Unit 5
Shape and space

Five daily lessons

Year 4
Summer term

Unit Objectives
Year 4

- Sketch the reflection of a simple shape in a mirror line parallel to one side (all sides parallel or perpendicular to the mirror line).   Page 106

- Recognise positions and directions: for example, describe and find the position of a point on a grid of squares where the lines are numbered.   Page 108

- Recognise simple examples of horizontal and vertical lines.   Page 108

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:

- Resource sheet 5.1
- Activity sheet 5.1
- Activity sheet 5.2/OHT 5.6
- OHT 5.1
- OHT 5.2
- OHT 5.3
- OHT 5.4
- OHT 5.5
- OHT cm² grid
- Arrow cards
- Digit cards
- Whiteboards
- Large mirror
- Small mirrors
- Large symmetrical shape cut from paper
- Scissors
- A4 paper
- Overhead projector
- Squared paper
- Small shapes
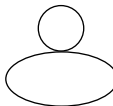- Display of repeating patterns, e.g. Islamic patterns, tiling patterns, brick patterns, wallpaper, etc.

Year 3

Link Objectives

Year 5

- **Identify and sketch lines of symmetry in simple shapes, and recognise shapes with no lines of symmetry.**

- Sketch the reflection of a simple shape in a mirror line along one edge.

- Read and begin to write the vocabulary related to position, direction and movement: for example, describe and find the position of a square on a grid of squares with the rows and columns labelled.

- Recognise reflective symmetry in regular polygons.

- Complete symmetrical patterns with two lines of symmetry at right angles.

- 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.

- Recognise positions and directions: read and plot co-ordinates in the first quadrant.

(Key objectives in bold)

Planning sheet	Day One	Unit 5 *Shape and space*		Term: *Summer*	Year Group: *4*

Oral and Mental		Main Teaching		Plenary
Objectives and Vocabulary	**Teaching Activities**	**Objectives and Vocabulary**	**Teaching Activities**	**Teaching Activities/Focus Questions**

Derive doubles of multiples of: whole numbers to 50; multiples of 10 to 500; multiples of 100 to 5000 and the corresponding halves.	• Write 4 on the board.
	
	Q What is 4×10? 40×10? 400×10?
	
	Record responses in columns and remind the children that digits move one place to the left when multiplying by 10.
	
	Q What is double 4? 40? 400?
	
	Record alongside the previous list:
	
	   4 8
	  40 80
	 400 800
	4000 8000
	
	Q What do you notice about the list of doubles?
	
	Establish that the original digit is unchanged and that double 4 is used to derive the other double facts. Use the list to establish that half of 8 is the fact used for all the other halves.
	
	• Repeat, starting with 32 and reinforce the patterns.
	
	Q What is double 26? So what is double 260? Double 2600?
	
	Q What is half of 46? 460? 4600?
	
	• Ask a variety of doubling and halving questions for children to show answers using arrow cards, e.g. double 350, half 8400, double 2700, half 72, etc.
		Identify lines of symmetry in 2-D shapes. Understand and use the associated vocabulary.
		
		VOCABULARY
		line of symmetry
		mirror line
		symmetrical
		reflect
		reflection
		
		RESOURCES
		Large symmetrical shape cut from paper
		Large mirror
		Small mirrors, one per group.
		Activity sheet 5.1
			• Remind the class that they learned about symmetrical shapes in year 3. Hold up a large symmetrical shape cut from paper such as:
			
			Q Where would I fold this shape so that one side would fit exactly over the other?
			
			Try out suggestions and establish the correct fold line.
			
			• Draw a picture similar to the shape on the board and ask a child to indicate where the fold line could be drawn. Draw in the line and remind the class that this line is called a line of symmetry, the line which divides the shape so that one half is a reflection of the other.
			
			• Illustrate by holding a large mirror along the line. Invite children in groups to come out and observe the reflection, whilst the remaining children make a list of symmetrical shapes they can see in the classroom. Discuss the observed reflection with each group and establish that the mirror image shows the covered half of the shape.
			
			Q How is the reflected half of the shape different from the other half?
			
			Establish that it is reversed. Illustrate by making a cross on one edge of the shape on the board. Ask the children to suggest where the cross should be placed on the reflected side of the shape. Draw it in the correct position.
			
			• Draw a shape in which more than one line of symmetry can be identified on the board.
			
			Q Where can a mirror line be drawn on this shape?
			
			Q Can you see any more lines of symmetry?
			
			Draw the lines then repeat with another shape. Establish that some shapes have more than one line of symmetry.
			
			• Draw a shape with no lines of symmetry, ask the children whether they can identify a mirror line and establish that some shapes are not symmetrical.
			
