily parallel or perpendicular to the mirror line); In two mirror lines at right angles (sides of shape all parallel or perpendicular to the mirror line). Recognise where a shape will be after two translations.
- Make and investigate a general statement about familiar numbers or shapes by finding examples that satisfy it.
- Suggest extensions asking 'What if...?'

(Key objectives in bold)

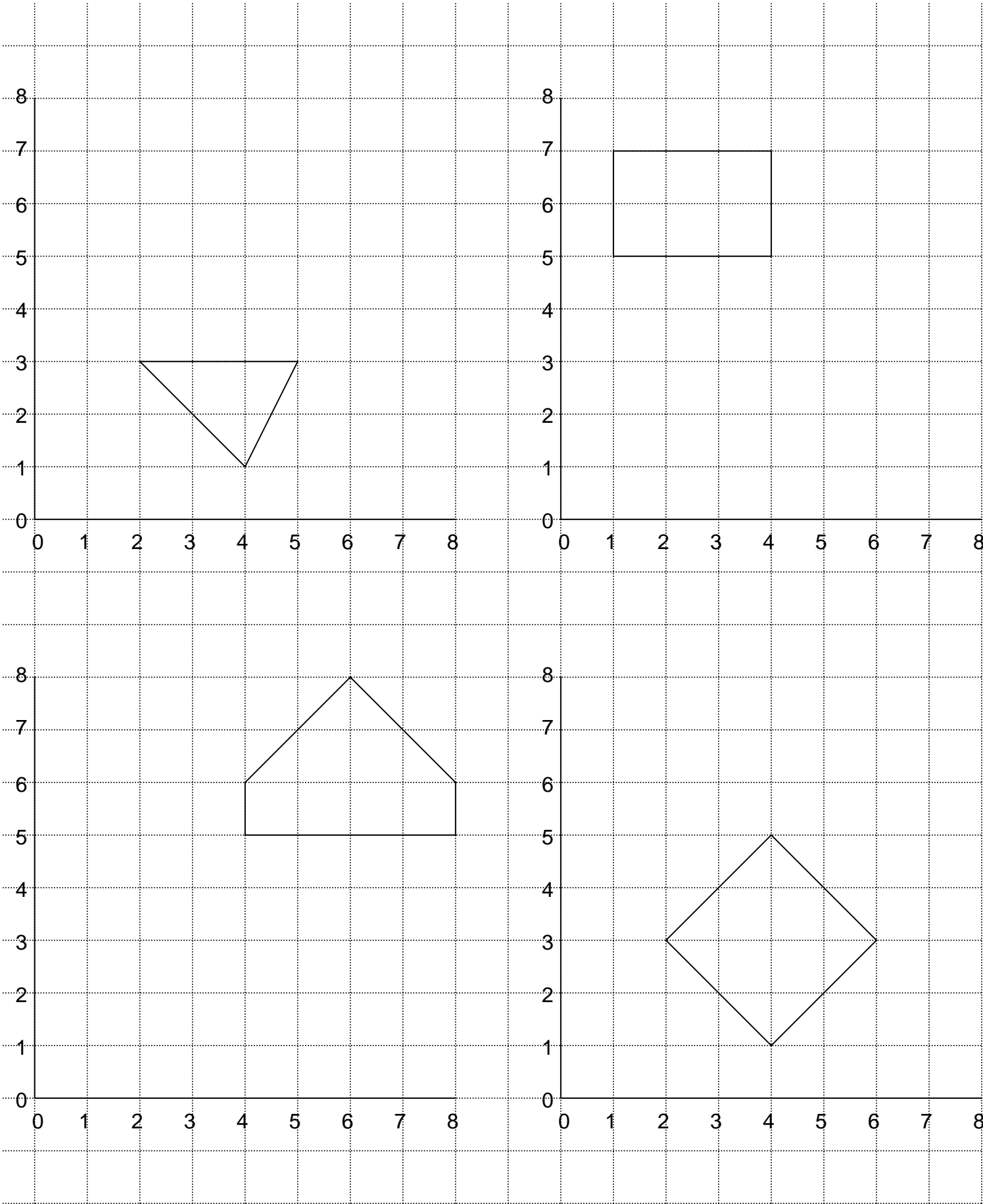
Planning sheet	Day One	Unit 8 <i>Shape and space</i>	Term: <i>Summer</i>	Year Group: 5
Oral and Mental		Main Teaching		Plenary
Objectives and Vocabulary	Teaching Activities	Objectives and Vocabulary	Teaching Activities	Teaching Activities/Focus Questions
<p>Visualise and name polygons</p> <p>VOCABULARY isosceles equilateral scalene triangle square rectangle quadrilateral pentagon hexagon heptagon octagon nonagon decagon regular irregular</p>	<ul style="list-style-type: none"> Describe a variety of shapes for children to visualise and name after two clues, e.g. this polygon has three sides. The lengths of two of its sides are equal (isosceles triangle). This shape has six sides. The six angles are not the same size (irregular hexagon). Ask the children to work in pairs and choose a shape of their own. They are to select two clues about the shape which they must give to others in the class. Invite pairs to give their two clues for the class to identify their shapes. 	<p>Recognise where a shape will be after translation.</p> <p>Make shapes with increasing accuracy.</p> <p>VOCABULARY translate translation horizontal(ly) vertical(ly) congruent transform</p> <p>RESOURCES OHT 8.1 Activity sheet 8.1</p>	<ul style="list-style-type: none"> Place a shape on the board. Move it in a straight line horizontally to the right. <p>Q What is the special name for this type of movement?</p> <p>Establish that it is a translation and that the shape has been translated horizontally to the right. Ask selected children to translate the shape: vertically upwards, downwards and horizontally to the left.</p> <p>Q How could we determine how far in each direction the shape has been translated?</p> <p>Collect suggestions and try them out with the children. Discuss the use of a numbered grid.</p> <ul style="list-style-type: none"> Show the first set of co-ordinates on OHT 8.1. Ask children to give the co-ordinates of the points of the triangle. Record them on the board as: (2, 3) (4, 1) (5, 3). <p>Q What will be the new co-ordinates if the triangle is translated two units upwards?</p> <p>Record the new co-ordinates. Plot them on the grid and join together using a ruler to make a triangle. Discuss the accurate plotting and joining of points.</p> <ul style="list-style-type: none"> Use with the other shapes on OHT 8.1, translating them to the left, right, upwards or downwards. Discuss the effect of translating a shape, e.g. <p>Q What changes when a shape is translated?</p> <p>Q What remains the same?</p> <p>Establish that the position is changed, but that the size and shape remain the same. Explain that shapes which are identical are known as congruent shapes.</p> <ul style="list-style-type: none"> Give out Activity sheet 8.1. Explain that in Part 1 of the sheet each shape is to be translated according to the instructions. The new points are to be plotted and joined and the co-ordinates recorded for the original position of the shape and new positions. In Part 2, the children should draw the translated shape then record the new co-ordinates. 	<ul style="list-style-type: none"> Discuss the children's results. Ask for the co-ordinates for each example, and record on the board for the children to check. Deal with errors or misunderstandings. <p>Q Are the two shapes in each of your examples congruent? How do you know?</p> <p>Establish that in each example the two shapes are identical in all but their positions and are therefore congruent.</p> <p>By the end of the lesson the children should be able to:</p> <ul style="list-style-type: none"> Draw the position of a shape after one translation; Draw 2-D shapes by plotting points on a numbered grid and joining them together accurately. <p>(Refer to supplement of examples, section 6, pages 105 and 107.)</p>

