

# SS7 • Transforming shapes

## Mathematical goals

To enable learners to:

- recognise and visualise transformations of 2D shapes;
- translate, rotate, reflect and combine these transformations.

## Starting points

Learners unfamiliar with the terms 'rotation', 'reflection' and 'translation' will need some introduction to these. The session also assumes some acquaintance with equations of lines of reflection, e.g.  $y = 4$ ,  $x = 4$ ,  $y = x$ ,  $y = -x$ . It is not essential, however, that all learners understand these ideas fully at the outset; during the session they will learn from each other through discussion.

## Materials required

- OHT 1 – *Transformations*.

This should be cut in half so that the black L shape can be moved around over the grid to show different transformations.

For each learner you will need:

- mini-whiteboard.

For each small group of learners you will need:

- a copy of OHT 1 – *Transformations*, printed on acetate;
- a pin (to help find centres of rotation);
- Card set A – *Transformation cards 1: pictures*;
- Card set B – *Transformation cards 2: words*;
- Card set C – *Additional cards: words and pictures* (2 pages).

## Time needed

Approximately 1 hour.

## Suggested approach **Beginning the session**

Place the grid from OHT 1 – *Transformations* on an overhead projector. Place the L shape on top of the grid.

Ask learners where they think the image of the L shape will be after it has been translated/reflected/rotated in different ways. Discuss their responses. For each response, use the OHTs to demonstrate the correct position and how it can be found.

## **Working in groups**

Ask learners to sit in pairs. Give out the copies of the OHT, pins, Card set A – *Transformation cards 1: pictures* and Card set B – *Transformation cards 2: words*.

The OHT should be cut horizontally along the centre of the page. Make sure that learners do not cut round the L shape as they will then find it difficult to find centres of rotation that lie outside the shape.

Explain that you would like learners to start by linking two *Picture* cards using a *Word* card. They should then try to link up more pairs and, ultimately, aim to end up with a connected network using as many of the cards as possible.

Encourage learners to explain carefully to each other why cards are linked and perhaps demonstrate this to you using the acetates on their table.

Learners who are likely to struggle should concentrate on linking pairs of pictures. If this proves very challenging they could be given a pair of pictures and asked to find the transformation that links them.

Learners who find the initial task easy could be given Card set C – *Additional cards: words and pictures*. They can use these cards to extend the networks they have already created.

When learners are happy with their results, ask them to compare their network with networks produced by other groups. It is easiest if cards are left on the tables and the learners move round. You can ask them to check other networks and to make notes of differences that emerge.

## Reviewing and extending learning

Ask learners to do the following, using mini-whiteboards:

Show me the new coordinates of the point (1,4) after it is:

- reflected in the  $x$  axis; (1,-4)
- reflected in the  $y$  axis; (-1,4)
- rotated through  $180^\circ$  about (0,0); (-1,-4)
- reflected in the line  $y = x$ ; (4,1)
- reflected in the line  $y = -x$ ; (-4,-1)
- rotated  $90^\circ$  clockwise about (0,0); (4,-1)
- rotated  $90^\circ$  anticlockwise about (0,0). (-4,1)

You may like to repeat this with a general starting point  $(x,y)$ .

You can extend the work to include combinations of transformations:

What is the single transformation that will produce the same result as:

- reflection in  $x$  axis, followed by reflection in  $y$  axis?  
(rotation  $180^\circ$  about (0,0))
- rotation  $90^\circ$  clockwise about (0,0) followed by reflection in  $y$  axis? (reflection in line  $y = -x$ )

Tracing paths round the cards laid on the table will help to generate and answer questions such as these.

### What learners might do next

Learners may enjoy making up some cards of their own. They could use a different shape from the L and make up a small set of four cards showing the shape in different positions and four transformations that link them.

### Further ideas

This session uses multiple representations of states and transformations. Similar activities in other mathematical contexts are included in this pack, e.g.