			• Give out Activity sheet 5.1. Ask the children to visualise then draw all the lines of symmetry they can find in each shape in question 1, then check by placing a mirror vertically on the line. Ask them to complete the shapes in question 2 by drawing their reflections through the mirror lines.
				• Discuss the activity and clarify any misconceptions.
				
				Q Which shapes had only one line of symmetry?
				
				Q Which had more than one?
				
				Q Which shapes are not symmetrical?
				
				• Record the letters of the appropriate shapes under headings, e.g. one line of symmetry, on the board. Discuss, and if necessary model, the number of lines of symmetry on a square and a star.
				
				• Ask the children to give examples of shapes in the classroom which are symmetrical. Add these to the lists. Ask the children to explain or indicate where lines of symmetry could be drawn on them.
				
				By the end of the lesson the children should be able to:
				• **Use the vocabulary associated with symmetry;**
				• **Identify and sketch two or more lines of symmetry;**
				• **Recognise shapes with no lines of symmetry.**
				
				(Refer to supplement of examples, section 6, page 106.)

VOCABULARY double half RESOURCES Arrow cards				

Planning sheet	Day Two	Unit 5 *Shape and space*	Term: *Summer*	Year Group: *4*

Oral and Mental

Objectives and Vocabulary	Teaching Activities
Read and write whole numbers to 10 000 in figures and words and know what each digit represents. Round any positive integer less then 1000 to the nearest 10 or 100.	• Write a four-digit number on the board and ask the class to read it aloud together on your signal. Point to individual digits and ask them to say what they represent, e.g. in 7428, the 2 is 20, etc. Repeat with four or five further four-digit numbers, including some containing a zero. • Ask the children in pairs to order the numbers, smallest to largest. Take feedback and record in a vertical list on the board, emphasising how the digits are compared from the left of the numbers, since these have the greatest place value. • Remind the class about the rules for rounding numbers. Indicate the first number in the ordered numbers on the board. **Q** What is this number when rounded to the nearest 10? The nearest 100? Record each alongside the first number on the board. • Ask the children to round the other numbers to the nearest 10 and then the nearest 100. Take feedback and model on the board.

VOCABULARY
place value
round

Main Teaching

Objectives and Vocabulary	Teaching Activities
Classify 2-D shapes according to their lines of symmetry.	• Remind the class that in the previous lesson they identified lines of symmetry in shapes. Draw a square on the board and ask a child to come out and draw one line of symmetry. **Q** Why is this a line of symmetry? Establish that a line of symmetry divides a shape in half so that one half is a mirror image, or reflection, of the other. • Repeat with three further squares on the board, asking the children to draw a line of symmetry in a different position. Emphasise the different positions of the lines; horizontal, vertical and diagonal. • Ask the children to draw a triangle, quadrilateral and pentagon. Explain that the shape need not be regular and draw examples of irregular shapes on the board to illustrate. Ask them to cut out their shapes very carefully along the edges. • Give out a set of symmetrical paper shapes to each group, e.g. cut out from Resource sheet 5.1. Ask the group to use these and the shapes they made themselves and to sort them into three sets according to their symmetry; none, one or more than one line of symmetry. Explain that they can check by drawing lines of symmetry, by using a mirror or by folding the shapes. Discuss the checking methods with groups as they work and reinforce the teaching points made earlier and the associated vocabulary. • Extend the activity by asking the groups to subdivide the set with more than one line of symmetry according to their own criteria.

VOCABULARY
line of symmetry
symmetrical
mirror line
reflection
horizontal
vertical
diagonal
quadrilateral
pentagon

RESOURCES
A4 paper
Rulers
Scissors
Mirrors
Overhead projector
Resource sheet 5.1
OHT 5.1

Plenary

| Teaching Activities/Focus Questions |
|---|
| • Ask the children to explain the criteria they used for sorting the shapes with more than one line of symmetry and to hold up a shape that each set contained.

  Q Do all squares have four lines of symmetry?

  Q What about rectangles? Circles?

Through questioning and discussion, establish that all rectangles have two lines of symmetry, that squares have four and circles have an infinite number.

• Use OHT 5.1. Ask a child to choose one shape and place it in the appropriate section of the diagram. Continue, using other shapes.