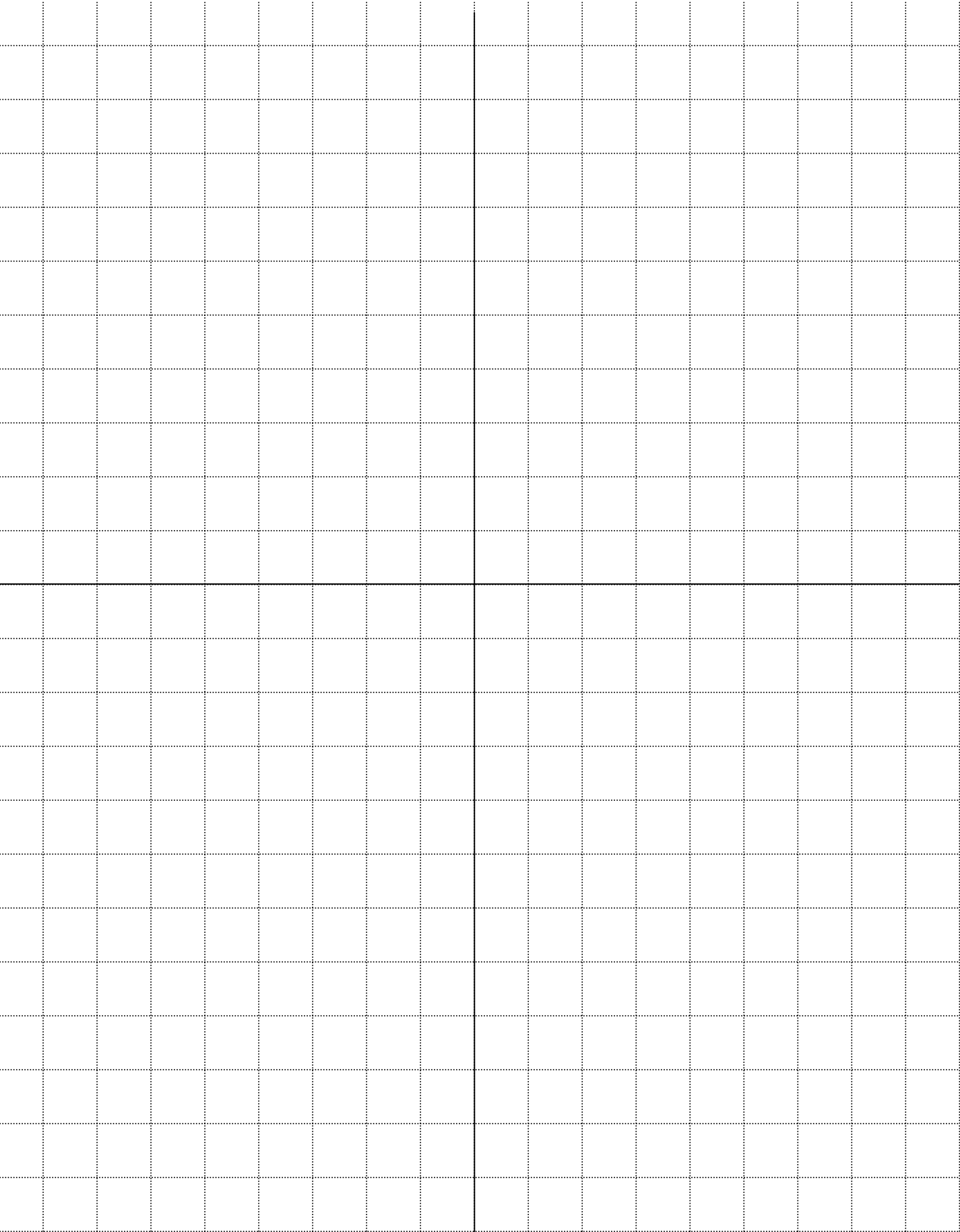
Planning sheet	Day Two	Unit 8 <i>Shape and space</i>		Term: <i>Summer</i>	Year Group: 5						
Oral and Mental		Main Teaching			Plenary						
Objectives and Vocabulary	Teaching Activities	Objectives and Vocabulary	Teaching Activities	Teaching Activities/Focus Questions							
<p>Classify 2-D shapes according to their properties.</p> <p>VOCABULARY isosceles equilateral scalene triangle square rectangle quadrilateral pentagon hexagon heptagon octagon nonagon decagon regular irregular polygon</p> <p>RESOURCES Set of 2-D shapes</p>	<ul style="list-style-type: none">Draw a circle on the board or OHT and place a variety of 2-D shapes next to it. Explain to the class that you are thinking of a rule. If the shape meets the rule it can be put into the circle (e.g. has a right angle; has only two equal sides; has a curved edge; is regular; is irregular; has an angle greater than 90°, etc.)Put a shape inside the circle which reflects the rule. <div>Q What could the rule be?</div> <p>Discuss suggestions and agree possibilities. Place another shape inside the circle.</p> <div>Q Which of your rules could still be possible?</div> <p>Continue until only the correct rule remains.</p> <div>Q Are there any other shapes which could be placed in the circle using the same rule?</div> <p>Ask the children to name any such shapes. Place them in the circle.</p> <ul style="list-style-type: none">Repeat, but this time ask a child to choose a rule and with the class, select shapes they think might be in the circle.	<p>Make shapes with increasing accuracy.</p> <p>Recognise reflective symmetry in regular polygons.</p> <p>Make and investigate a general statement about familiar shapes by finding examples that satisfy it.</p> <p>VOCABULARY symmetrical line/lines of symmetry axis/axes of symmetry reflection congruent</p> <p>RESOURCES Large paper square Large paper equilateral triangle Mirrors Rulers Activity sheet 8.2</p>	<ul style="list-style-type: none">Using the same circle and shapes as for the oral and mental activities, place all the shapes which have no lines of symmetry inside the circle. <div>Q What could be the rule for this set of shapes?</div> <p>Discuss suggestions, agree possibilities and draw out ‘have no lines/axes of symmetry’ as one possible rule.</p> <div>Q What rule would be appropriate for all the other shapes?</div> <p>Establish ‘is symmetrical’ (or ‘has at least one line/axis of symmetry’, etc.) as the rule.Remind the children that a line or axis of symmetry divides a 2-D shape into congruent halves, each half being a reflection of the other. Demonstrate this by folding one of the shapes along a line of symmetry.Hold up a large paper square and ask children to indicate its lines/axes of symmetry. Fold the square along each suggested line to check whether the two halves formed are reflective. Establish that a square has four axes of symmetry.Repeat with a large paper equilateral triangle and draw out that it has three axes of symmetry. Emphasise that each one divides an angle and its opposite side in half.Draw the following table in the board:<table><tr><td>Regular shape</td><td>Number of axes of symmetry</td></tr><tr><td>Equilateral triangle</td><td>3</td></tr><tr><td>Square</td><td>4</td></tr></table><div>Q Can anyone see a relationship between the shape and the number of axes of symmetry?</div><p>Discuss (or draw out if necessary) that the number of axes of symmetry is equal to the number of sides and the number of angles.</p><div>Q Do you think this is true for every regular polygon? How could we find out?</div><p>Establish the need to test by checking examples.</p><ul style="list-style-type: none">Give out Activity sheet 8.2. Explain that in each example the dots should be carefully joined together using a ruler, then the axes of symmetry identified and marked. Have mirrors available for the children to use. The table on the board should be copied and continued by the children as they explore the shapes.</p>	Regular shape	Number of axes of symmetry	Equilateral triangle	3	Square	4	<ul style="list-style-type: none">Discuss the children’s findings. <div>Q What have you discovered about the number of axes of symmetry in regular polygons?</div> <p>Confirm that the number of axes of symmetry is equal to the number of sides.</p> <div>Q What are the properties of regular polygons?</div> <p>List suggestions on the board, including: all angles are equal; all sides are equal; the number of lines/axes of symmetry is equal to the number of sides. Establish that the first two conditions are essential.</p> <ul style="list-style-type: none">Hold up a rectangle. <div>Q Is this rectangle a regular polygon? How do you know?</div> <p>Establish that it is not regular because the sides are not all equal and that there are only two axes of symmetry.</p> <div>By the end of the lesson the children should be able to:</div> <ul style="list-style-type: none">Recognise the number of axes of reflective symmetry in regular polygons and know that the number is equal to the number of sides;Find examples that match a general statement;Draw 2-D shapes with increasing accuracy. <p>(Refer to supplement of examples, section 6, pages 81, 105, 107.)</p>	
	Regular shape	Number of axes of symmetry									
	Equilateral triangle	3									
	Square	4									

