

Unit 5 part 2

Rotations and reflections

Three daily lessons

National
Numeracy Strategy

Year 6
Spring term

Unit Objectives Year 6

- Recognise where a shape will be after a rotation through 90° about one of its vertices.
- 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 mirror line).

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Link Objectives

Year 5

- 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).
- Complete symmetrical patterns with two lines of symmetry at right angles (using squared paper or pegboard).

Year 7

- Understand and use the language and notation associated with reflections, translations and rotations.
- Recognise and visualise the transformation and symmetry of a 2D shape:
 - reflection in given mirror lines, and line symmetry;
 - rotation about a given point, and rotation symmetry;
 - translation.

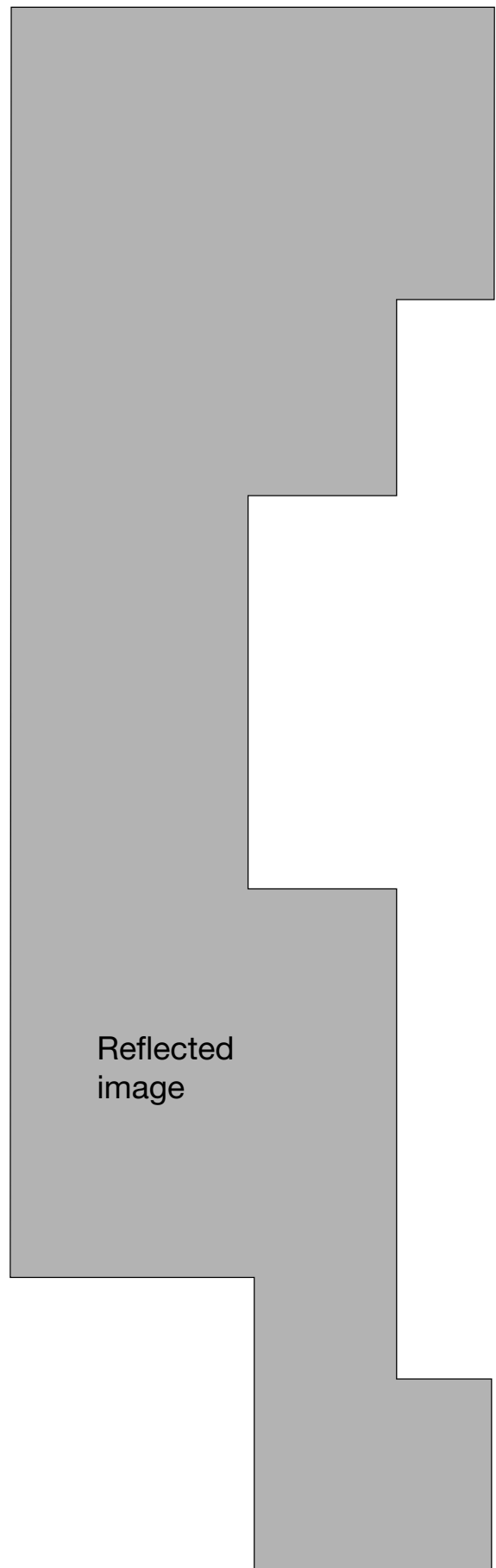
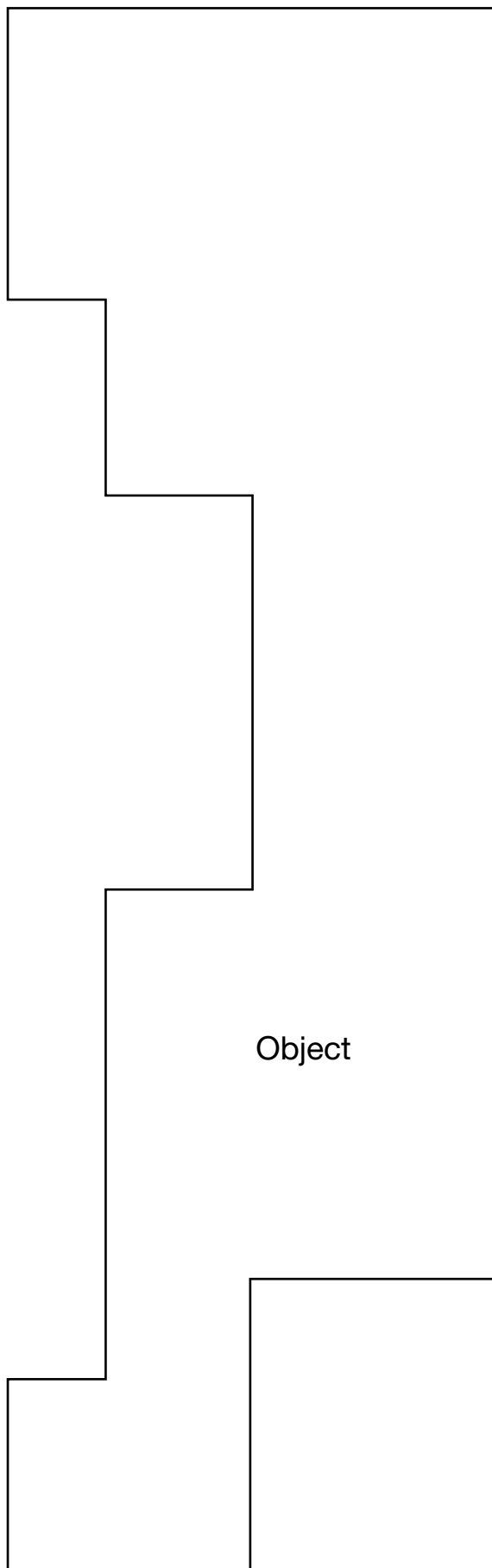
This Unit Plan is designed to guide your teaching.

You will need to adapt it to meet the needs of your class.

Resources needed to teach this unit:

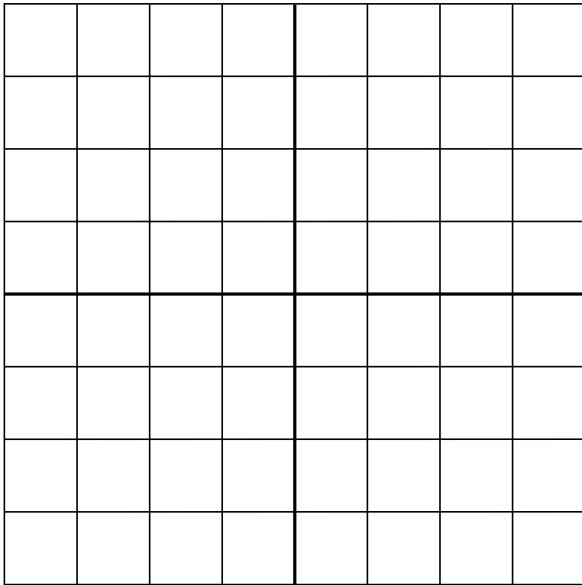
- Resource sheet 5pt.2.1
- Resource sheet 5pt.2.2
- Resource sheet 5pt.2.3
- Activity sheet 5pt.2.1
- Activity sheet 5pt.2.2
- Activity sheet 5pt.2.3
- OHT 5pt.2.1
- OHT 5pt.2.2
- OHT 5pt.2.3
- OHT 5pt.2.4
- OHT 5pt.2.5
- OHT 5pt.2.6
- OHT 5pt.2.7
- Squared paper
- Tracing paper
- Related Key Stage 2 national test questions