By the end of the lesson the children should be able to:

• **Identify two or more lines of symmetry in 2-D shapes;**
• **Sort shapes according to their lines of symmetry.**

(Refer to supplement of examples, section 6, page 106.) |

Planning sheet	Day Three	Unit 5 *Shape and space*		Term: *Summer*	Year Group: *4*

Oral and Mental		Main Teaching		Plenary
Objectives and Vocabulary	**Teaching Activities**	**Objectives and Vocabulary**	**Teaching Activities**	**Teaching Activities/Focus Questions**
Recall multiplication facts in × 2, × 3, × 4, × 5, × 10 tables and of multiples of 10. Multiply TU by U mentally.	• Ask quick questions to revise multiplication facts, using associated vocabulary, e.g. What are 8 threes? What is the product of 7 and 5? What is 5 times 30? • Write 14×3 on the board. > **Q** How can we use the multiplication facts we know to work this out? Establish the use of 10×3 and 4×3. Repeat with 16×5 and 26×3. • Ask a variety of TU × U questions using known facts. The children work in pairs with digit cards or whiteboards, one showing the multiple of the 10s, the other showing the multiple of the units. Ask the children to give the complete answer orally. • Ask further questions for the children to work individually giving the complete answer.	Sketch the reflection of a simple shape or pattern where the sides of the shape do not touch the mirror line (lines all parallel or perpendicular to the mirror line). Know that equivalent points are the same distance from the line of symmetry. Revise the use of co-ordinates.	• Display shape 1 on OHT 5.2. Explain that the dotted line represents a mirror. Point out that the shape does not touch the mirror. Ask a child to come up and indicate where the reflection of the shape should be placed. Draw the reflection and emphasise that it is the same distance away from the mirror line as the original shape on the other side of the line. Remind the children that a reflected shape is the same size as the original but flipped over, or reversed. • Repeat with shapes 2 and 3 on the OHT. • Mark a cross in one of the squares to the right of the first mirror line. The cross should not touch the line. > **Q** How many squares to the left of the line will the reflection of the cross be? Establish that the reflection will be the same number of squares from the line as the original cross. Ask a child to draw its reflection. Repeat with other marks for the children to reflect in the different mirror lines. • Show OHT 5.3 and repeat. Then show OHT 5.4. When the children have difficulty in positioning the reflection in 2, rotate the OHT so that the mirror line is horizontal or vertical to help them, then return it to its original position to view the completed reflection. • Hand out squared paper with mirror lines drawn on them, suitably spaced for the activity described below. Ask the children to work in pairs. They each draw a shape or pattern on one side of each mirror line. The shapes/patterns must not touch the line. The children swap with a partner, then draw the reflections of their partner's shapes or patterns.	• Discuss the paired activity and clarify any misconceptions. • Display OHT 5.5. Remind the class how to use co-ordinates to describe position. Ask the children to record the co-ordinates of the reflection of the shape. • Take feedback and draw the reflection according to the agreed co-ordinates. HOMEWORK – Make a pattern on squared paper on one side of a mirror line by colouring squares, then draw its reflection. --- **By the end of the lesson the children should be able to:** • **Sketch the reflection of simple shapes or patterns in mirror lines;** • **Use co-ordinates to describe position.** (Refer to supplement of examples, section 6, page 106.)
VOCABULARY times multiplied by multiple product RESOURCES Digit cards or whiteboards		VOCABULARY mirror Line line of symmetry reflection co-ordinates RESOURCES OHT 5.2 OHT 5.3 OHT 5.4 OHT 5.5 Squared paper with spaced mirror lines		

Planning sheet	**Day Four**		**Unit 5** *Shape and space*	**Term:** *Summer*	**Year Group:** *4*