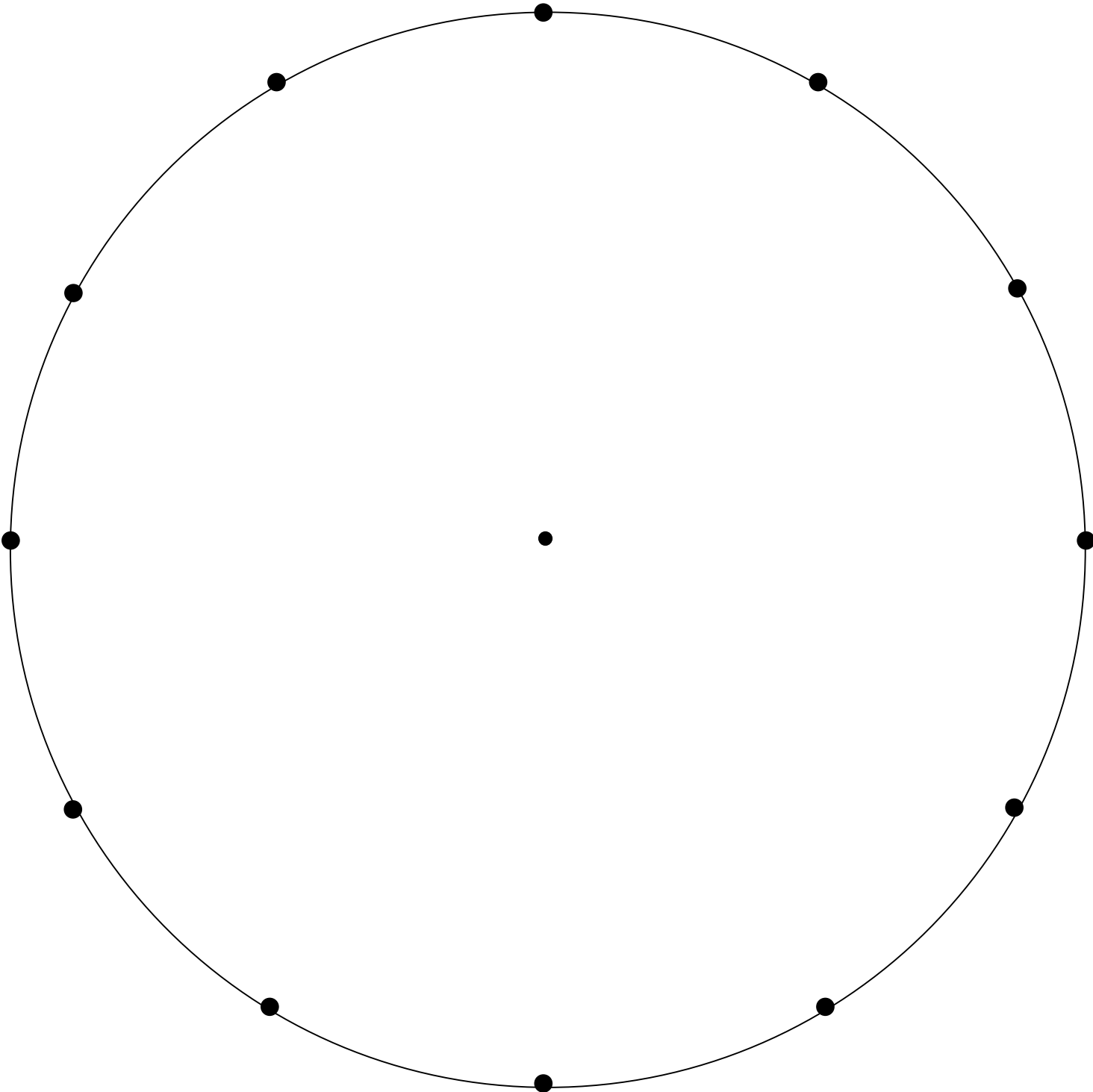
Planning sheet	Day Three	Unit 8 <i>Shape and space</i>	Term: <i>Summer</i>	Year Group: 5
Oral and Mental		Main Teaching		Plenary
Objectives and Vocabulary	Teaching Activities	Objectives and Vocabulary	Teaching Activities	Teaching Activities/Focus Questions
<p>Read and write whole numbers and know what each digit represents.</p> <p>VOCABULARY digit</p> <p>RESOURCES Whiteboards</p>	<ul style="list-style-type: none"> Write any seven-digit number on the board, e.g. 5 364 827. Ask the class to read it aloud together on your signal. <div>Q What is the value of the three? Of the 8? Of the 5?, etc.</div> <p>Establish the values in terms of number, e.g. three hundred thousand; eight hundred; five million, etc.</p> <ul style="list-style-type: none"> Ask the children to add and subtract different numbers to and from the number on the board and show answers on their whiteboards, e.g. add thirty; subtract twenty thousand; add four; subtract two thousand, etc. Each time ask the class to read aloud the new number on your signal. Using the original number on the board ask questions such as: <div>Q What would we need to add to the number to make 5 364 900?</div> <div>Q What would we need to subtract to leave 5 100 000?</div> <p>The children record answers on their whiteboards.</p> <ul style="list-style-type: none"> Invite the children to pose a question that involves adding or subtracting to make a new number. 	<p>Recognise where a shape will be after reflection in a mirror line parallel to one side.</p> <p>Suggest extensions asking 'What if...?'.</p> <p>VOCABULARY reflection mirror line parallel congruent image reversal</p> <p>RESOURCES Mirrors Rulers Activity sheet 8.3 Self-assessment sheet 8.1</p>	<ul style="list-style-type: none"> Draw a right-angled triangle on the board. Draw a mirror line along the vertical side as shown below and explain to the class that it represents a mirror.  <p>mirror line</p> <div>Q What will the reflection of this shape look like?</div> <p>Discuss the reflection. Establish that the image and the original shape will be congruent, that the reflection will be a reversal of the original, and that the two shapes will touch each other at the mirror line. Ask a volunteer to sketch the reflection. Discuss whether it is accurate and adjust if necessary.</p> <ul style="list-style-type: none"> Draw the original triangle again below the first example on the board. This time place the mirror line parallel to the vertical side but leave a space between the two. Repeat the process described above and establish that the mirror line should be exactly half way between the shape and its reflection. Repeat but this time place the mirror line parallel to the horizontal side of the triangle. Repeat with the mirror line parallel to the sloping side. In pairs, ask the children to use rulers and pencils to draw carefully any four sided shape in their books. They are to place a mirror line parallel to one side, then swap with their partner who is to draw the reflection. Discuss the results and deal with any misconceptions that arise. Give out Activity sheet 8.3. Ask the children to complete these on their own. Explain that they are to draw the images carefully and afterwards use a mirror to check the reflected shape. 	<ul style="list-style-type: none"> Discuss the children's methods of drawing the images of the reflected shapes. Work through any which caused difficulties on the board and rectify any misconceptions. <p>Emphasise the congruency, the reversal and the equal distances from the mirror line.</p> <ul style="list-style-type: none"> Give out Self-assessment sheet 8.1. Ask the children to complete the first cloud question. <div> <p>By the end of the lesson the children should be able to:</p> <ul style="list-style-type: none"> Sketch the reflection of a simple shape in a mirror line parallel to one edge, where the edges of the shape are not all parallel or perpendicular to the mirror line; Extend puzzles or problems involving exploring different alternatives ('What if...?'). <p>(Refer to supplement of examples, section 6, pages 79 and 107.)</p> </div>