department for
education and skills

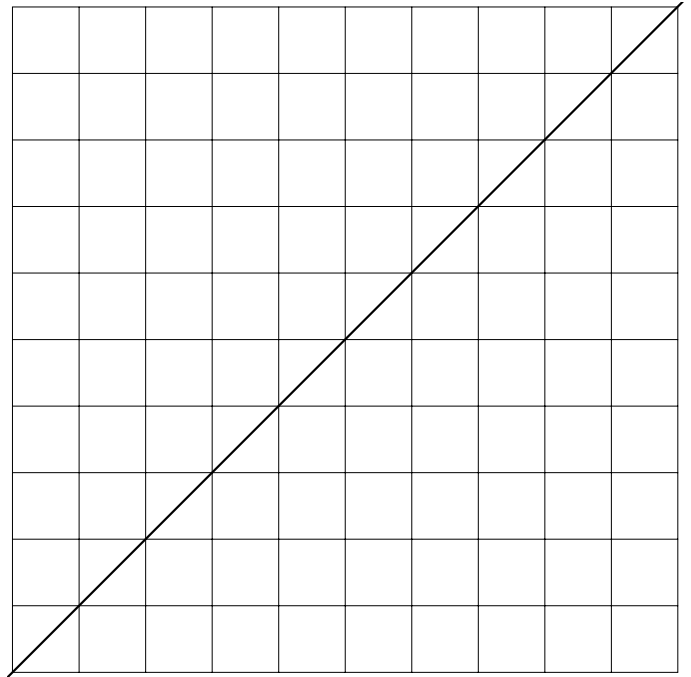


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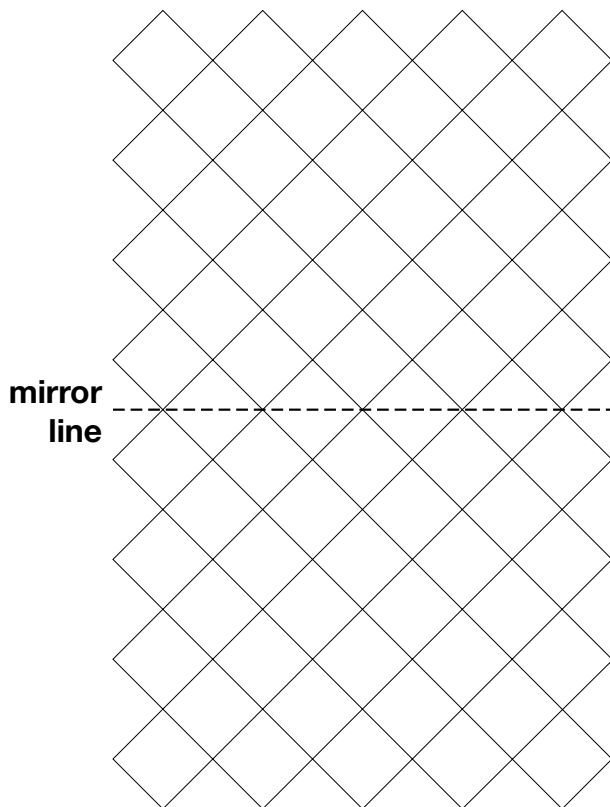
mirror line



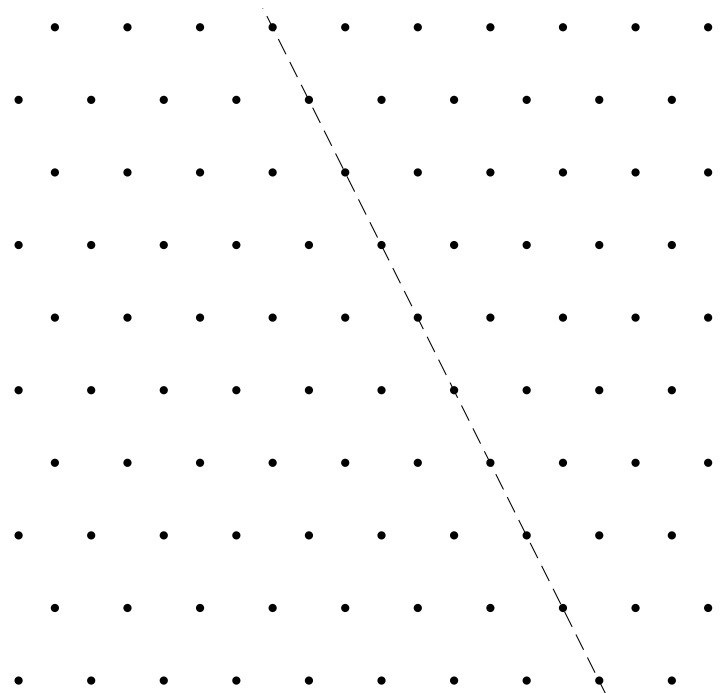
mirror
line



mirror
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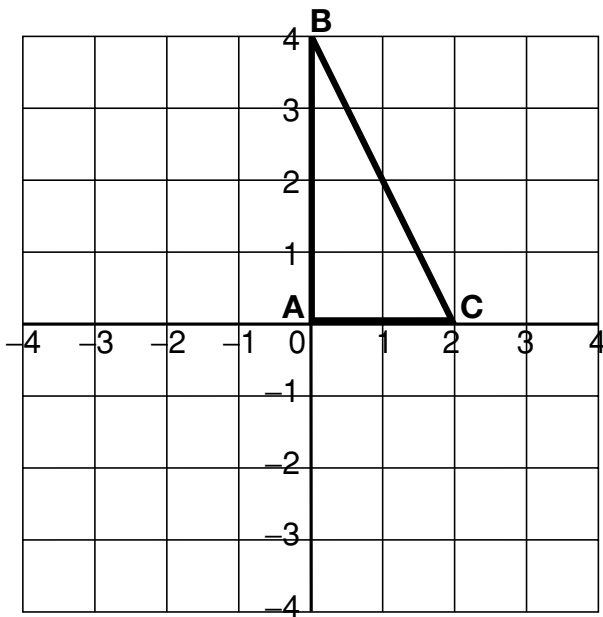


mirror
line



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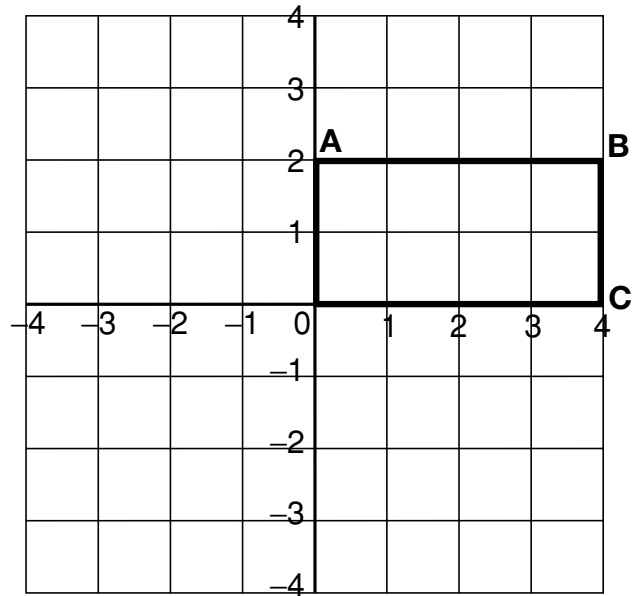
Using the origin as the centre of rotation, rotate the shape through (i) 90° clockwise, (ii) 90° anticlockwise and (iii) 180° . Draw the new rotated shape using pencil and ruler. Write the new coordinates for the points identified by letters.