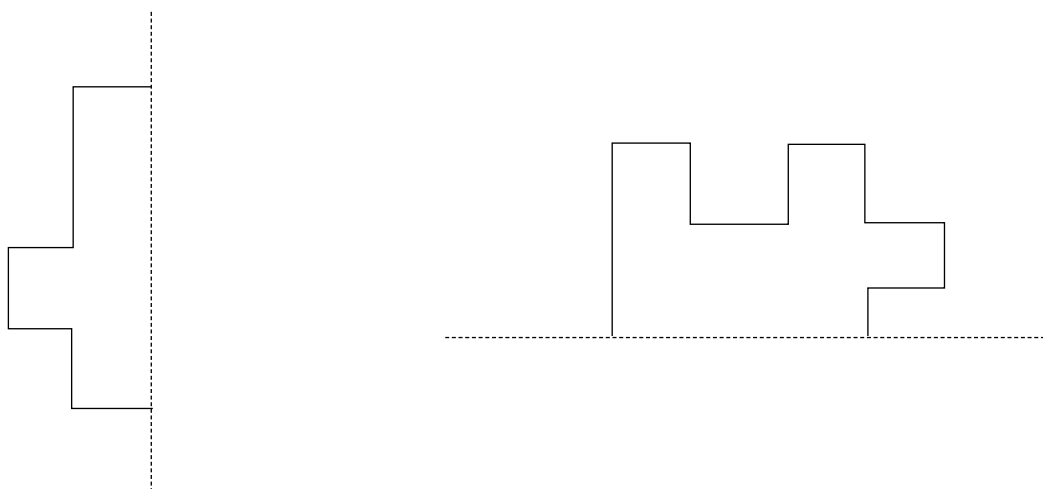| **Oral and Mental**		**Main Teaching**		**Plenary**
Objectives and Vocabulary	**Teaching Activities**	**Objectives and Vocabulary**	**Teaching Activities**	**Teaching Activities/Focus Questions**
Derive quickly pairs of numbers that total 100. Add/subtract a pair of two-digit numbers.	• Ask the children to show the number which makes a total of 100 when added to 82, using whiteboards or digit cards. Write 82 + 18 = 100 on the board and remind the class that when numbers total 100, the units total 10 and the 10s total 90. • Ask the children to work with a partner. They each hold up a two-digit number which together total 100. • Give any pair of two-digit numbers and ask the children to show the total. Record the equation and ask the children to explain the strategies they used to find the answer. • Give a target number. Ask the children and partners to show a pair of numbers which have the target number as their total. • Discuss and record some of the pairs. Repeat with other target numbers.	Make patterns by repeatedly translating or reflecting shapes. Know that rows on a grid are described as horizontal, columns as vertical.	• Place a shape on a grid on the OHP. Slide it to the right in a straight line. ┌─────────────────────────────────────┐ │ **Q** How has this shape been moved? │ └─────────────────────────────────────┘ • Encourage different descriptions and establish that the shape has moved in a horizontal straight line to the right. Repeat, sliding the shape in straight lines to the left horizontally, and up and down vertically. • Explain to the class that when a shape is moved in a straight line, the movement is called a translation. Ask the children to come up and move the shape according to your instructions, e.g. translate the shape upwards vertically. ┌──┐ │ **Q** Can you think of another way to move a shape which is not a translation? │ └──┘ Discuss suggestions and establish that reflection is a different type of movement. (If rotation is suggested, agree and discuss, but don't dwell on it in this unit). Demonstrate reflecting the shape in different ways on the OHP. • Make a pattern of shapes on the OHP which involves translation, e.g. a row of identical triangles, or a row of triangles, circles, triangles, etc. Ask the children to describe it using 'translated'. Repeat with a pattern in which a shape is repeatedly reflected. ┌──┐ │ **Q** What happens when a shape is translated? Reflected? │ └──┘ Emphasise that translation and reflection only change the position of the shapes, their size and shape remain the same. The same shape appears in reverse when reflected. • Look at one of the repeating patterns on display. Ask the children to describe the basic pattern and how it repeats. Prompt them to use appropriate vocabulary. • Ask the children to make their own patterns which involve repeated translation and/or reflection. Provide squared paper and explain that their patterns will be displayed in the plenary. • At an appropriate time use a computer program to create and reflect patterns and tiles.	• Ask a volunteer to come out and hold up their pattern. Ask other children to describe how the pattern is repeated. • Repeat with other children. • If possible, display all the children's patterns in the classroom after the lesson. ┌──────────────────────────────────┐ │ **By the end of the lesson the children should be able to:** │ │ • **Understand and use the terms horizontal, vertical, translation and reflections;** │ • **Make and describe repeating patterns which involve translation or reflection.** │ │ (Refer to supplement of examples, section 6, pages 106 and 108.) │ └──────────────────────────────────┘
VOCABULARY total digit RESOURCES Digit cards or whiteboards		VOCABULARY movement repeating pattern reflection translation horizontal vertical RESOURCES OHP OHT cm² grid Small shapes, e.g. circles, letter shapes, triangles, etc. Squared paper Examples of repeating patterns on display, e.g. Islamic patterns, brick patterns, tiling patterns, wallpaper, etc.		