Planning sheet	Day Four	Unit 8 <i>Shape and space</i>	Term: <i>Summer</i>	Year Group: 5
Oral and Mental		Main Teaching		Plenary
Objectives and vocabulary	Teaching Activities	Objectives and vocabulary	Teaching Activities	Teaching Activities/Focus Questions
<p>Recall multiplication facts for the 8 times table and derive related multiplication and division facts.</p>	<ul style="list-style-type: none"> On the board draw the dial: <div data-bbox="463 306 723 568" data-label="Diagram"> </div> <p>In the centre write $\times 8$ and with the class recite the 8 times table. One eight is eight, two eights are sixteen, etc. Repeat. Point to one of the numbers on the dial, e.g. 4, and ask:</p> <p>Q What is 4 multiplied by 8?</p> <p>Record the number 32 on the outside of the dial next to 4.</p> <p>Record on the board: $4 \times 8 = 32$.</p> <p>Q What division fact involving 8 can you give me?</p> <p>Establish that $4 = 32 \div 8$, and record this on the board.</p> <p>Repeat until the dial is complete.</p> <ul style="list-style-type: none"> Replace $\times 8$ by $\times 80$, and with the class recite the 80 times table. Repeat. Point to one of the numbers on the inside of the dial, e.g. 4, and ask: <p>Q What is 4 multiplied by 80? What division fact involving 80 can you give me?</p> <p>Establish $4 \times 80 = 320$ and $4 = 320 \div 80$.</p> <p>On the dial change the number 32 to 320. Repeat. Emphasise how knowing the 8 times table helps to work out the 80 times table and related division facts.</p> 	<p>Complete symmetrical patterns with a vertical and horizontal lines of symmetry.</p> <p>VOCABULARY vertical horizontal line of symmetry quadrant</p> <p>RESOURCES OHT 8.2 Activity sheet 8.4 Mirrors Rulers</p>	<ul style="list-style-type: none"> Show OHT 8.2. Explain that it shows two axes or mirror lines, and four quadrants. Highlight a square in the top left-hand quadrant of the grid. Ask: <p>Q Where will the image of this square be if we reflect it in the horizontal axis?</p> <p>Invite children to identify the new square. Repeat using the vertical axis. Start with a square in a different quadrant in the grid.</p> Explain that the images can also be reflected again in the axes. Demonstrate how starting with one square this can be reflected in each axis to produce three new squares, so there is one in each quarter. Establish that the pattern obtained this way is symmetrical and show that the squares are equal distances from the axes of symmetry. Give out Activity sheet 8.4. The children are to work in pairs. Each child chooses one of the quadrants on the grid and makes a shape using up to 20 squares. The pairs swap sheets and generate the pattern formed by reflecting the shape in each of the axes so the shape appears in each of the quadrants. The children can use mirrors to check the reflections. Share some of the patterns and highlight the congruence between the shapes in the four quadrants and the equal distances from the lines of symmetry. <p>Q Does it matter which of the four quadrants you start your shape in?</p> <p>Collect and discuss answers.</p>	<ul style="list-style-type: none"> Show the grid on OHT 8.2. Draw the following shape. <div data-bbox="1832 325 2074 584" data-label="Image"> </div> <p>Q How can we reflect this hexagon in the two axes?</p> <p>Invite the children to demonstrate the reflections. Establish that as the hexagon crosses the vertical axis, there are two reflected shapes. Complete the shape with the class.</p> <p>HOMEWORK – Ask the children to use Activity sheet 8.4 at home and, starting with a shape that crosses an axis of symmetry, complete the symmetric pattern formed by reflecting the shape in both of the axes.</p> <p>By the end of the lesson the children should be able to:</p> <ul style="list-style-type: none"> Complete symmetrical patterns on squared paper with a horizontal or a vertical line of symmetry. <p>(Refer to supplement of examples, section 6, page 107.)</p>