(i) A → B → C →

(ii) A → B → C →

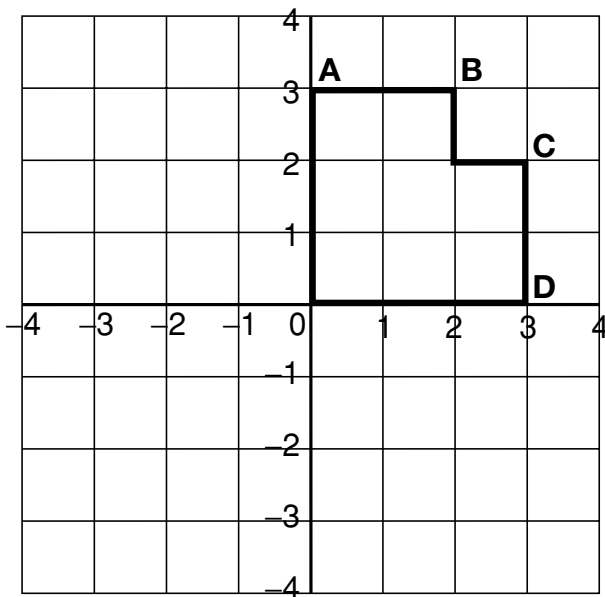
(iii) A → B → C →



(i) A → B → C →

(ii) A → B → C →

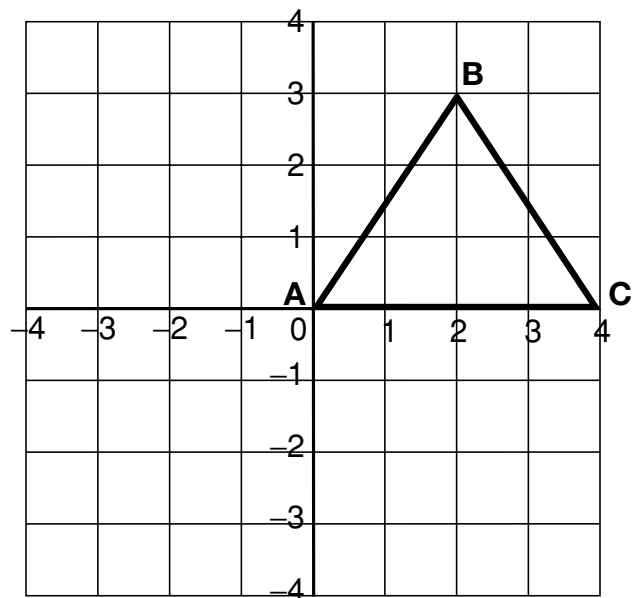
(iii) A → B → C →



(i) A → B → C → D →

(ii) A → B → C → D →

(iii) A → B → C → D →



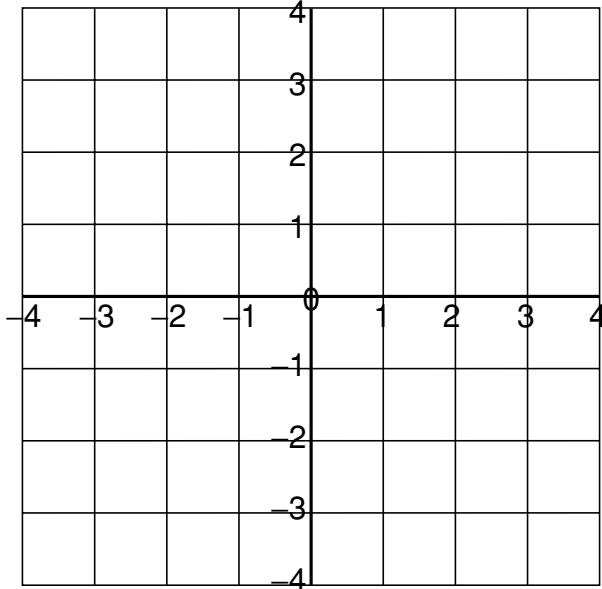
(i) A → B → C →

(ii) A → B → C →

(iii) A → B → C →

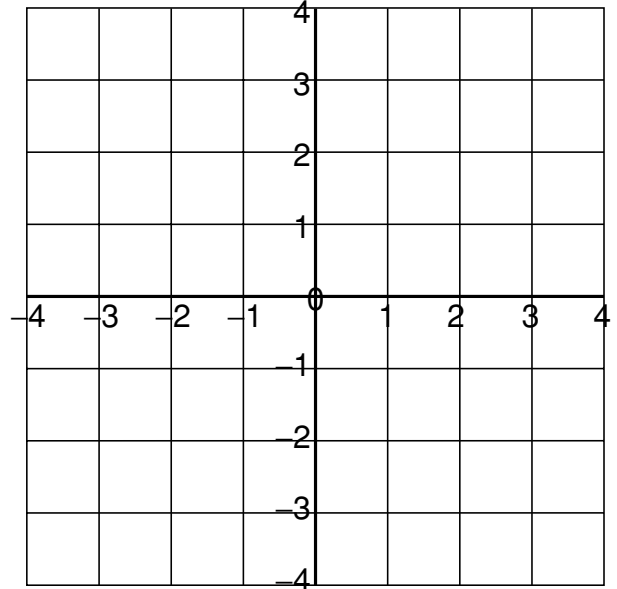
Draw the shapes described and label three of the points A, B and C. Rotate the shapes (i) 90° clockwise, (ii) 90° anticlockwise and (iii) 180° about the origin. Draw the new rotated shape using a pencil and ruler, and write the coordinates for the new positions of A, B, C.

1. Draw a rectangle with one corner at the origin.



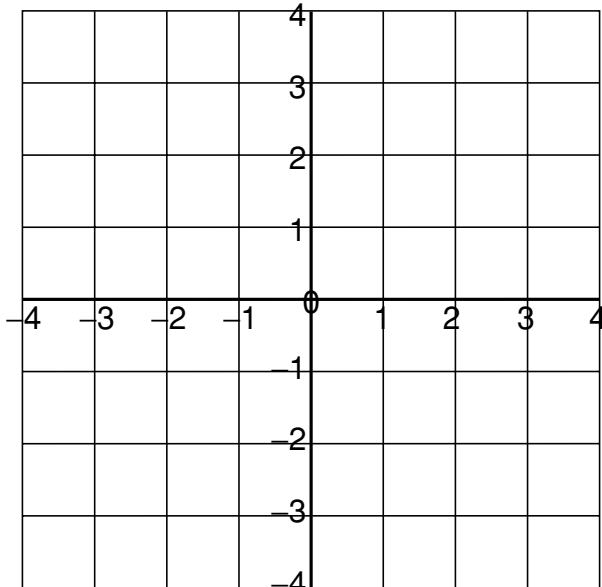
- (i) A → B → C →
 (ii) A → B → C →
 (iii) A → B → C →

2. Draw a parallelogram with one corner at the origin.



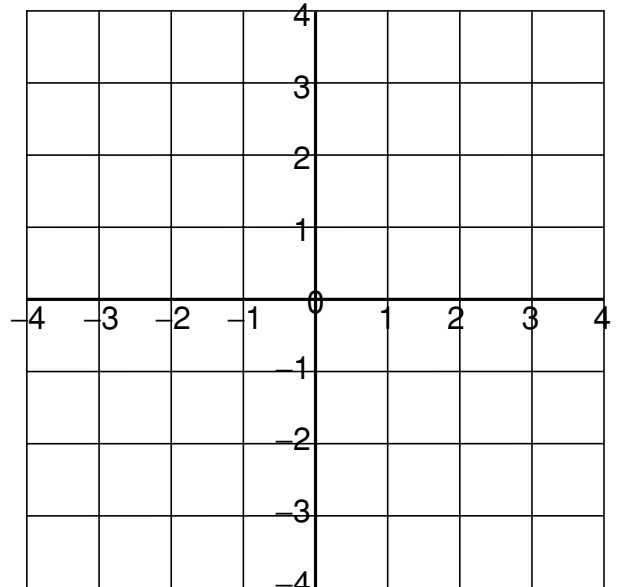
- (i) A → B → C →
 (ii) A → B → C →
 (iii) A → B → C →

3. Draw a trapezium, with one corner at the origin.



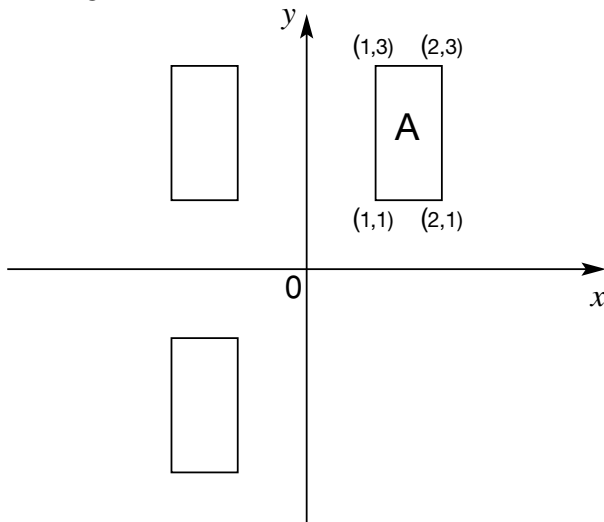
- (i) A → B → C →
 (ii) A → B → C →
 (iii) A → B → C →

4. Draw a triangle which has none of its corners at the origin.

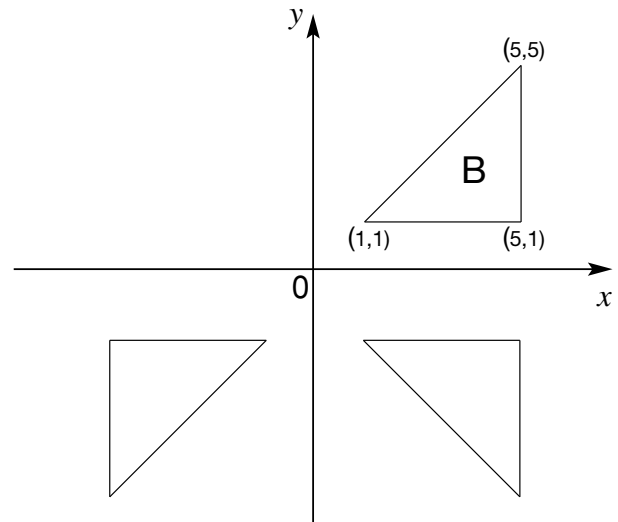


- (i) A → B → C →
 (ii) A → B → C →
 (iii) A → B → C →

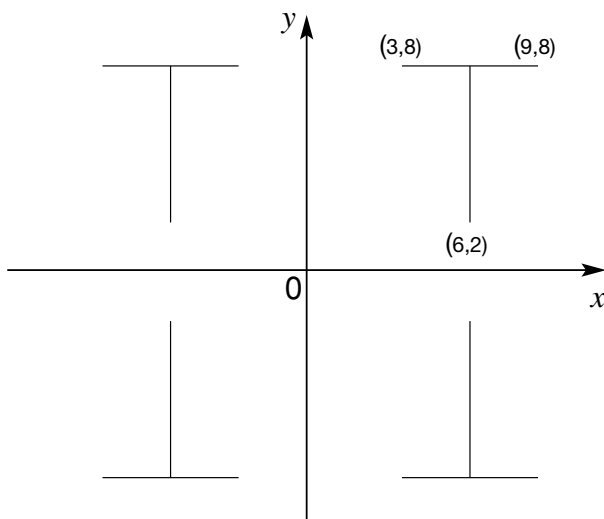
1. Rectangle A is reflected in the y-axis and then the x-axis. Write down the coordinates of the two rectangles.



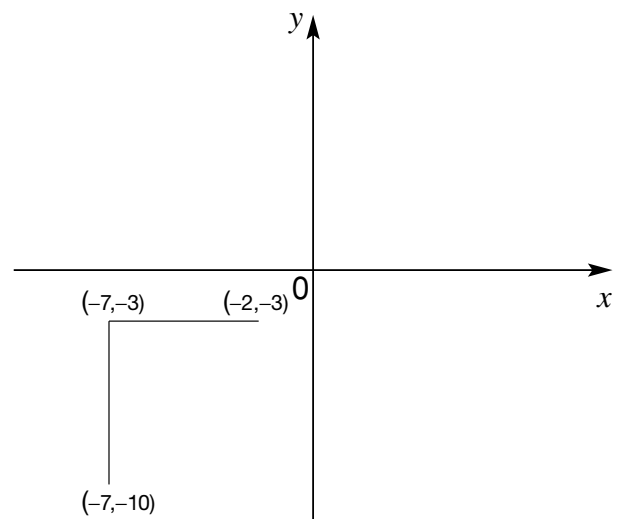
2. Triangle B has been reflected in the x-axis and then the y-axis. Write down the coordinates of the two triangles.