Planning sheet	Day Five	Unit 5 *Shape and space*		Term: *Summer*	Year Group: *4*

| Oral and Mental		Main Teaching		Plenary
Objectives and Vocabulary	**Teaching Activities**	**Objectives and Vocabulary**	**Teaching Activities**	**Teaching Activities/Focus Questions**
Use knowledge of multiplication and division.	• Write 24 on the board. Ask the children to suggest all the different multiplication and division facts they can which have 24 as the answer. Write the facts in a list or around 24 as a web. ┌─────────────────────────┐ │ **Q** What other facts about 24 can we write from those on the board? │ └─────────────────────────┘ Encourage the use of doubling and halving, e.g. from 6×4 derive 12×2, from $48 \div 2$ derive $96 \div 4$, etc. Record all correct suggestions. • Give another target, e.g. 36, and ask the children to record all the facts they can for the target, using multiplication and division, doubling and halving.	Use co-ordinates to describe position. Translate and reflect shapes.	• Review the homework set on day 3. Ask volunteers to display their work and to indicate squares at random for other children to identify in the reflection. • Show OHT 5.6. Use the triangle on the lower part of the OHT cut from thin card. Place the triangle so that its corners exactly match intersections on the grid. Ask the children to identify the co-ordinates of the vertices. Record them on board, e.g. (2,3) (4,7) (4,3). ┌─────────────────────────┐ │ **Q** If I translate the triangle 2 squares to the right what will the new co-ordinates be? │ └─────────────────────────┘ Discuss, record agreed co-ordinates on the board, then move the shape to demonstrate that they are correct. Repeat with one or two other translations. ┌─────────────────────────┐ │ **Q** If I flip the shape over its vertical side, what will the new co-ordinates be? │ └─────────────────────────┘ Discuss, record co-ordinates and reflect the shape to check. ┌─────────────────────────┐ │ **Q** How else do we describe a 'flipping' movement? │ └─────────────────────────┘ Establish that it is a reflection. Reflect the shape through different sides and repeat the identification and recording of co-ordinates. • Ask the children to work in pairs. Pupils need two copies of Activity sheet 5.2. Each child draws a shape on a numbered grid, then translates it and reflects it and draws the shape in the new positions. They take turns to describe the original position of the shape using co-ordinates. Their partner records the co-ordinates, plots them on another numbered grid and joins the points to make the shape. Each child describes to their partner how they translated and then reflected their shape. The partner draws the translation and reflection on their grid. Finally, they compare drawings.	• Ask questions to review the main teaching points and vocabulary covered in the unit, e.g. ┌─────────────────────────┐ │ **Q** What do we call the movement of a shape in a straight line? │ └─────────────────────────┘ ┌─────────────────────────┐ │ **Q** What does a letter P look like when it is reflected in a horizontal mirror line? │ └─────────────────────────┘ ┌─────────────────────────┐ │ **Q** What are the co-ordinates of a point which is 2 squares to the right of (6,3)? 3 squares vertically below (7,2)? │ └─────────────────────────┘ ┌─────────────────────────┐ │ **Q** How many lines of symmetry can be drawn on a rectangle? An equilateral triangle? │ └─────────────────────────┘ Write examples of symmetrical capital letters, etc. Children could record their answers if required for assessment. ┌─────────────────────────┐ │ **By the end of the lesson the children should be able to:** • **Translate and reflect shapes;** • **Describe position on a grid using co ordinates.** (Refer to supplement of examples, section 6, pages 106 and 108.) │ └─────────────────────────┘
VOCABULARY multiplication division doubling halving		VOCABULARY co-ordinates translate reflect horizontal vertical RESOURCES OHT 5.6 Activity sheet 5.2		