Planning sheet	Day Five	Unit 8 <i>Shape and space</i>	Term: <i>Summer</i>	Year Group: 5
Oral and Mental		Main Teaching		Plenary
Objectives and Vocabulary	Teaching Activities	Objectives and Vocabulary	Teaching Activities	Teaching Activities/Focus Questions
<p>Recall multiplication facts for the 9 times table and derive related multiplication and division facts.</p>	<ul style="list-style-type: none"> On the board draw the dial: <div data-bbox="430 303 692 564" data-label="Diagram"> </div> <p>In the centre write $\times 9$ and with the class recite the 9 times table. One nine is nine, two nines are eighteen, etc. Repeat. Point to one of the numbers on the dial, e.g. 4, and ask:</p> <p>Q What is 4 multiplied by 9?</p> <p>Record the number 36 on the outside of the dial next to 4.</p> <p>Record on the board $4 \times 9 = 36$.</p> <p>Q What division fact involving 9 can you give me?</p> <p>Establish that $4 = 36 \div 9$, and record this on the board.</p> <p>Repeat until the dial is complete.</p> Replace $\times 9$ by $\times 90$, and with the class recite the 90 times table. Repeat. <p>Point to one of the numbers on the inside of the dial, e.g. 4, and ask:</p> <p>Q What is 4 multiplied by 90? What division fact involving 90 can you give me?</p> <p>Establish $4 \times 90 = 360$ and $4 = 360 \div 90$.</p> <p>On the dial change the number 36 to 360. Emphasise how knowing the 9 times table helps to work out the 90 times table and related division facts.</p>	<p>Complete symmetrical patterns with a vertical or horizontal line of symmetry.</p> <p>Suggest extensions asking 'What if...?'. </p> <p>VOCABULARY symmetrical lines/axes of symmetry reflection</p> <p>RESOURCES OHT 8.3 Activity sheet 8.5 Rulers Mirrors Self-assessment sheet 8.1</p>	<ul style="list-style-type: none"> Discuss the homework activity set on day 4. Share some of the results with the class. Remind the children that we started with one axis of symmetry then two axes. <p>Q Can we have more axes of symmetry?</p> <p>Agree we can and refer back to the work earlier in the week involving the regular polygons.</p> <ul style="list-style-type: none"> Show OHT 8.3. Join up two points on the circumference to form a diameter, and say this is an axis of symmetry. Draw a cross or small shape and with the axis horizontal reflect the shape/cross. Rotate the circle and emphasise that no matter where the axis of symmetry is, the shape/cross will be the same distance either side of the line. Join up two other points on the circumference to form another diameter, so that the angle between the two axes is 60°. <p>Q How do we reflect our shape/cross in this new axis?</p> <p>Invite the children to reflect the shape/cross and discuss their positions in the circle. Rotate the circle to emphasise the pattern. Have in turn the two axes in the horizontal and vertical positions to check the symmetry.</p> <p>Q Is there any other axis of symmetry in the pattern?</p> <p>Establish there is. Draw this at 60° to the two other axes and complete the reflections in all three axes.</p> <ul style="list-style-type: none"> Give out Activity sheet 8.5 and ask the children to draw the same three lines of symmetry with rulers and pencils and make up their own symmetrical patterns. They should use a mirror to help them and to check their axes of symmetry work. 	<ul style="list-style-type: none"> Show and discuss some of the patterns formed. Emphasise that the three axes of symmetry are equally spaced around the centre of the circle and if they were not the pattern would not work. Say that if we had four axes of symmetry these would also have to be equally spaced around the circle. Refer back to the case of the square. <p>ASSESSMENT –</p> <ul style="list-style-type: none"> Give out Self-assessment sheet 8.1. Ask the children to complete the second and third cloud questions. Discuss with the class the work they have been engaged in over the week. Ask the children to set themselves a target based on the work. <p>By the end of the lesson the children should be able to:</p> <ul style="list-style-type: none"> Complete symmetrical patterns on squared paper with two lines of symmetry at right angles; Suggest extensions to mathematical problems by trying out their own ideas ('What if...?'). <p>(Refer to supplement of examples, section 6, pages 79 and 107.)</p>