#### **N7 Using percentages to increase quantities**

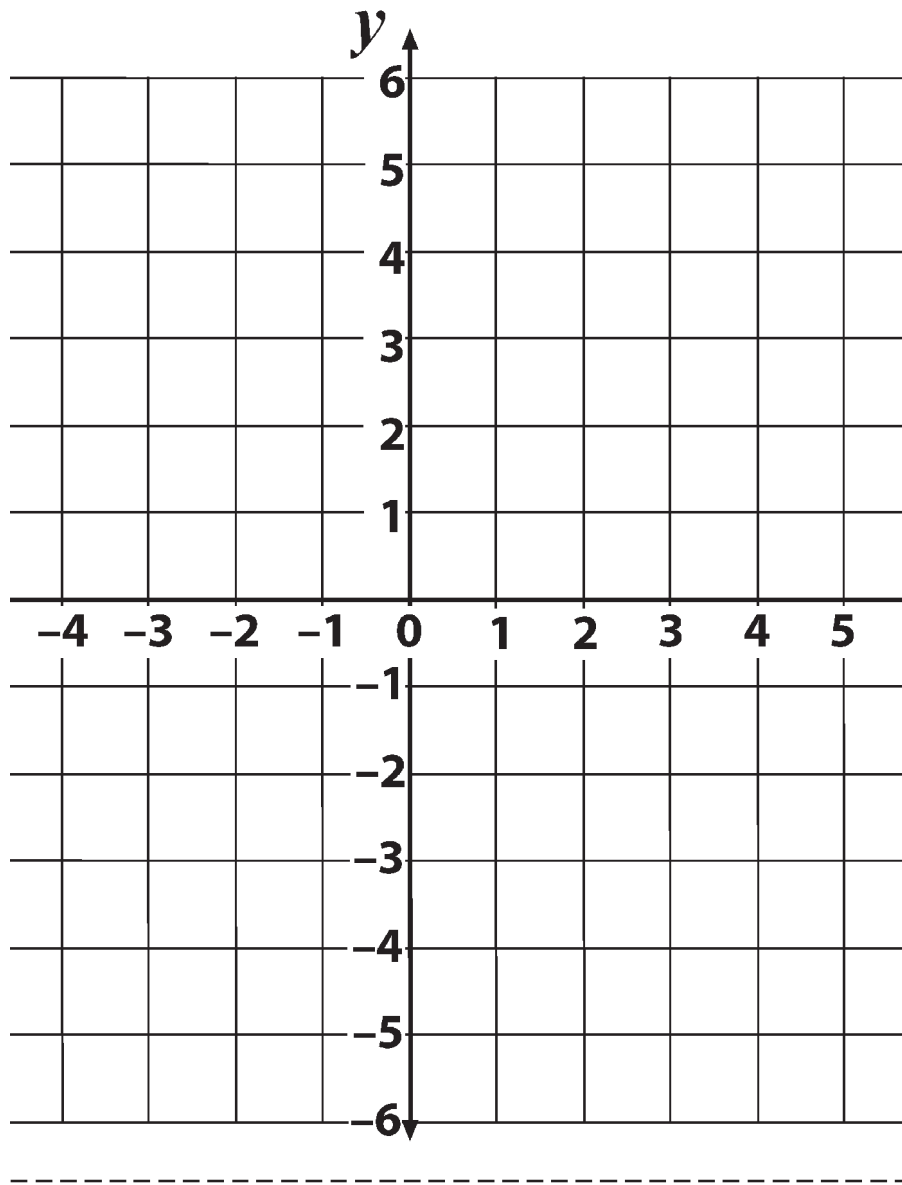
(states are money values; transformations are percentage increases/decreases);