Lines of Symmetry

1. Use a ruler to draw all the lines of symmetry you can on each shape, then check with a mirror.

A

B

C

D

E

F

G

H
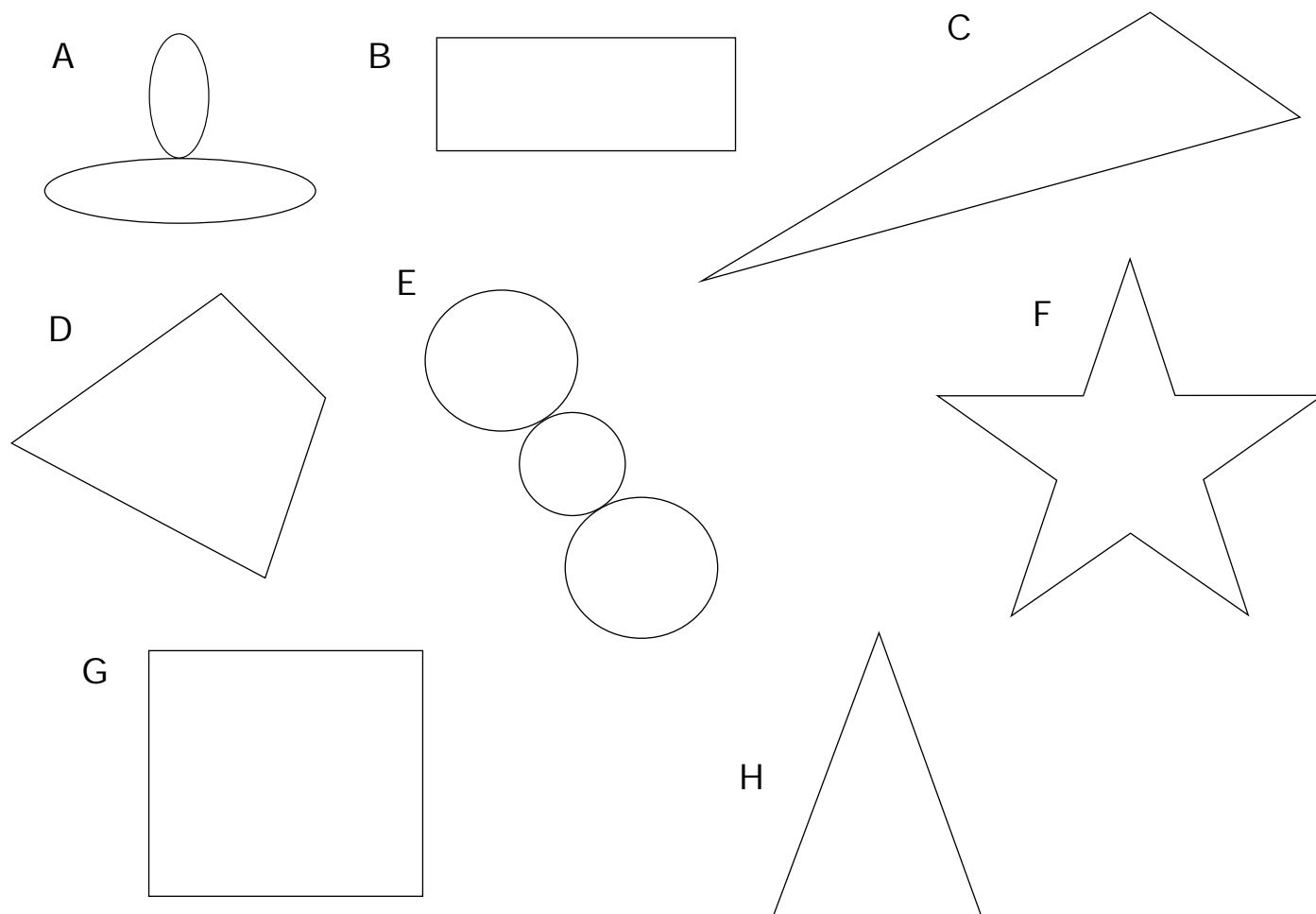
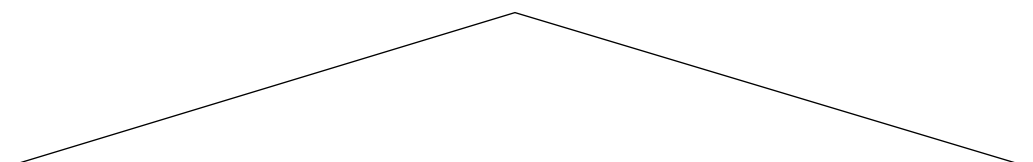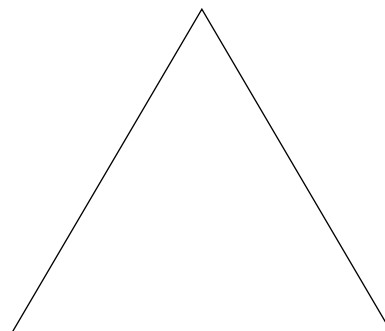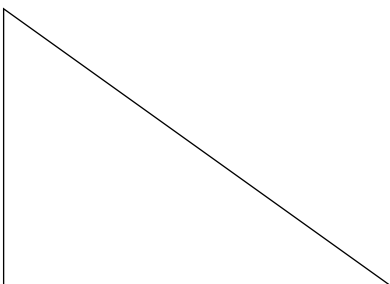2. Draw the reflection of each shape on the other side of the dotted mirror line.

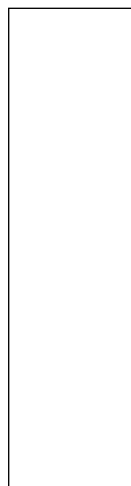# Numbered Grid

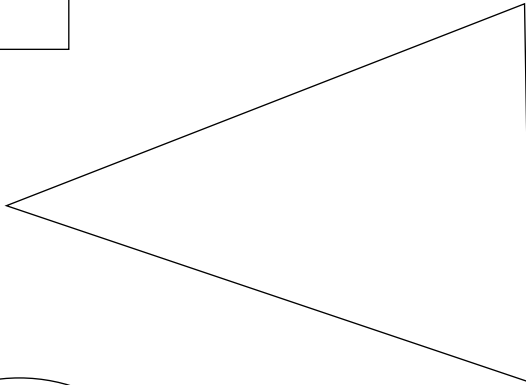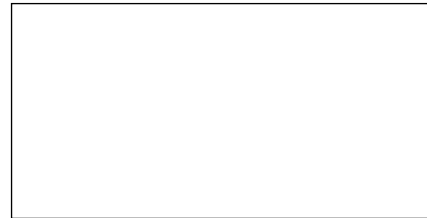| 12 |
| 11 |
| 10 |
| 9 |
| 8 |
| 7 |
| 6 |
| 5 |
| 4 |
| 3 |
| 2 |
| 1 |
| 0   1   2   3   4   5   6   7   8   9   10   11   12 |
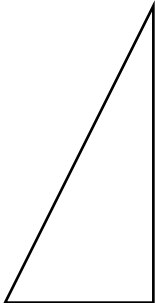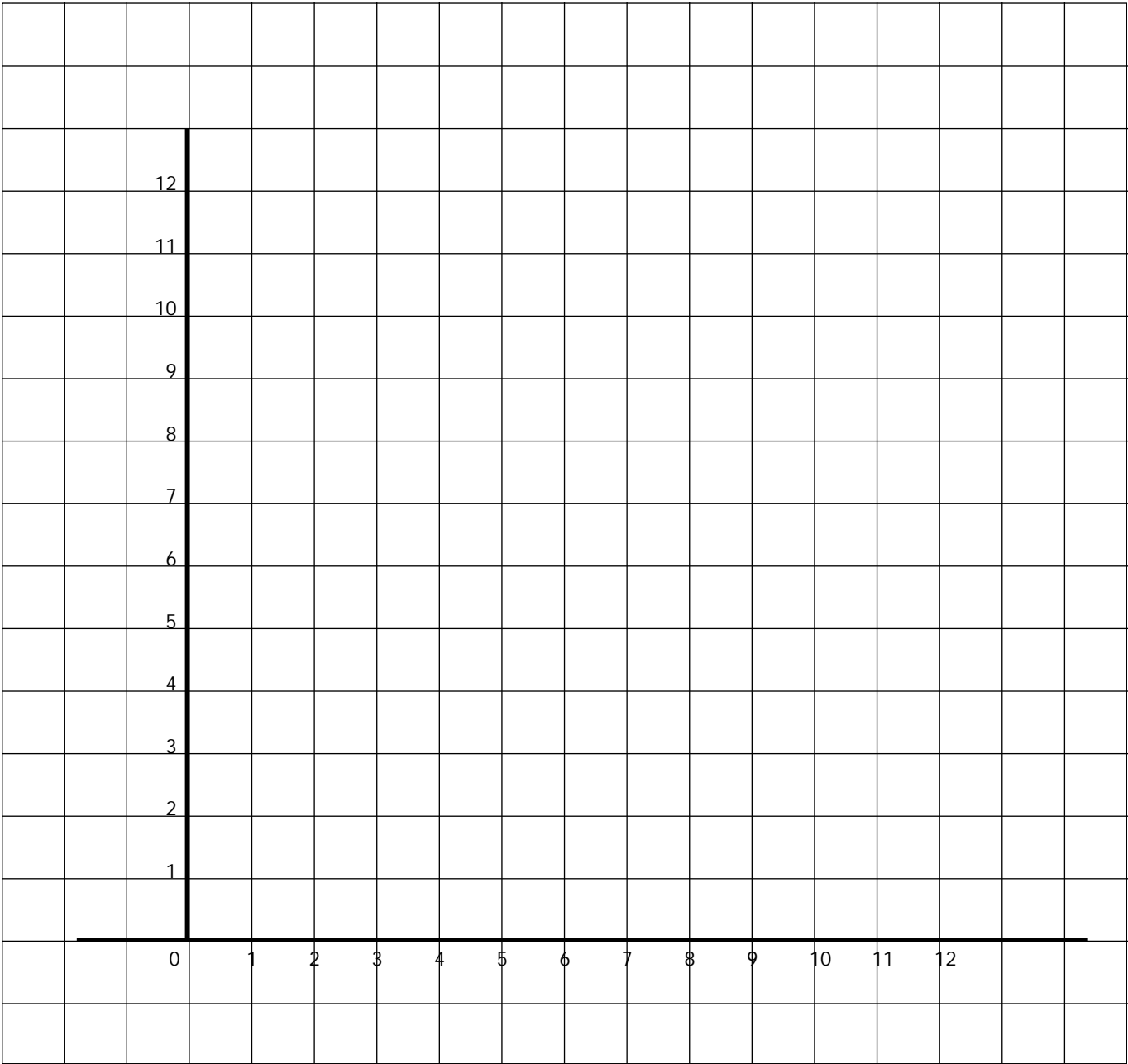
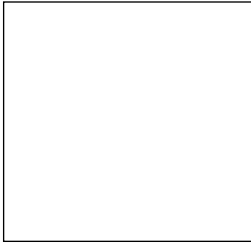## Symmetrical Shapes