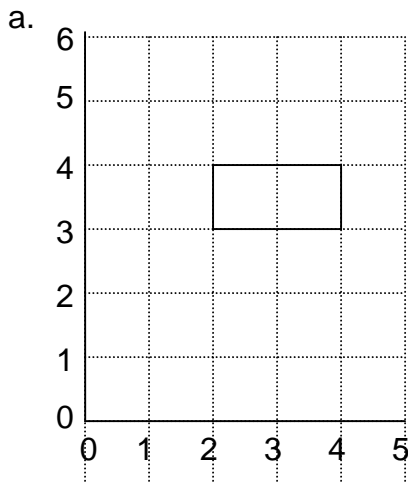




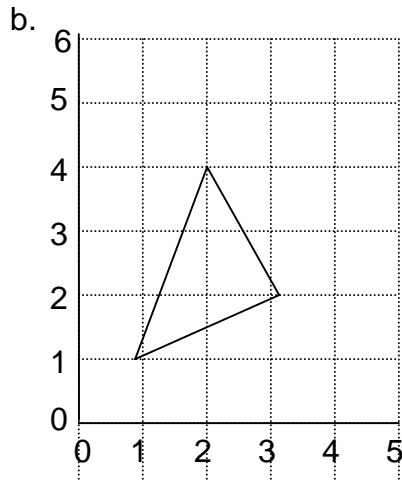


Part 1

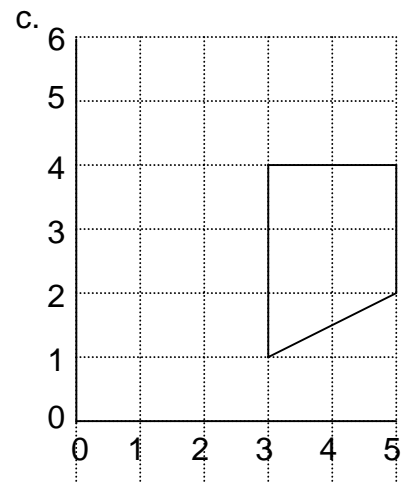
Write down the co-ordinates for each shape. Translate each shape as stated and draw it in its new position. Write the new co-ordinates after the shape has been translated.