#### **N8 Using directed numbers in context**

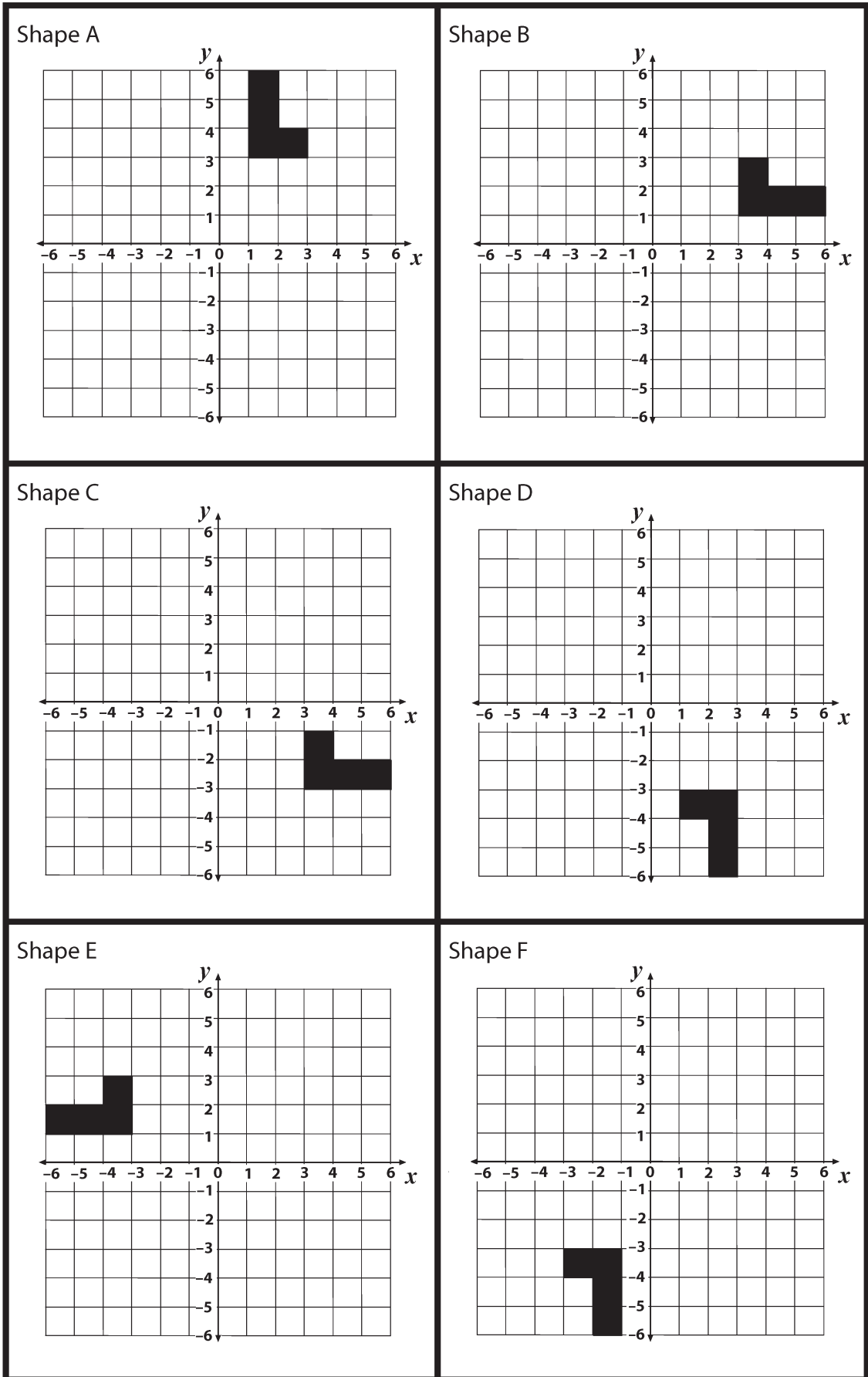
(states are temperatures; transformations are rises and falls).

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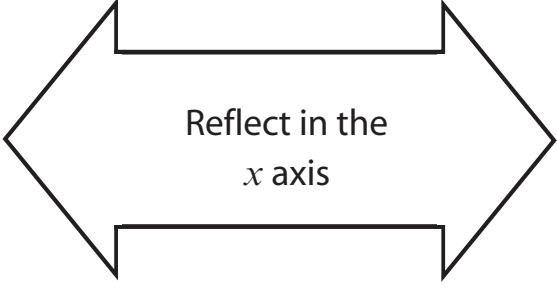
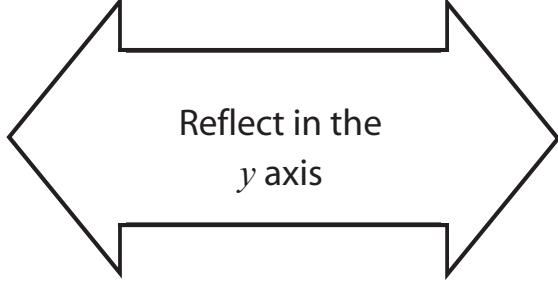
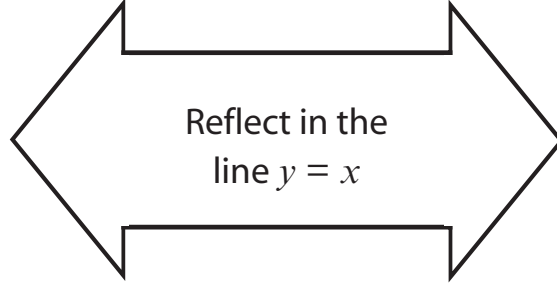
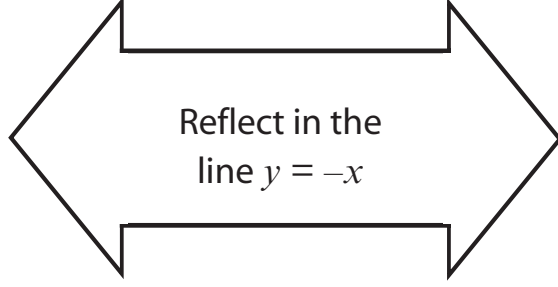
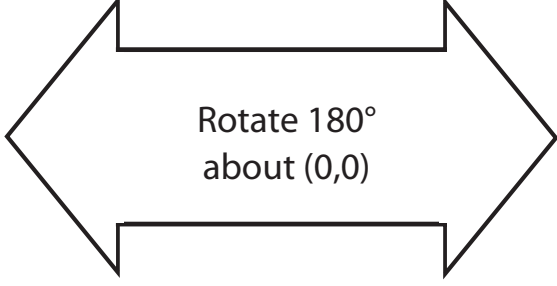
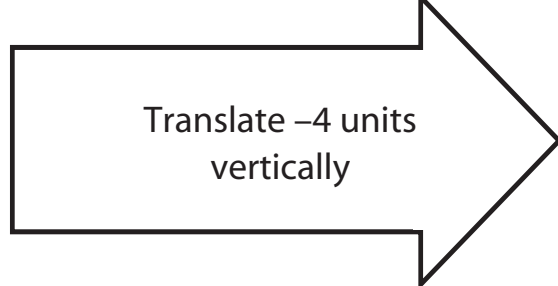
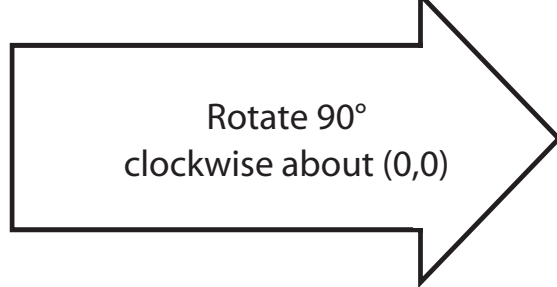
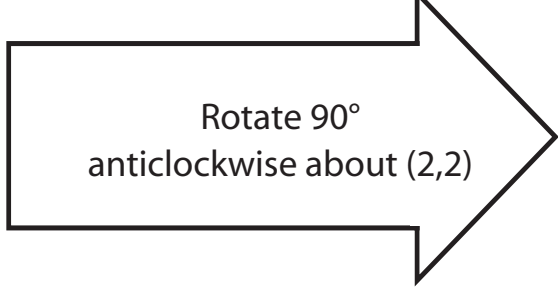
SS7 OHT 1 – Transformations



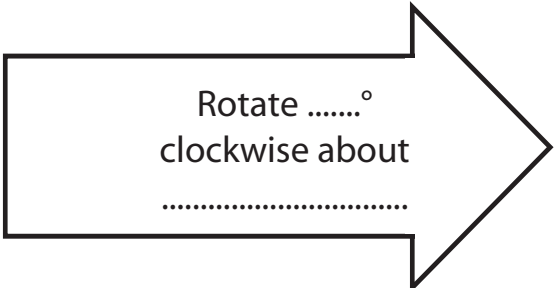
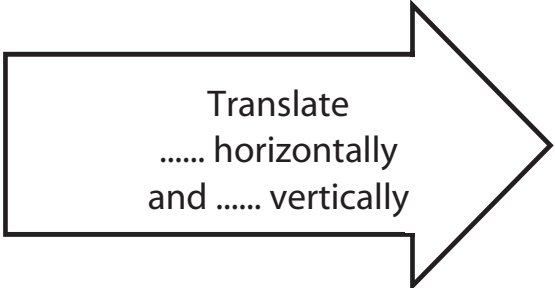
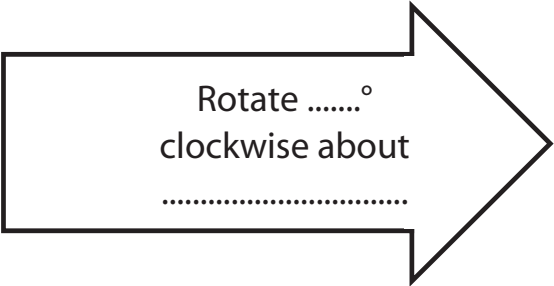
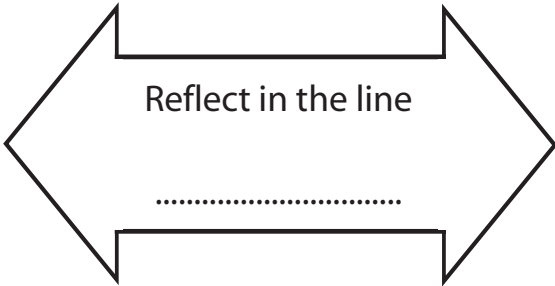
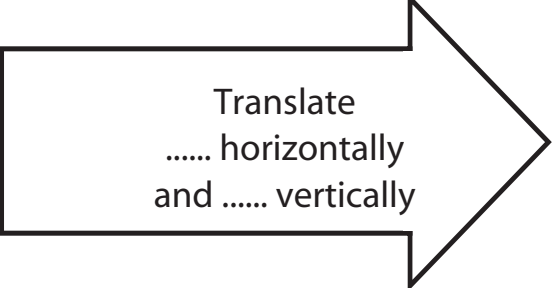
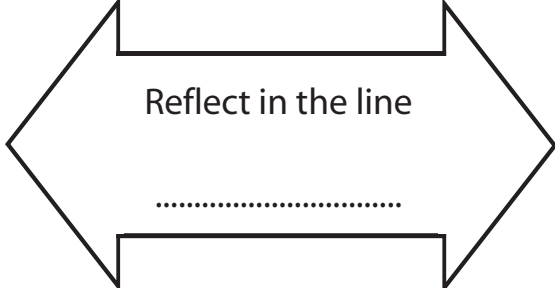
SS7 Card set A – Transformation cards 1: Pictures



SS7 Card set B – Transformation cards 2: Words

 <p>Reflect in the <math>x</math> axis</p>	 <p>Reflect in the <math>y</math> axis</p>
 <p>Reflect in the line <math>y = x</math></p>	 <p>Reflect in the line <math>y = -x</math></p>
 <p>Rotate <math>180^\circ</math> about <math>(0,0)</math></p>	 <p>Translate <math>-4</math> units vertically</p>
 <p>Rotate <math>90^\circ</math> clockwise about <math>(0,0)</math></p>	 <p>Rotate <math>90^\circ</math> anticlockwise about <math>(2,2)</math></p>

**SS7 Card set C – Additional cards: Words and pictures**

 <p>Rotate .....° clockwise about .....</p>	 <p>Translate ..... horizontally and ..... vertically</p>
 <p>Rotate .....° clockwise about .....</p>	 <p>Reflect in the line .....</p>
 <p>Translate ..... horizontally and ..... vertically</p>	 <p>Reflect in the line .....</p>



SS7 Card set C – Additional cards: Words and pictures (continued)