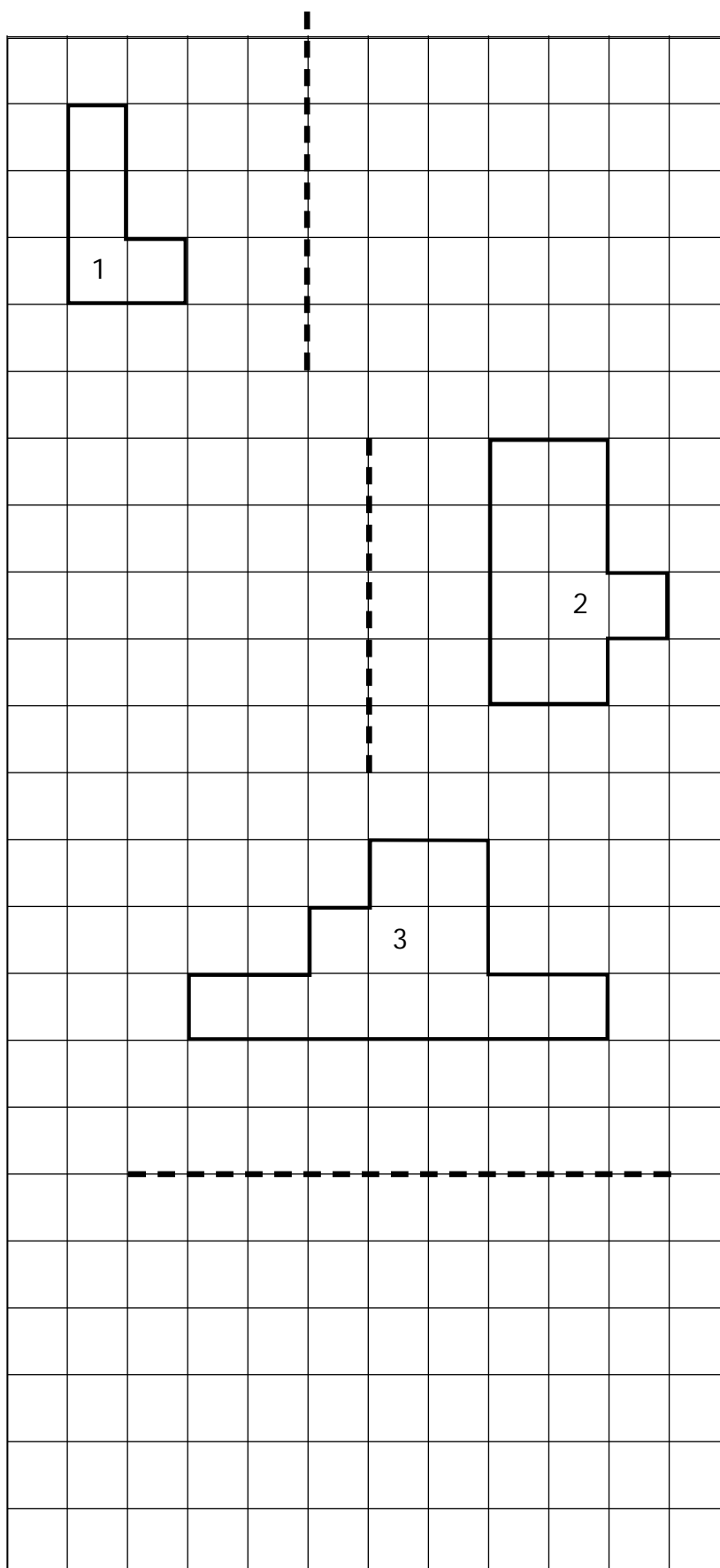
To be copied and cut out for children to sort, one set of shapes per group
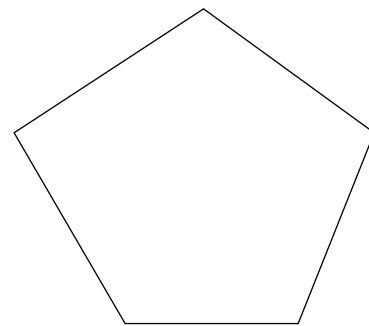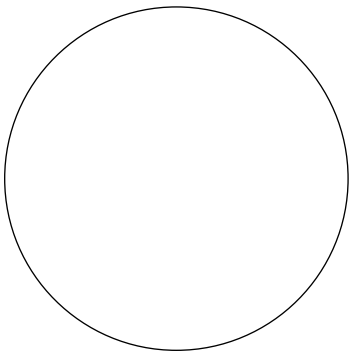
Sorting Diagram

Shapes with no lines of symmetry	
Shapes with at least one line of symmetry	

Reflections in a Mirror line

Reflections

1

					X		O		X		O						
				X		O		X		O		X					
				O		X		O		X		O					

2

Using Co-ordinates