Translate three
units downwards



Translate two
units to the right

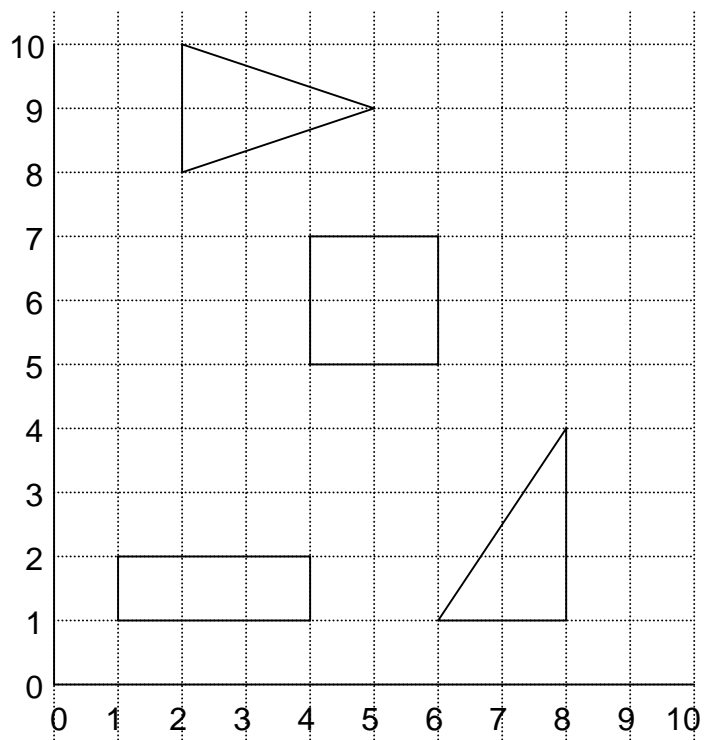


Translate two
units to the left and
one unit upwards

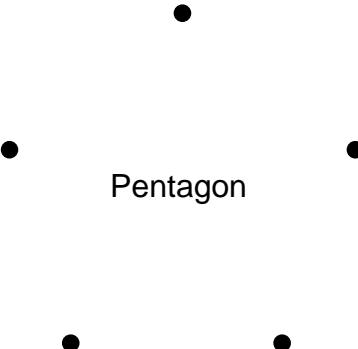
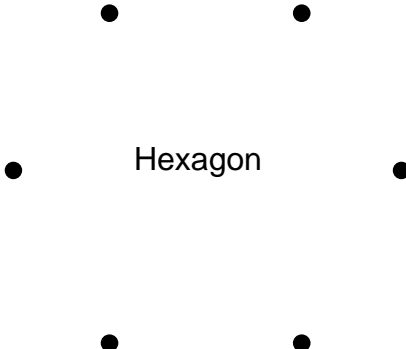
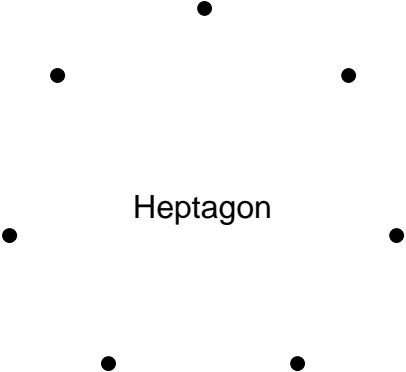
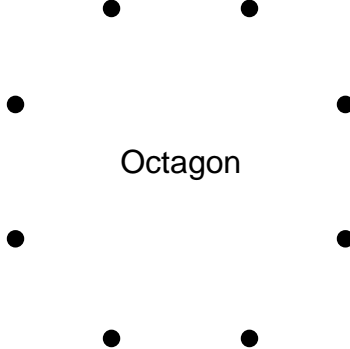
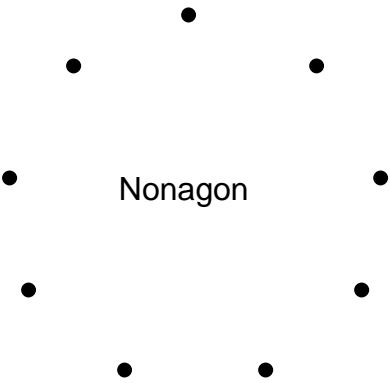
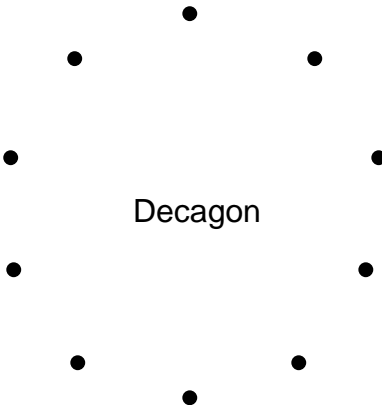
Part 2

Draw the translated shape and write the co-ordinates for the shape after it has been translated.

- The isosceles triangle is translated four units to the right.
- The square is translated three units to the left.
- The rectangle is translated two units upwards.
- The right-angled triangle is translated one unit upwards and two units to the left.