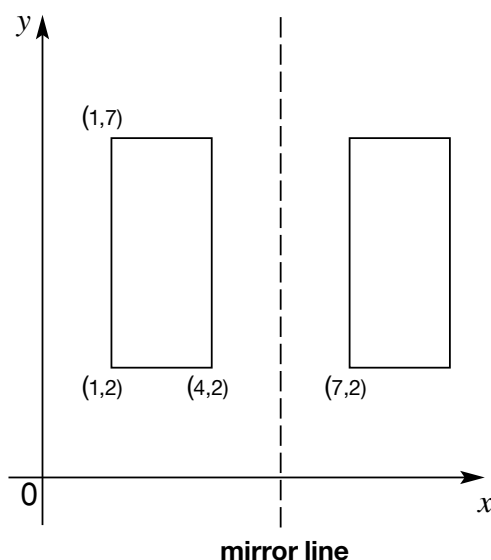
3. The T-shape has been reflected in both axes. Write down the coordinates of each T-shape.



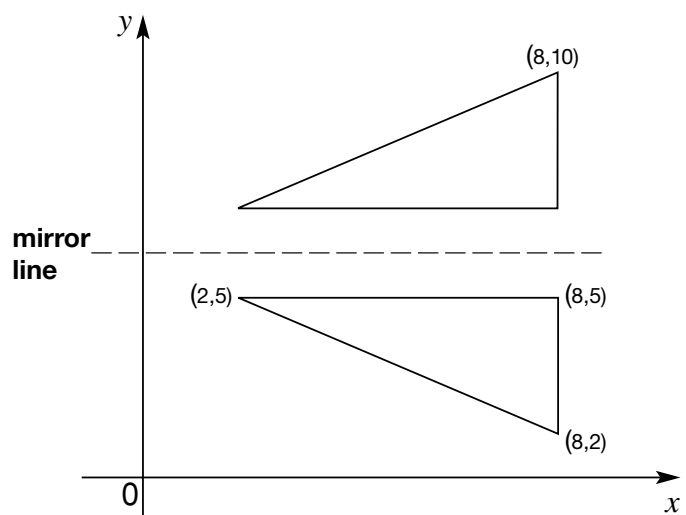
4. Reflect the L-shape in the x-axis and the y-axis. Draw the reflections and add the coordinates.

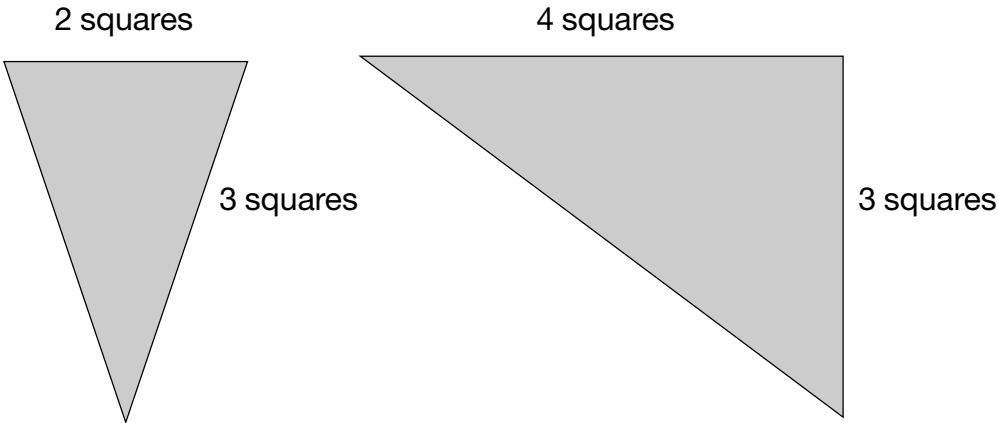
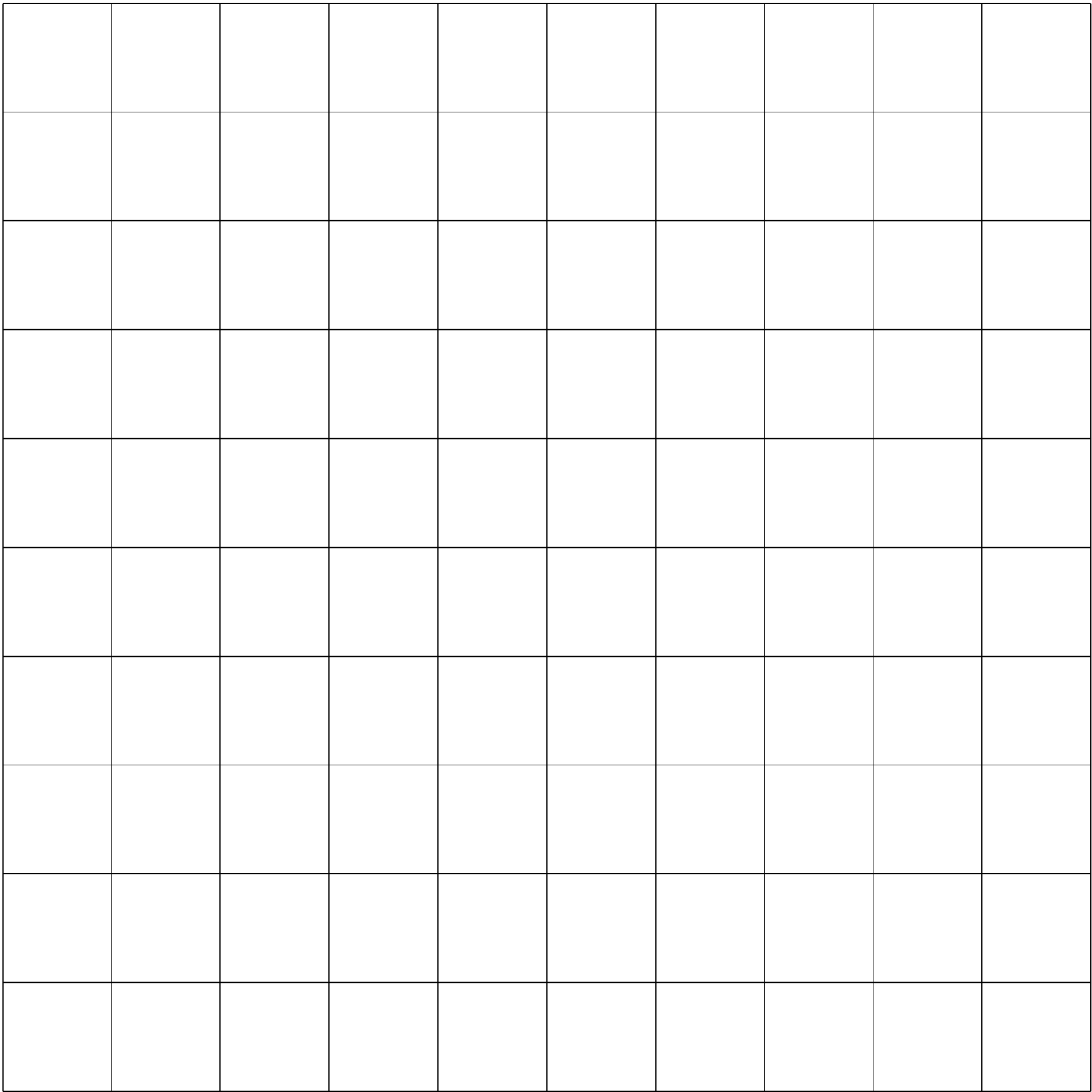


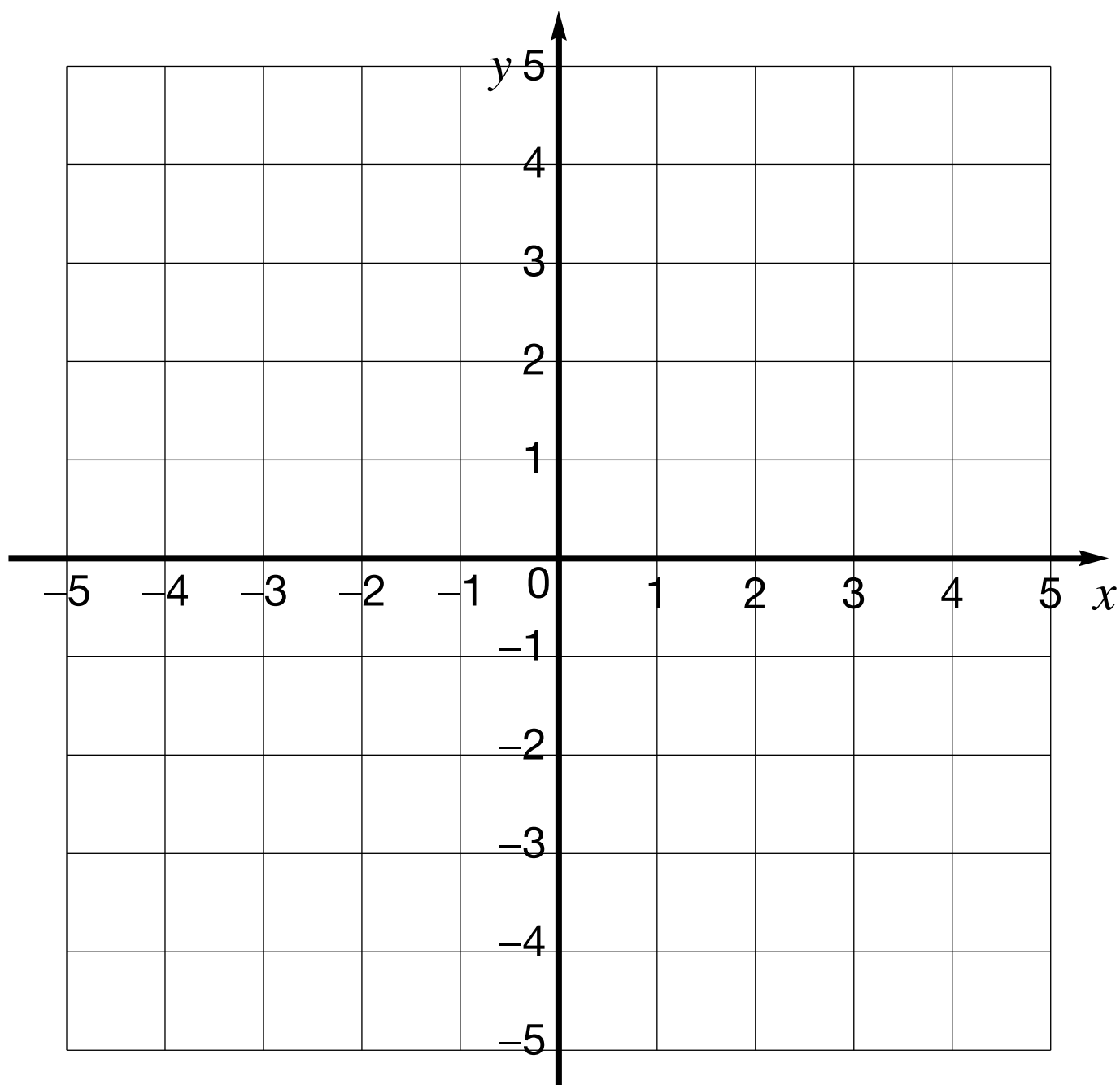
5. The rectangle has been reflected in the mirror line. Write down the missing coordinates.

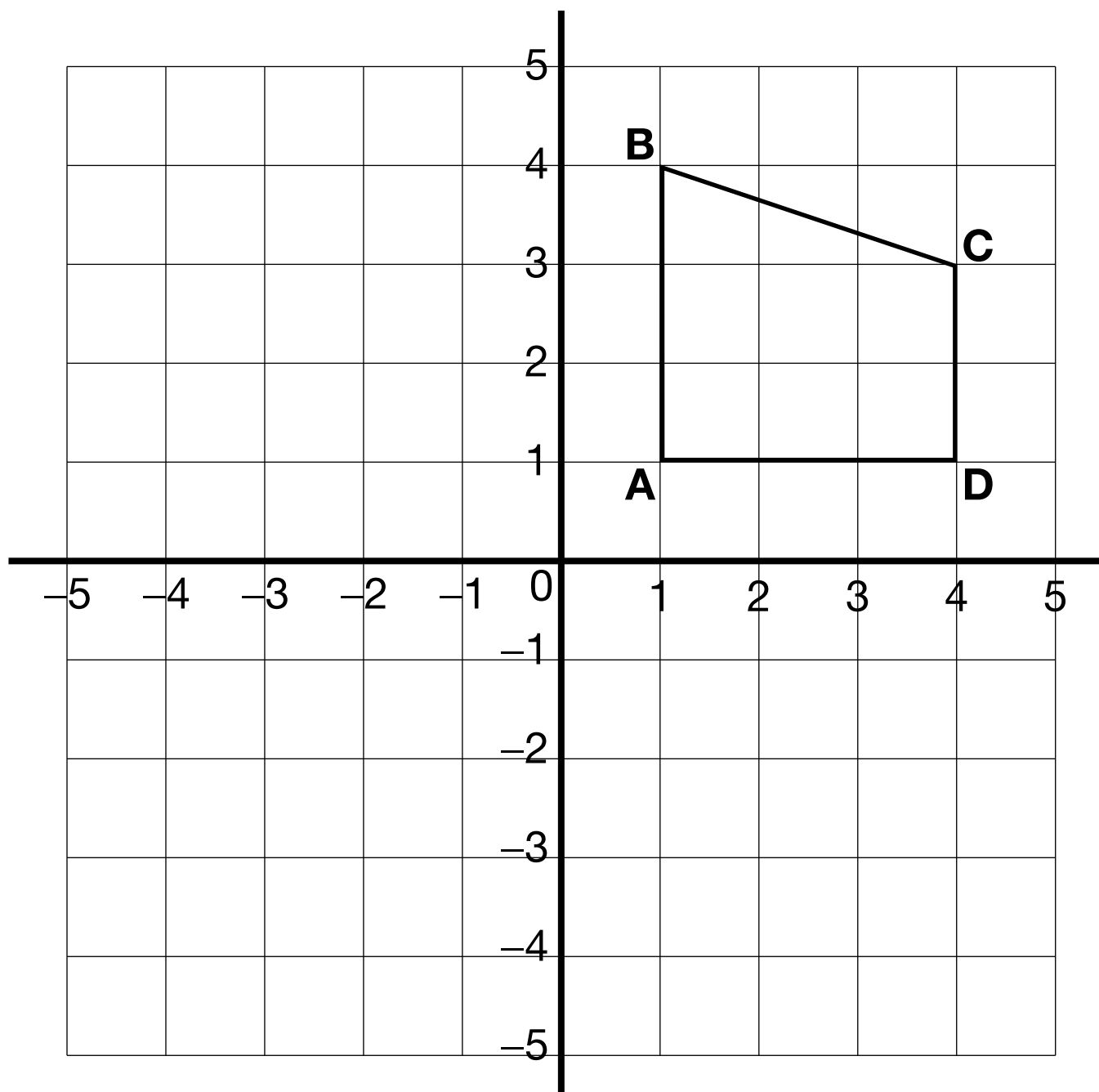


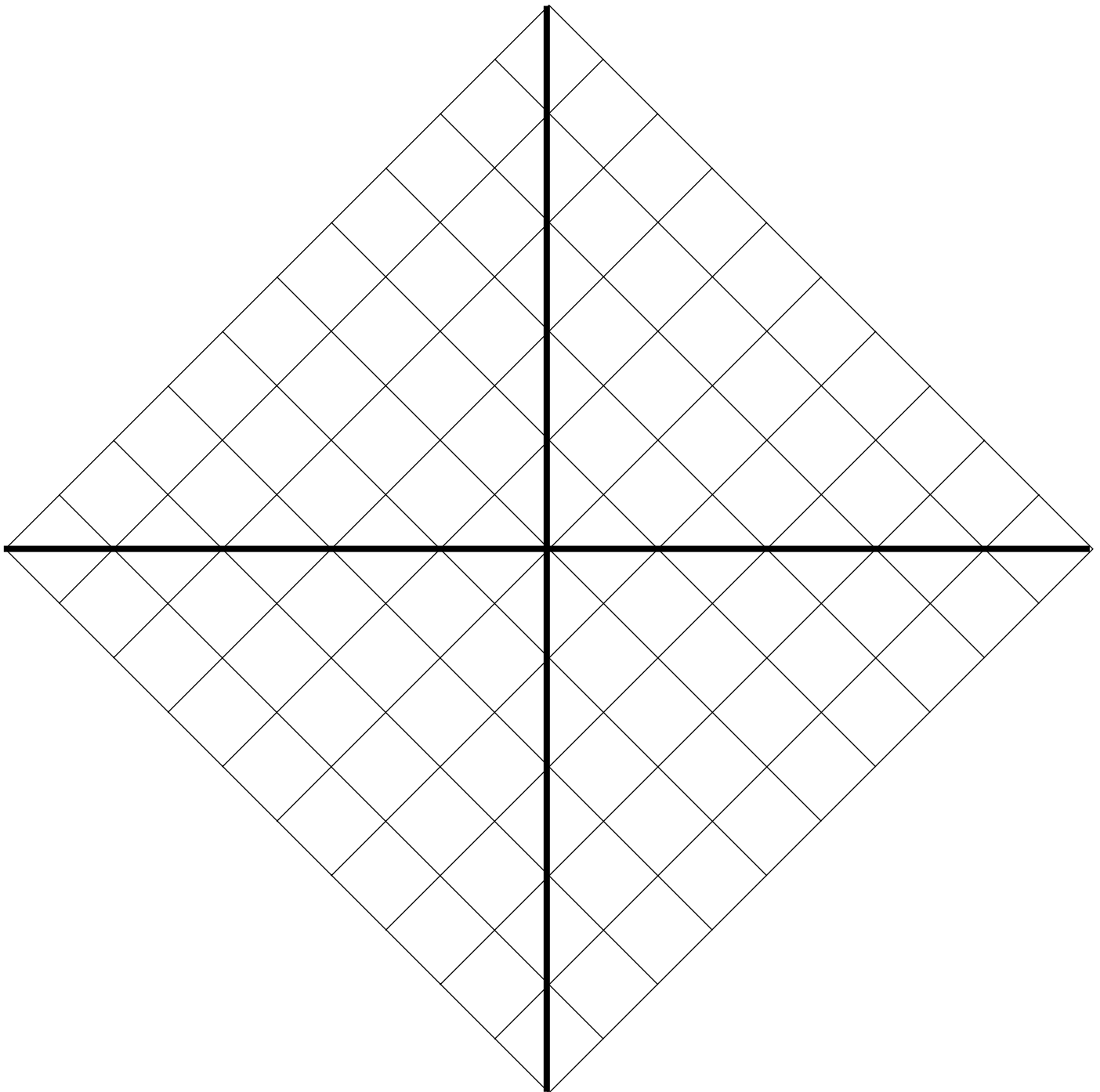
6. The triangle has been reflected in the mirror line. Write down the missing coordinates.

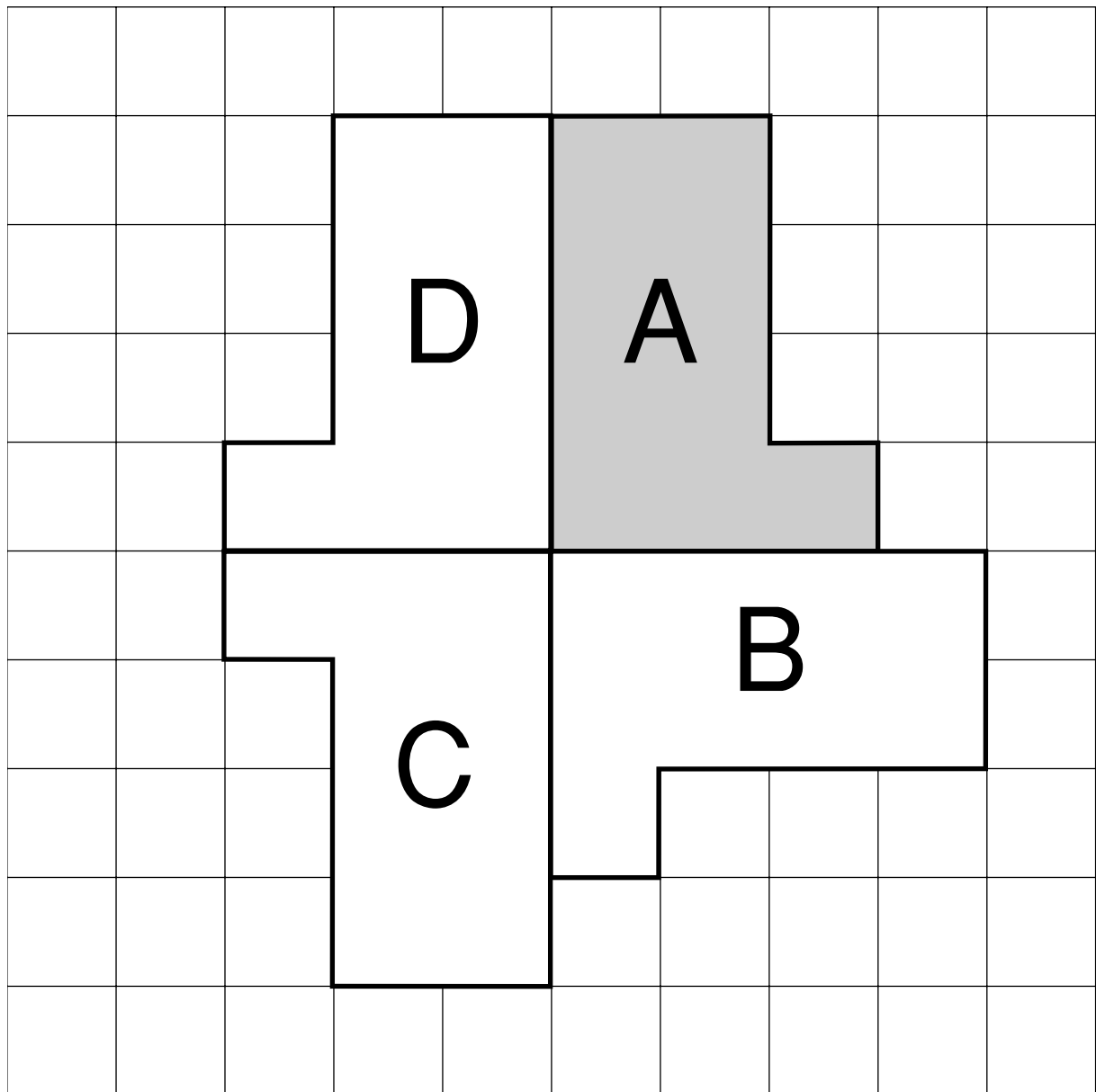












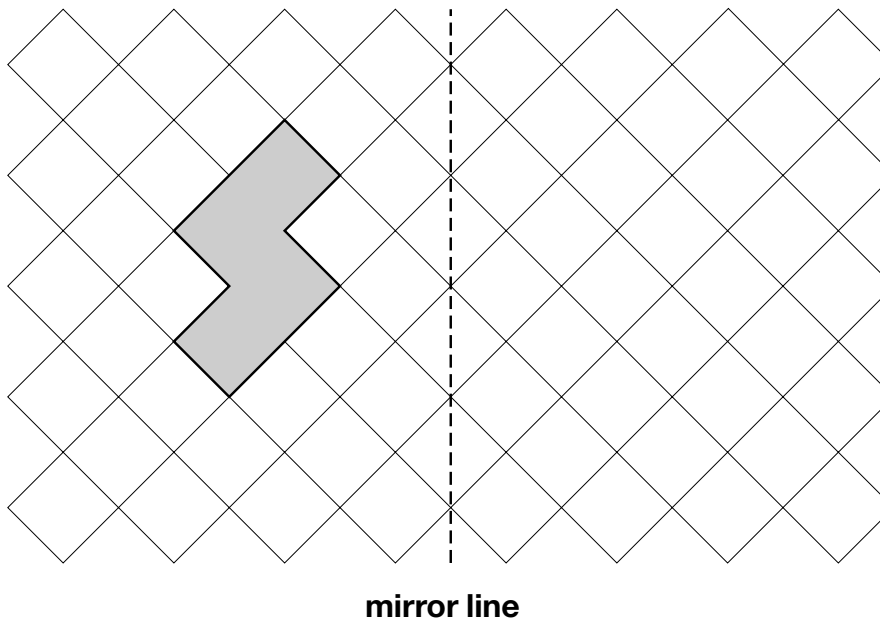
Related Key Stage 2 National test questions:

2001 Test A

4

Draw the **reflection** of the shaded shape in the mirror line.

You may use a mirror or tracing paper.



4

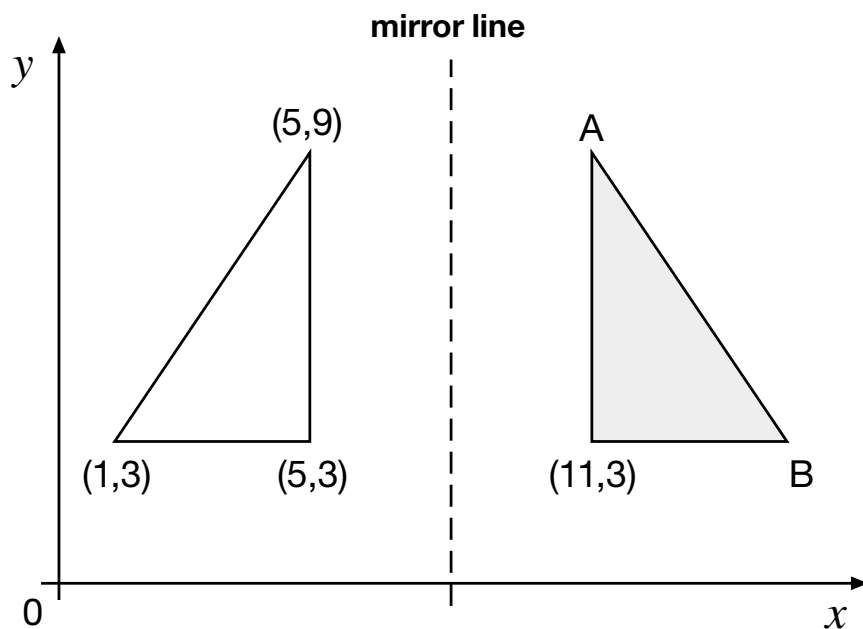
1 mark

Total

2000 Test A

22

The shaded triangle is a reflection of the white triangle in the mirror line.



Write the **coordinates** of point **A** and point **B**.

**A** is**B** is

22a

1 mark

22b

1 mark

Total

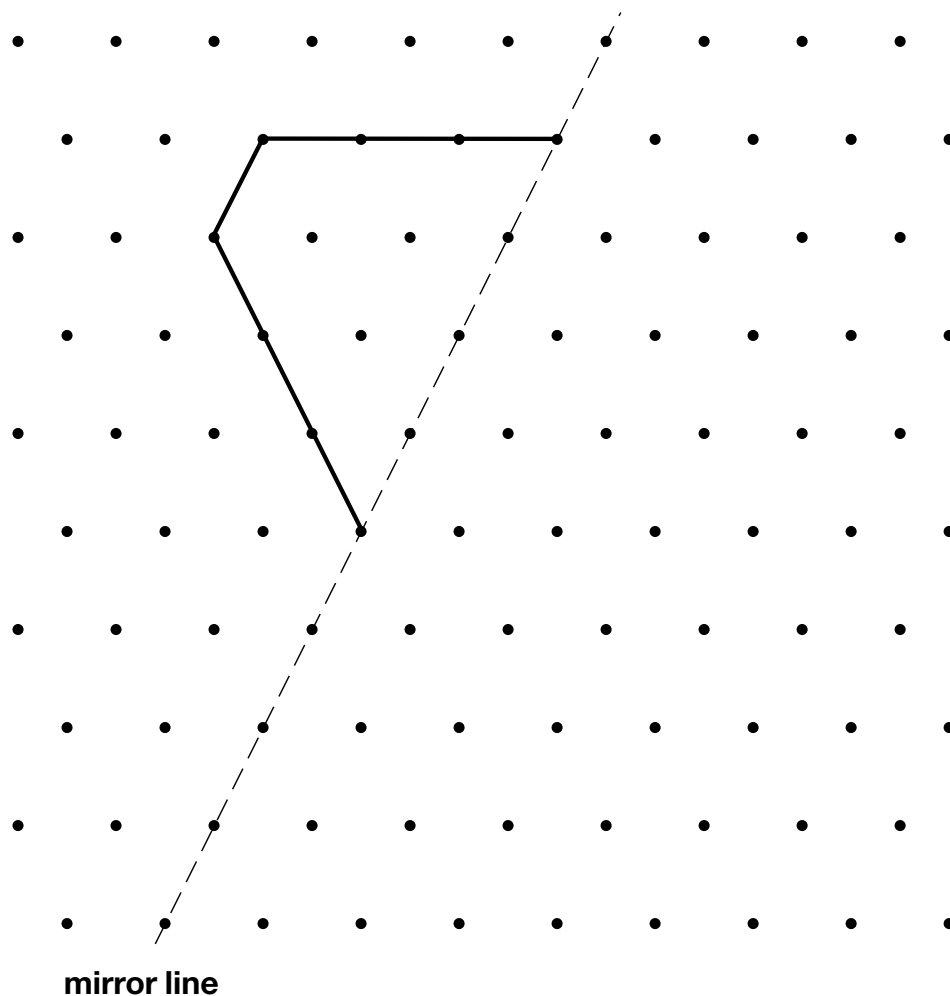
2000 Test B

6

Draw the **reflection** of the shape in the **mirror line**.

Use a ruler.

You may use a mirror or tracing paper.



6

1 mark

Total

2000 **Test B**

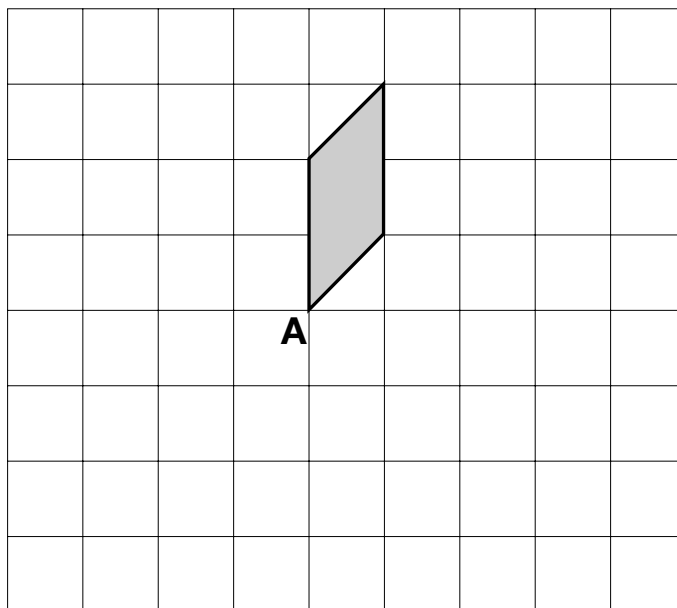
15

Here is a shaded shape on a grid.

The shape is **rotated 90° clockwise** about point **A**.

Draw the shape in its **new position** on the grid.

You may use tracing paper.



15
2 marks

Total

2002 Test A

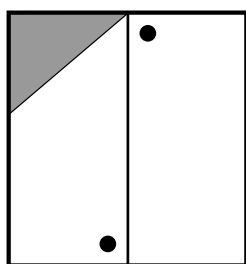
3

Here is a square with a design on it.

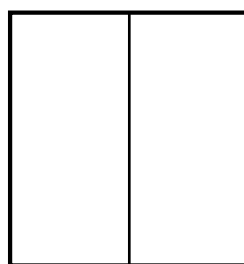
The square is reflected in the mirror line.

Draw the missing triangle and dots on the reflected square.

You may use a mirror or tracing paper.



mirror line



3

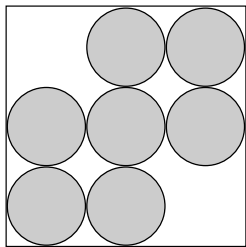
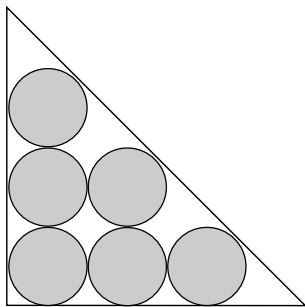
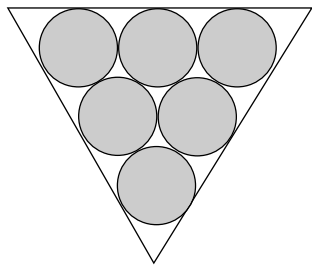
1 mark

Total

5

Use a ruler to draw **one** line of symmetry on **each** of these designs.

You may use a mirror or tracing paper.

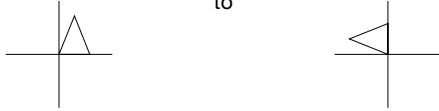


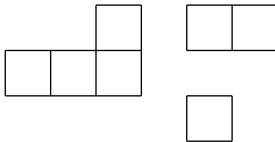
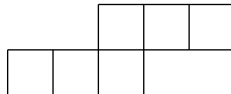
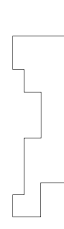
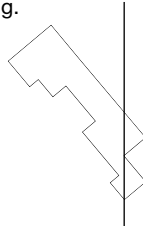
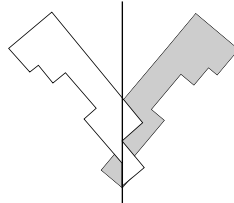
5

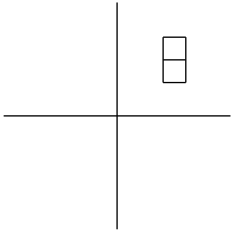
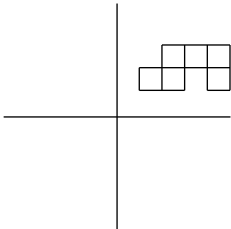
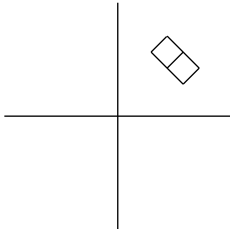
2 marks

2002 Mental Arithmetic

15	What is ninety-nine per cent of two hundred?		99%
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Planning sheet	Day One	Unit 5pt.2 <i>Rotations and reflections</i>	Term: <i>Spring</i>	Year Group: 6
Oral and Mental		Main Teaching		Plenary
Objectives and Vocabulary	Teaching Activities	Objectives and Vocabulary	Teaching Activities	Teaching Activities / Focus Questions
<p>Count up and back in steps of 9 and 90.</p> <p>Use vocabulary associated with rotation.</p> <p>VOCABULARY rotation rotate clockwise anticlockwise</p>	<ul style="list-style-type: none"> Children count up in 9s and then back to zero. <div>Q What is a good strategy for counting up in 9s?</div> <p>Identify the increase in the 10s and the decrease in the units, e.g. 27 to 36.</p> <p>Children count up in 90s.</p> <p>Make the link to counting up in 90 degrees.</p> <p>Draw a circle on the board and count around in 90 degrees both clockwise and anticlockwise.</p> <ul style="list-style-type: none"> Get the children to stand up and give them instructions like: ‘Rotate 90 degrees clockwise’. ‘Rotate 270 degrees anticlockwise’. Establish that a quarter turn is 90 degrees, a half turn is 180 degrees, and a full turn is 360 degrees. Get the children to count in 90s again, this time turning a quarter turn clockwise at each stage. Stop at a point and ask: <div>Q How many complete turns have you made?</div>	<p>Recognise where a shape will be after 90 degrees rotation about a vertex.</p> <p>VOCABULARY rotation rotate anticlockwise clockwise vertex</p> <p>RESOURCES Activity sheet 5pt.2.1 Activity sheet 5pt.2.2 OHT 5pt.2.1 OHT 5pt.2.2 OHT 5pt.2.3 Tracing paper</p>	<ul style="list-style-type: none"> Show OHT 5pt.2.1. Using each of the triangles in turn, demonstrate rotation of a triangle through 90 degrees, clockwise and anticlockwise, about each of its vertices. Each time identify the centre of rotation, and emphasise the angle and direction. <p>Ask children to come out and show various rotations. Demonstrate rotations of 180 and 270 degrees.</p> <div>Q What is a 90 degrees clockwise rotation followed by a 90 degrees clockwise rotation equivalent to?</div> <p>Establish other equivalences and the effect of a clockwise rotation followed by an anticlockwise rotation.</p> <ul style="list-style-type: none"> Show OHT 5pt.2.2. Using the same two triangles rotate about the origin, e.g. <div>  </div> <div>Q How would you describe this rotation?</div> <p>Accept anticlockwise 90 degrees and clockwise 270 degrees about the origin. Repeat using the triangles at other positions on the grid and other shapes.</p> <div>Q What do you notice about the coordinates of the shape before and after rotation?</div> <p>Highlight the interchange in the coordinates and changes in the signs.</p> <ul style="list-style-type: none"> Give the children Activity sheet 5pt.2.1 to work through. Make tracing paper available, and show children how they might use it. Collect answers and correct any mistakes and misunderstandings. 	<ul style="list-style-type: none"> Show OHT 5pt.2.3. Say you want to rotate the trapezium about the origin through 90 degrees, anticlockwise. <div>Q Where will A be after the rotation? What position will B, C and D take?</div> <p>Get children to draw where the points move to and where the shape will be after the rotation.</p> <p>HOMEWORK – Give out Activity sheet 5pt.2.2. Discuss the tasks and ensure children understand how to draw their starting shapes. Make tracing paper available.</p> <div> <p>By the end of the lesson the children should be able to:</p> <ul style="list-style-type: none"> Sketch the position of a simple shape after a rotation of 90 or 180 degrees about a vertex. <p>(Refer to supplement of examples, section 6, page 111.)</p> </div>

Planning sheet	Day Two	Unit 5pt.2 <i>Rotations and reflections</i>		Term: <i>Spring</i>	Year Group: 6
Oral and Mental		Main Teaching			Plenary
Objectives and Vocabulary	Teaching Activities	Objectives and Vocabulary	Teaching Activities		Teaching Activities / Focus Questions
Recognise reflective symmetry.	<ul style="list-style-type: none">Draw these shapes on the board:<div></div><div>Q Which of these shapes has symmetry?</div><div>Establish that one has no symmetry, one has two axes of symmetry and one has four axes of symmetry.</div>Give out squared paper. Ask the children to use the shapes to make four new shapes that have axes of symmetry.<div>Ask the children to describe their shapes to their partner.</div><div>Q How many axes of symmetry do your shapes have?</div><div>Collect the shapes and discuss their symmetry.</div>	Recognise where a shape will be after reflection in a line touching the shape at a point.	<ul style="list-style-type: none">On the board draw<div></div><div>Q Does this space have an axis of symmetry?</div><div>Establish it does not.</div>On the board draw a vertical line. Explain that this is a line of reflection or a mirror line. Attach the shape from Resource sheet 5pt.2.1 to the board against the line, i.e.<div></div> <div>Using the object from Resource sheet 5pt.2.1 agree where the reflection should be attached to the board.</div> <ul style="list-style-type: none">Move the object and agree the reflected image. Keep one point of the shape touching the mirror line.<div>Q Where will the reflected image be?</div><div>Allow the shape to cross the mirror line, e.g.<div></div></div>	<div>Q What happens to the reflected image?</div> <div>Discuss that as the object moves across the mirror line, so does the reflected image, e.g.<div></div></div> <div>Repeat with a horizontal mirror line.</div> <ul style="list-style-type: none">Show OHT 5pt.2.2. Remind children of the names of the x and y axes. Pick a point and write down the coordinate e.g. (-2, 3).<div>Q Reflect this point in the y-axis, what is the coordinate of the reflected point? What is the coordinate of the point reflected in the x-axis?</div><div>Collect answers and repeat with other points and with shapes.</div>Give out Activity sheet 5pt.2.3. Discuss the questions with the children and ask them to complete the questions.	<ul style="list-style-type: none">Collect the children's answers. Discuss their strategies and ensure they understand that a reflection does not change the shape only its position. Use questions 5 and 6 to consolidate children's understanding of coordinates and reflection. <div>By the end of the lesson the children should be able to:</div> <ul style="list-style-type: none">Sketch the reflection of a simple shape in a mirror line. <div>(Refer to supplement of examples, section 6, page 107.)</div>
VOCABULARY reflective symmetry axes of symmetry		VOCABULARY line of reflection mirror line x-axis, y-axis object reflected image			
RESOURCES Squared paper		RESOURCES Resource sheet 5pt.2.1 Activity sheet 5pt.2.1 OHT 5pt.2.2			

Planning sheet	Day Three	Unit 5pt.2 <i>Rotations and reflections</i>	Term: <i>Spring</i>	Year Group: 6
Oral and Mental		Main Teaching		Plenary
Objectives and Vocabulary	Teaching Activities	Objectives and Vocabulary	Teaching Activities	Teaching Activities / Focus Questions
<p>Recognise where a shape will be after reflecting in a vertical and horizontal mirror line.</p> <p>VOCABULARY reflection mirror line</p> <p>RESOURCES Resource sheet 5pt.2.2/ OHT 5pt.2.4</p>	<ul style="list-style-type: none"> Show OHT 5pt.2.4. Explain that the two bold lines are mirror lines. Identify two squares on the grid which form a rectangle on the first quadrant, e.g.  <div>Q What is the reflection of this rectangle in the vertical mirror line; the horizontal mirror line?</div> <p>Get children to show the reflected shapes. Repeat using 3 squares.</p> <p>Give out Resource sheet 5pt.2.2/OHT 5pt.2.4. Say you are going to build up a shape of squares and the children are to copy it onto their sheet then reflect the shape in the two mirror lines. Start with one square and build up the shape to include 6 squares, e.g.</p>  <p>Collect answers and correct mistakes. Get children to extend the shape for the others to reflect in the two lines.</p>	<p>Recognise where a shape will be after reflection in two mirror lines at right angles.</p> <p>VOCABULARY diagonal</p> <p>RESOURCES Resource sheet 5pt.2.2/ OHT 5pt.2.4 Resource sheet 5pt.2.3/ OHT 5pt.2.6 OHT 5pt.2.5 OHT 5pt.2.7</p>	<ul style="list-style-type: none"> Show OHT 5pt.2.5, placing it so that the two mirror lines are vertical and horizontal. Identify 2 squares on the grid which form a rectangle in the first quadrant e.g.  <div>Q How would you reflect this in the two mirror lines?</div> <p>Establish that the distance the shape is away from a mirror line stays the same and children can use this fact and count the squares, and fix the corners. The shape does not change and children can use tracing paper to keep the shape the same. Demonstrate how the shape is reflected in the two mirror lines.</p> <ul style="list-style-type: none"> Turn the OHT around so the lines on the grid are horizontal and vertical and the mirror lines are diagonal. <div>Q What has changed? How would you reflect shapes in diagonal mirror lines?</div> <p>Emphasise that children can always turn the page as you turned the OHT.</p> <ul style="list-style-type: none"> Show Resource sheet 5pt.2.3/OHT 5pt.2.6. Remind the children that the reflections can involve different types and size of grid, and the mirror lines can be diagonal to the page. <p>On the OHT identify shapes and with the children find their reflections in the mirror line. Turn the OHT to help children find the reflections.</p> <ul style="list-style-type: none"> Give out Resource sheet 5pt.2.3/OHT 5pt.2.6. In pairs children identify shapes for their partners to reflect. <p>Collect examples and correct any misunderstandings and errors.</p>	<ul style="list-style-type: none"> Discuss the homework and remind children about the key features of rotations and reflections. Show OHT 5pt.2.7. <div>Q Which reflection or rotation would move shape A to D, C to B?</div> <p>Repeat using another starting shape.</p> <div>By the end of the lesson the children should be able to:</div> <ul style="list-style-type: none"> Sketch the reflection of a simple shape in two mirror lines at right angles. <p>(Refer to supplement of examples, section 6, page 107.)</p>