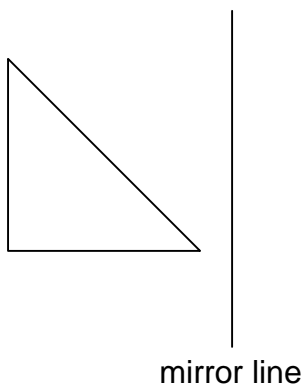
- 1. Carefully draw each shape by joining the dots (use a ruler from the centre of one dot to the centre of another).
- 2. Draw all the lines of symmetry on each shape (you may cut out the shapes if you wish).
- 3. Copy and complete the table on the board.

<div><p>Pentagon</p></div>	<div><p>Hexagon</p></div>
<div><p>Heptagon</p></div>	<div><p>Octagon</p></div>
<div><p>Nonagon</p></div>	<div><p>Decagon</p></div>

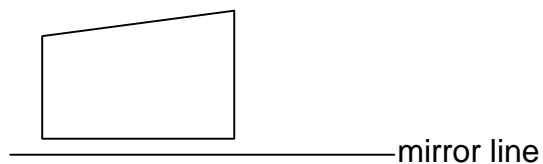
Part 1

Draw the reflection of each shape.

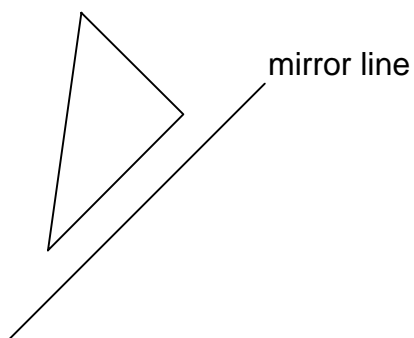
1.



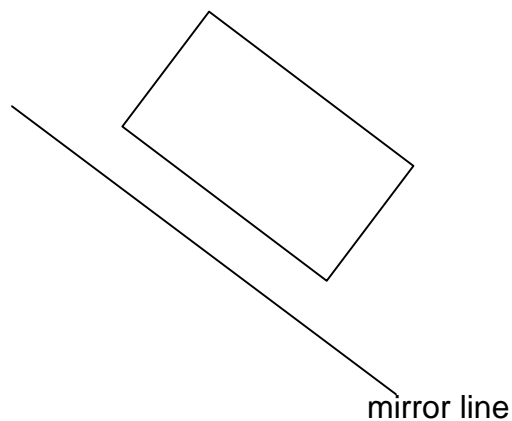
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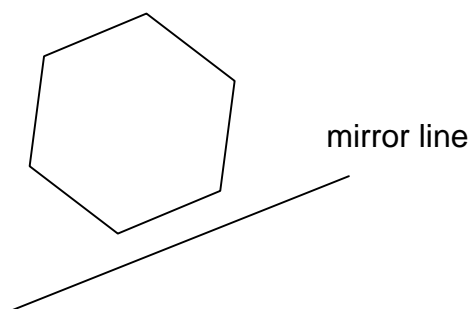
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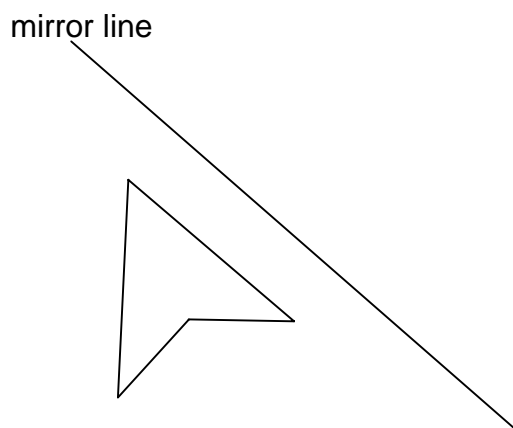
4.



5.



6.



My Mathematics

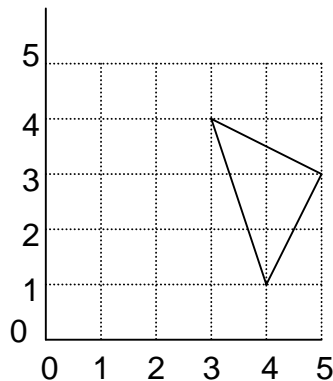
Translate this shape two squares to the left. And one square up. Write the co-ordinates for the original shape and the translated shape in the brackets provided.

Original shape

(,)

(,)

(,)



Translated shape

(,)

(,)

(,)

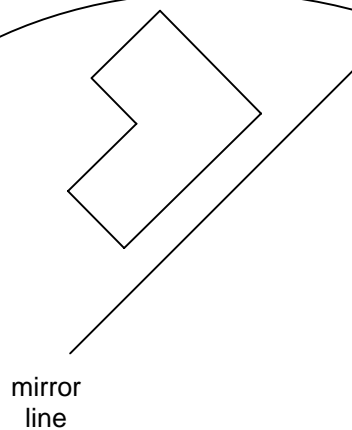
I did this:
on my own

☐

with some help

☐

Draw the reflection of the hexagon in the mirror line shown.



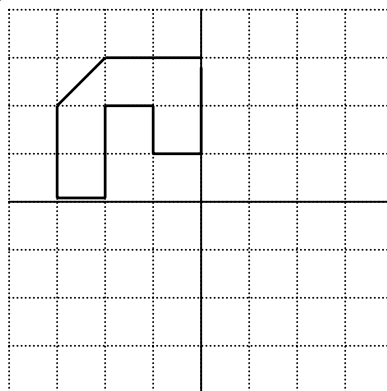
I did this:
on my own

☐

with some help

☐

Reflect this octagon in the horizontal and the vertical mirror lines to form a symmetrical pattern.



I did this:
on my own

☐

with some help

☐

Name: _____

I can improve my work on translation and reflection of shapes by:
