Summer Block 2

Position and direction

Small steps

Step 1	Read and plot coordinates
Step 2	Problem solving with coordinates
Step 3	Translation
Step 4	Translation with coordinates
Step 5	Lines of symmetry
Step 6	Reflection in horizontal and vertical lines

Read and plot coordinates

Notes and guidance

Children first saw a coordinate grid in Year 4 when they read and plotted points on a grid. They also translated points and described translations. In this small step, they recap reading and plotting coordinates on a coordinate grid. They still work only within the first quadrant (positive numbers for both coordinates), with the four-quadrant grid being taught in Year 6

Remind children what a coordinate looks like and what each number refers to. Highlight the importance of reading and plotting the x-value of the coordinate first. Children identify the coordinates of given points on a grid, then move on to plotting points with given coordinates. This can lead to drawing shapes on a coordinate grid with given coordinates or working out the coordinates of a shape from known information.

Things to look out for

- Children may confuse the x- and y-values of the coordinates and read or plot them in the wrong order.
- Children may assume that the intervals on the axes always go up in 1s.

Key questions

- What is a coordinate grid?
- What are the two axes called?
- What are coordinates?
- When reading or plotting coordinates, which axis do you look at first?
- Does it matter which way round the values of coordinates are written?
- If the point moves up/down/left/right one place, what happens to the coordinates of the point?

Possible sentence stems

- Read the _____-axis before the _____-axis.
- The x-coordinate of the point is _____ and the y-coordinate is _____
  The point has the coordinates (_____, _____).

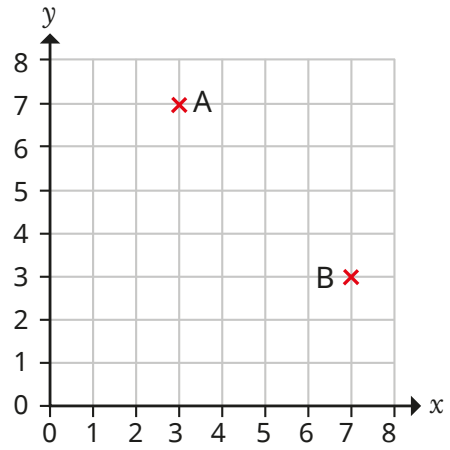
National Curriculum links

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

Read and plot coordinates

Key learning

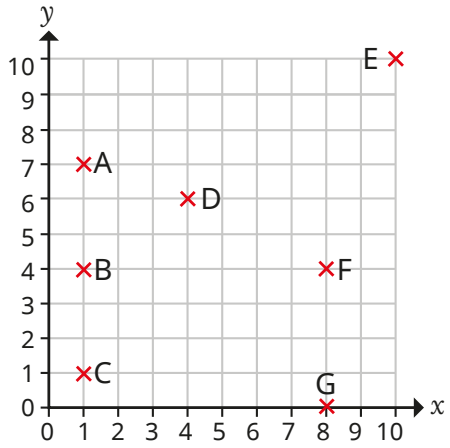
- Two points are plotted on the coordinate grid.



  - Which point has the coordinates (7, 3)?

    How do you know?
  - What are the coordinates of the other point?

- Seven points are plotted on a coordinate grid.



  - What are the coordinates of each point?
  - How many of the points have an x-coordinate of 1?
  - How many of the points have a y-coordinate of 4?
  - How many of the points have the same x- and y-coordinates?

- Plot the points on the coordinate grid.

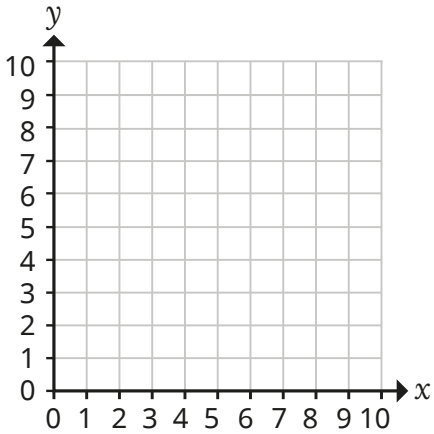
(3, 6)

(7, 3)

(7, 6)

(5, 0)

(3, 3)



  Join the points to make a polygon.

  What polygon have you drawn?

- Nijah draws a square on a coordinate grid.

  Two of the vertices have the coordinates (1, 1) and (5, 5).

  What are the coordinates of the other two vertices?

- Scott draws a straight line on a coordinate grid.

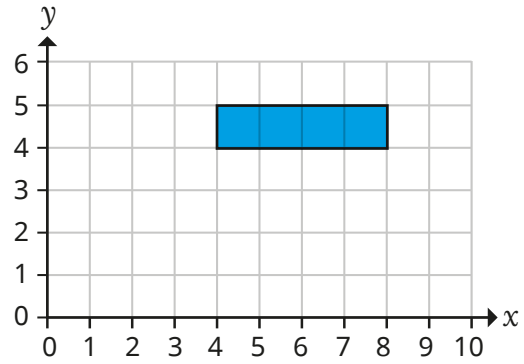
  The straight line passes through points with the coordinates (1, 4) and (1, 8).

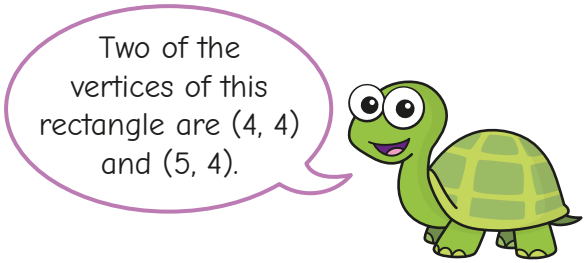
  Write the coordinates of three other points that the straight line passes through.

Read and plot coordinates

Reasoning and problem solving

Here is a rectangle on a coordinate grid.



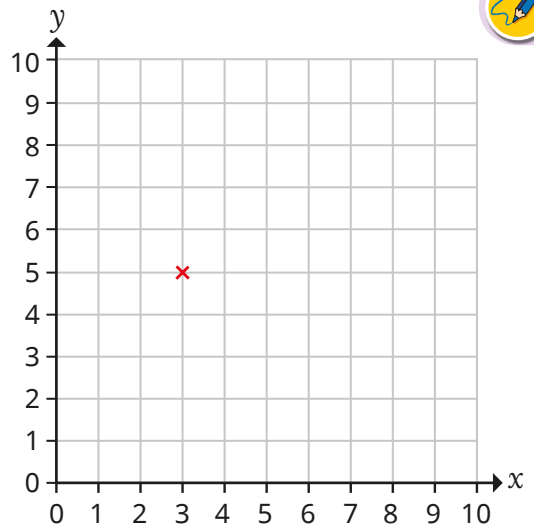


Do you agree with Tiny?

Explain your answer.

No

One vertex of a rectangle has been plotted on a coordinate grid.



The rectangle has a perimeter of 10 squares and fits on the grid.

What could the coordinates of the other three vertices of the rectangle be?

Is there more than one possible answer?

multiple possible answers, e.g.

(3, 6), (7, 6), (7, 5)

(5, 5), (5, 2), (3, 2)

(3, 8), (1, 8), (1, 5)

Problem solving with coordinates

Notes and guidance

In this small step, children move on from reading and plotting coordinates on a grid to solving problems involving knowledge and understanding of coordinates.

Children begin by looking at shapes on a grid where the axes are not fully labelled. By knowing the coordinates of one vertex, children can count up, down or across on the grid to work out the missing coordinates of the other vertices. They can also suggest possible coordinates for vertices based on the area or perimeter of a shape if they know the coordinates of one vertex.

Children then move on to problem solving when there are no gridlines, where they need to use the given coordinates to work out any missing coordinates and counting squares is not an option. By knowing that the coordinates of points on horizontal lines have the same y-coordinates and those on vertical lines have the same x-coordinates, children can find missing coordinates in rectilinear shapes.

Things to look out for

- Children may confuse the x- and y-axes.
- Without a grid on which to count squares, children may find it tricky to work out missing values.
- Children may assume that all axes count up in 1s.

Key questions

- Which axis do you look at first when writing coordinates?
- If the coordinates of this point are _____, what does that tell you about the coordinates of the points directly above/below/to the right/to the left?
- Do horizontal/vertical lines share a part of their coordinates?
- What happens to the x-/y-value of the coordinates when you move a point to the left/right/up/down by 1 square?
- If the perimeter/area of the shape is _____, what could the missing coordinates be?

Possible sentence stems

- The _____-coordinates of points on a vertical line are equal.
- The _____-coordinates of points on a horizontal line are equal.

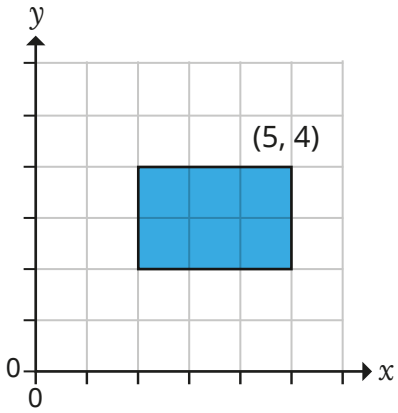
National Curriculum links

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

Problem solving with coordinates

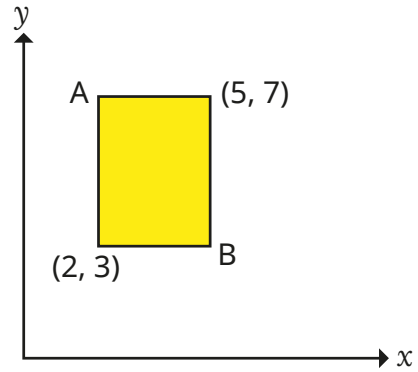
Key learning

- A rectangle has been drawn on a coordinate grid.



How can you use the given coordinates to work out the coordinates of the other three vertices?

- A rectangle has been drawn on a coordinate grid.

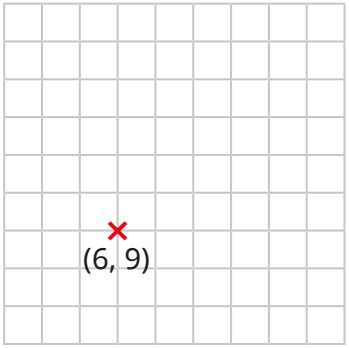


What are the coordinates of vertices A and B?

How did you work them out?

- Whitney is drawing a square on a coordinate grid.

The square has an area of 9 squares.

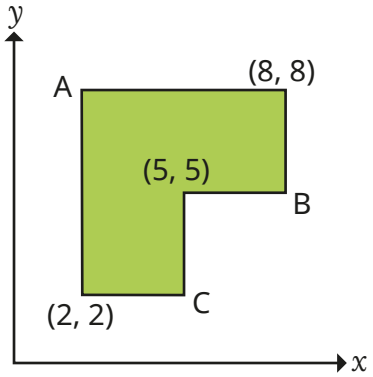


What could the coordinates of the other three vertices be?

How did you work them out?

Is there more than one possible answer?

- Work out the coordinates of points A, B and C.

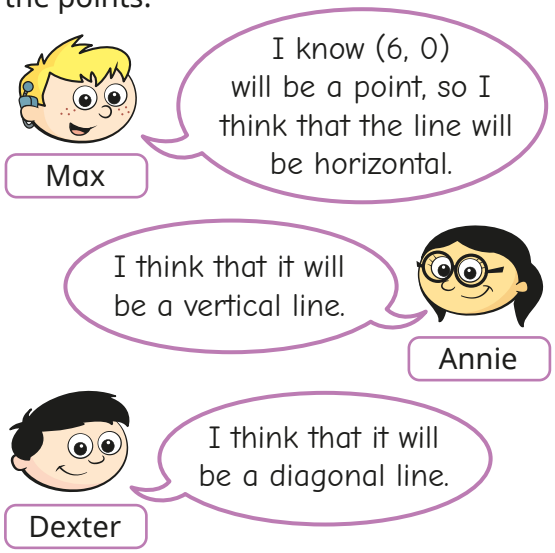


Problem solving with coordinates

Reasoning and problem solving

Max, Annie and Dexter are plotting points where the x-coordinate and the y-coordinate add up to 6

They will then draw a line through all the points.



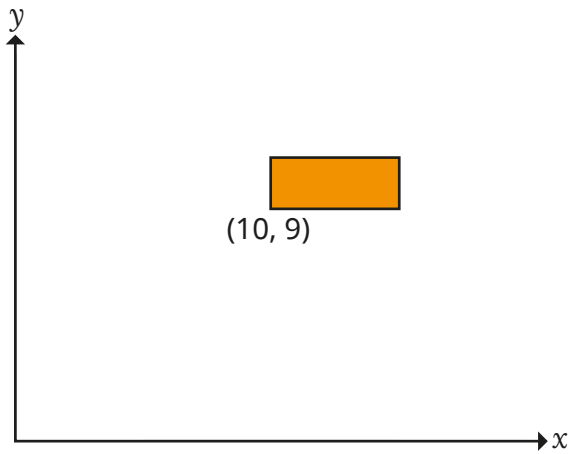
Who do you agree with?

Plot the points on a grid and draw the line to check your answer.

Dexter

diagonal straight line from (0, 6) to (6, 0)

The perimeter of the rectangle is 14 units.



What could the coordinates of the other vertices be?

How many possible answers can you find?

multiple possible answers, e.g.

(10, 10), (16, 10), (16, 9)

(10, 11), (15, 11), (15, 9)

(10, 12), (14, 12), (14, 9)

Translation

Notes and guidance

In Year 4, children translated shapes on a coordinate grid and described translations. This small step revisits that learning, on both a squared grid and a coordinate grid.

Children begin by translating a single point, before translating full shapes. Model translations on a grid, telling children that the point or shape moves to a different position, but remains exactly the same size and orientation. Children then translate shapes, starting with either up/down or left/right before moving on to a combination of both directions.

Show children two shapes on a grid where one is a translation of the other and ask them to describe the translation that has taken place. It is important to model this by looking at how one vertex has been translated, rather than considering the gap between the two shapes, as children can often confuse the two.

Things to look out for

- Children may confuse left and right.
- When describing a translation, children may look at the gap between shapes rather than how the vertices have been translated.
- Children may count the square the point starts on as "1", meaning that they do not translate by enough squares.

Key questions

- What does it mean to translate a shape?
- How does a shape change when it is translated? How does it stay the same?
- How can you translate a shape to the left/right/up/down?
- Can you translate a shape both left/right and up/down? Does it matter which you do first?
- Does translating the shape one vertex at a time make it easier? Why/why not?
- How has the shape been translated?

Possible sentence stems

- Shape A has been translated _____ squares to the left/right and _____ squares up/down.
- When a shape has been translated, the position of the shape _____ but the size of the shape _____

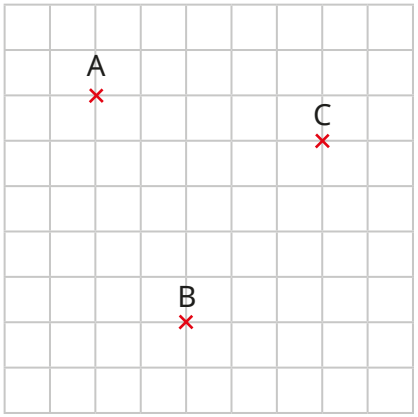
National Curriculum links

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

Translation

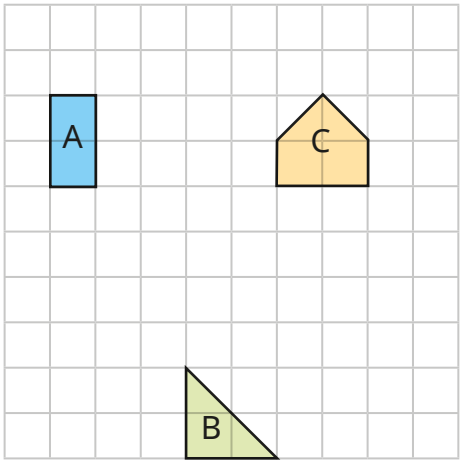
Key learning

- Three points are marked on a grid.



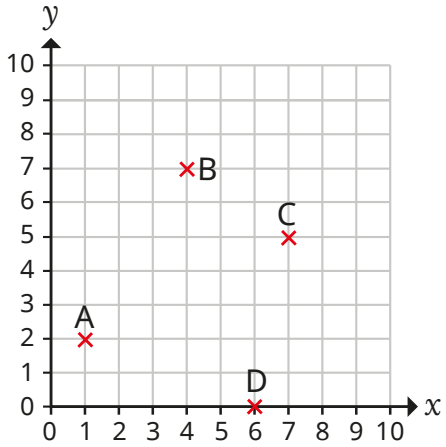
  - Translate point A 2 squares right.
  - Translate point B 4 squares up.
  - Translate point C 1 square to the left and 3 squares down.

- Three shapes are drawn on a grid.



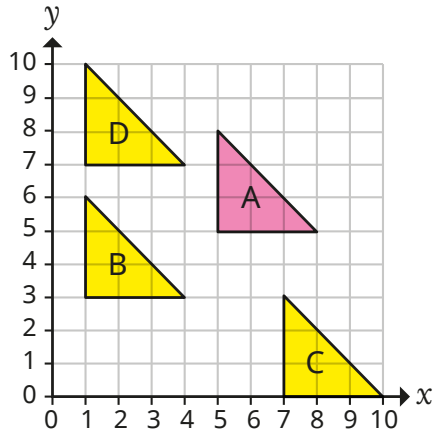
  - Translate shape A 4 squares down.
  - Translate shape B 3 squares left.
  - Translate shape C 1 square to the right and 2 squares down.

- Four points are plotted on a coordinate grid.



  Describe the translations:
  - A to B
  - C to D
  - D to A
  - A to D

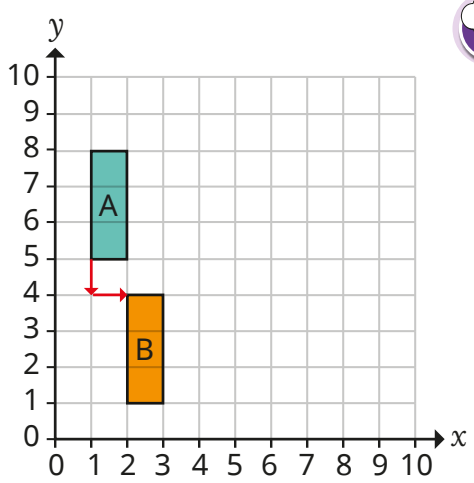
- Complete the sentence to describe the translation of shape A to shapes B, C and D.



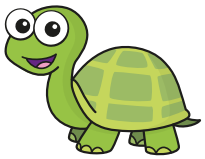
  Shape A has been translated _____ squares to the left/right and _____ squares up/down.

Translation

Reasoning and problem solving



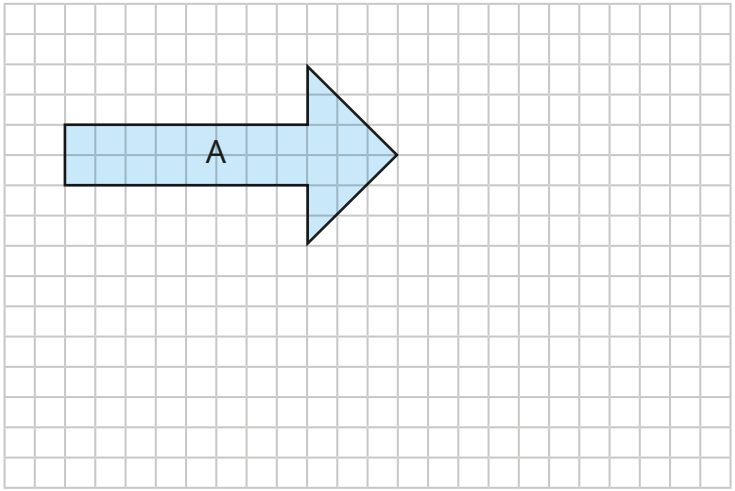
Shape A has been translated 1 square down and 1 square to the right.



Do you agree with Tiny?

Explain your answer.

No



Dani wants to translate shape A as far to the right and as far down as possible so that it still fits on the grid.

Complete the sentence.

Shape A can translate _____ squares to the right and _____ squares down and still fit on the grid.

11 squares to the right

8 squares down

Translation with coordinates

Notes and guidance

This small step builds on the learning of the previous step, to now include understanding of how coordinates change when points are translated.

Begin by getting children to realise that when a point is translated to the left or right, the y-coordinate remains the same and the x-coordinate changes, and when it is translated up or down, the x-coordinate remains the same and the y-coordinate changes. They can then use this understanding to work out the new coordinates of translated points without the help of a grid. They should also be able to describe how a point has been translated to another point both with and without using a grid.

Children then move on to looking at shapes on a coordinate grid. If they know where one of the vertices is going to be translated to, they can work out the coordinates of where the other vertices will be translated to.

Things to look out for

- Children may confuse the x- and y-axes.
- Children may find it hard to work out coordinates without the help of a grid.
- When translating a shape or point, children may count the point it is on as "1" and not translate enough spaces.

Key questions

- If a point on a coordinate grid moves up or down, what happens to the coordinates?
- What do you notice about the x-/y-coordinate when a point is translated up/down or left/right?
- If you know how a point is translated, how can you work out what the new coordinates will be?

Possible sentence stems

- When a point is translated up/down, the _____-coordinate stays the same and the _____-coordinate changes.
- When a point is translated left/right, the _____-coordinate stays the same and the _____-coordinate changes.
- When the point with coordinates _____ is translated _____ left/right and _____ up/down, the new coordinates are _____

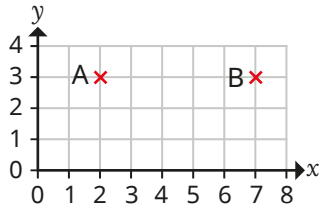
National Curriculum links

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

Translation with coordinates

Key learning

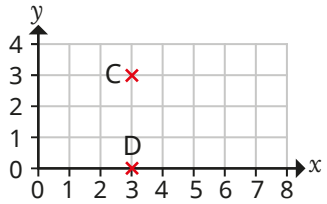
- Point A is translated to point B.



Write the coordinates of both points.

What do you notice?

Point C is translated to point D.



Write the coordinates of both points.

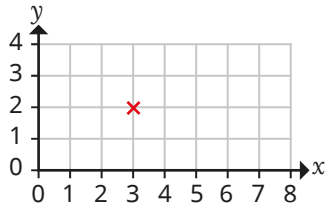
What do you notice?

- Teddy plots a point that has the coordinates (5, 4).

He translates the point so that it has the same x-coordinate, but a different y-coordinate.

Has he translated the point up/down or left/right?

- The point is translated 4 squares to the right and 2 squares down.



Write the coordinates of both points.

What do you notice?

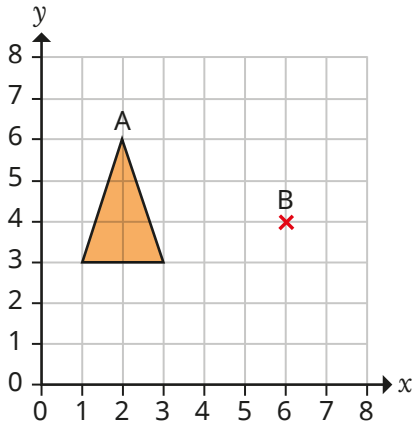
- Complete the table.

The first line has been done for you.

Coordinates	Translation	New coordinates
(1, 3)	2 right and 1 down	(3, 2)
(5, 2)	3 left and 2 up	
(6, 7)		(2, 5)
	1 left and 1 down	(5, 5)

- A triangle is translated so that point A translates to point B.

What are the coordinates of the other vertices of the translated triangle?



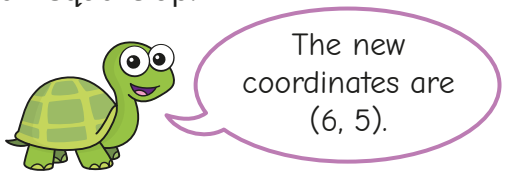
How did you work this out?

Translation with coordinates

Reasoning and problem solving

A point on a grid has the coordinates (5, 4).

The point is translated 1 square left and 1 square up.



Do you agree with Tiny?

Explain your answer.

No

Dora plots a point on a coordinate grid.

She translates the point 2 right.

She then translates that point 2 down.

She then translates that point 2 left.

She joins up all four points with straight lines.

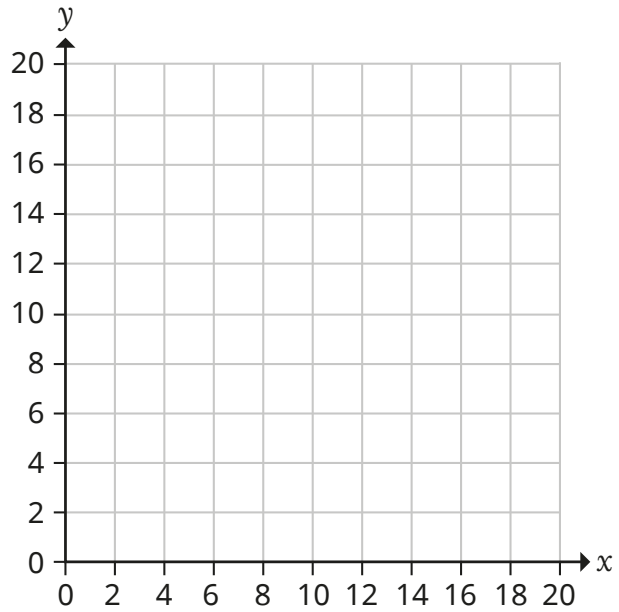
What shape has Dora drawn?

square

A rectangle is translated 2 squares left and 4 squares up.

The coordinates of three of the vertices of the translated rectangle are (6, 8), (10, 8) and (10, 14).

What are the coordinates of the vertices of the original rectangle?



(8, 4), (12, 4), (12, 10), (8, 10)

Lines of symmetry

Notes and guidance

Children first identified vertical lines of symmetry in shapes in Year 2. In this small step, that learning is extended to include any line of symmetry in a 2-D shape.

Begin by recapping the definition of a line of symmetry. Mirrors are a useful aid for this. Children then identify shapes on a grid that have a mirror line. Once they are confident at finding a single line in a shape (horizontal, vertical or diagonal), they move on to identifying shapes that have more than one line of symmetry.

Children can also identify lines of symmetry on shapes without the aid of the grid that they can use to check the size of both parts by counting. It is worth remembering that this is the first time that children have explored shapes with multiple lines of symmetry in different orientations, and a lot of modelling may be needed.

Things to look out for

- Children may only look for a vertical line of symmetry.
- Children may find only one line of symmetry when there are more.
- Children may draw a line of symmetry where there is an equal amount of shape on both sides, rather than a mirror image.

Key questions

- What does "symmetrical" mean? What is a line of symmetry?
- What does "vertical"/"horizontal"/"diagonal" mean?
- How can you show a line of symmetry on a shape?
- What will each side of a shape look like either side of a mirror line?
- Can a shape have more than one line of symmetry?
- How can grid lines help you to find lines of symmetry on a shape?
- Does using a mirror help you to find a line of symmetry?

Possible sentence stems

- The shape has _____ lines of symmetry.
- Either side of a mirror line, the shapes are _____

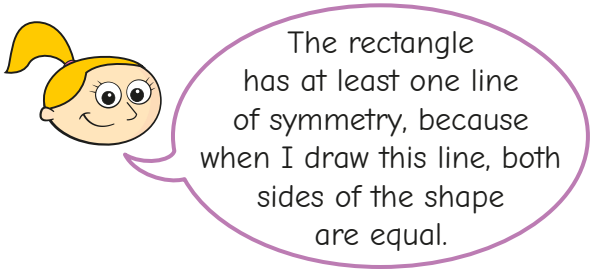
National Curriculum links

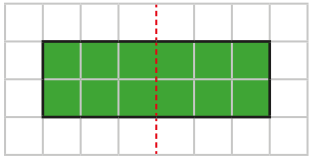
- Identify, describe and represent the position of a shape following a reflection or translation, using the appropriate language, and know that the shape has not changed

Lines of symmetry

Key learning

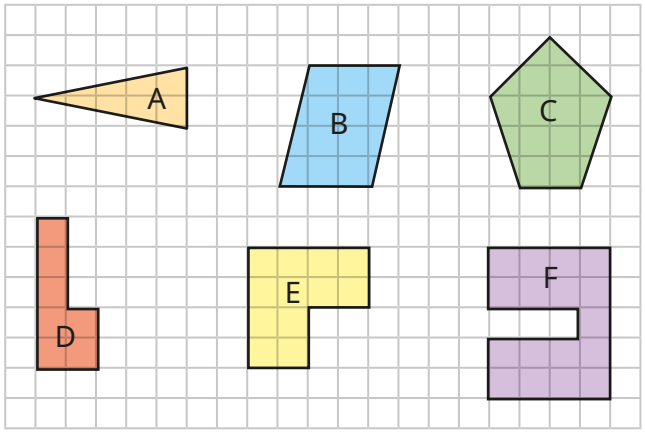
- Eva is identifying lines of symmetry on a rectangle.





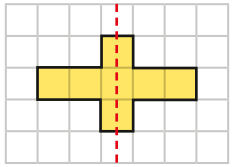
Are there any other lines of symmetry on the rectangle?

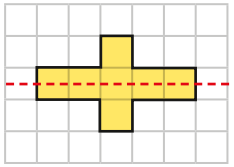
- Which of these shapes have **at least** one line of symmetry?



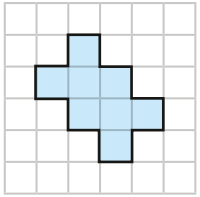
Are the lines of symmetry vertical, horizontal or diagonal?

- Ron and Sam are finding lines of symmetry in the same shape.

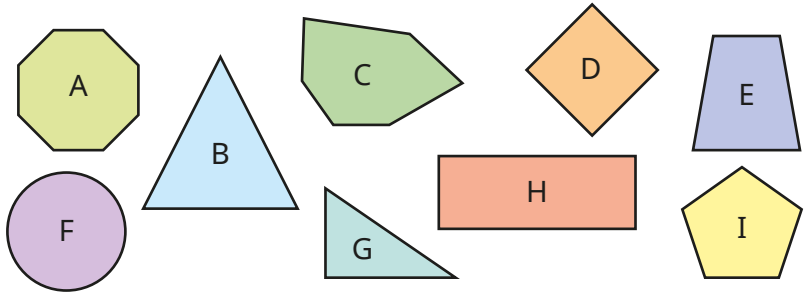




Add lines of symmetry to this shape.



- Sort the shapes into the table.



	1 line of symmetry	More than 1 line of symmetry
Up to 4 sides		
More than 4 sides		

Lines of symmetry

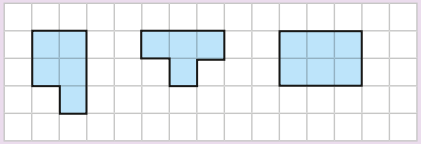
Reasoning and problem solving

Draw three shapes on a squared grid.

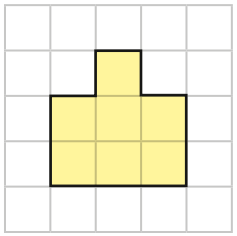
- One shape has no lines of symmetry.
- One shape has exactly one line of symmetry.
- One shape has more than one line of symmetry.

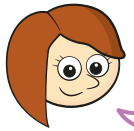
Use more than 3 squares but fewer than 7 squares for each shape.

multiple possible answers, e.g.



This shape has one line of symmetry.





Rosie

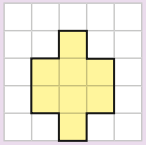
I can add a square to the shape so that it has two lines of symmetry.

I can remove a square so that it has more than two lines of symmetry.

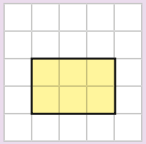
Amir

Draw the shapes that Rosie and Amir have described.

Rosie:



Amir:



Reflection in horizontal and vertical lines

Notes and guidance

Building on the previous step, in this small step children complete reflections for the first time.

Begin by looking at what reflection is and how it is different from translation. The use of mirrors is helpful for this, but this time children need to place the mirror on the given line rather than in the middle of the shape. As well as using squared paper, model reflecting a shape on a coordinate grid where the mirror line is a line parallel to one of the axes, reflecting one vertex of the shape at a time.

For added challenge, children can reflect shapes where the grid is not shown and they have to work out the new coordinates of the shape by considering how far away from the mirror line each coordinate is, rather than counting squares.

Things to look out for

- Children may translate a shape, rather than reflect it.
- Children may find that shapes that do not touch the mirror line are harder to reflect than those that do.
- Children may copy the shape, rather than reflecting it to face the opposite way.

Key questions

- What is reflection?
- What does a shape look like when it has been reflected?
- How can using a mirror help you to reflect shapes?
- How could reflecting one vertex of a shape at a time help?
- If the coordinates of vertex A are _____, what are the coordinates of the corresponding vertex when it has been reflected?
- How is reflection different from translation?

Possible sentence stems

- Vertex A is _____ squares away from the mirror line, so the corresponding vertex needs to be _____ squares away from the mirror line.
- The coordinates of the vertices of the reflected shape will be ...

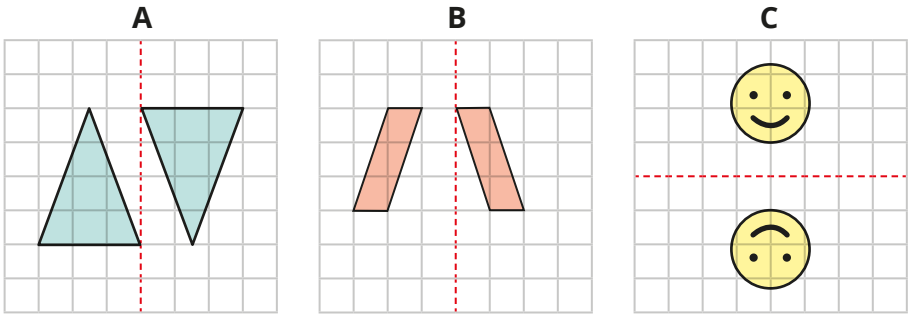
National Curriculum links

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

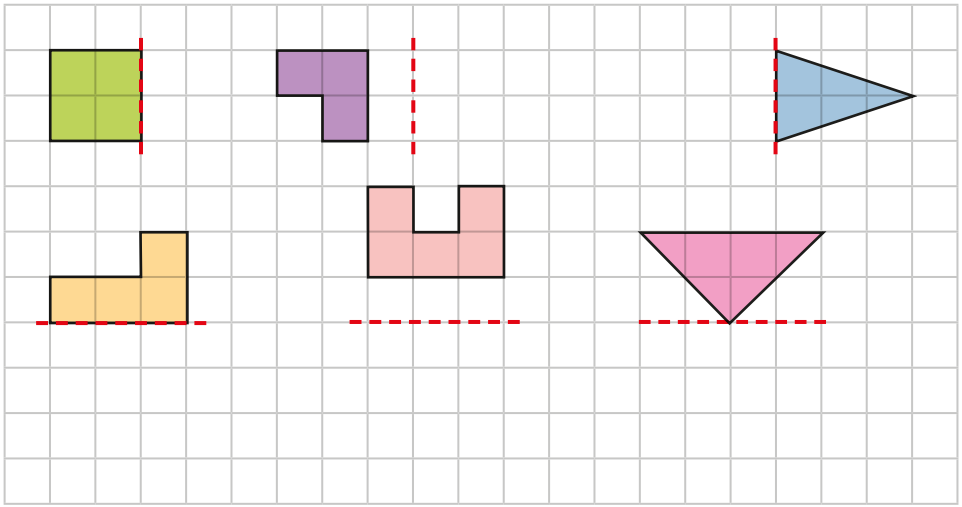
Reflection in horizontal and vertical lines

Key learning

- Which diagrams show a reflection in the given mirror line?

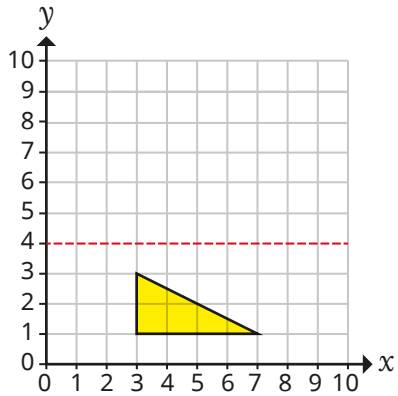


- Reflect each shape in its mirror line.

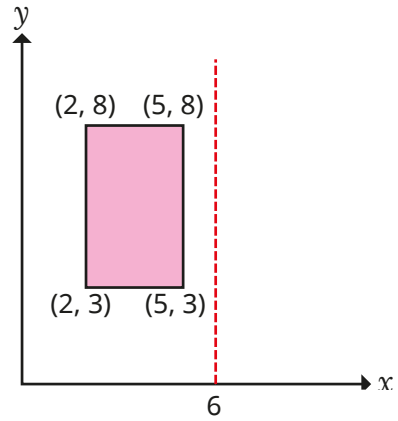


- Reflect the triangle in the mirror line.

  Write the coordinates of the vertices of the reflected triangle.



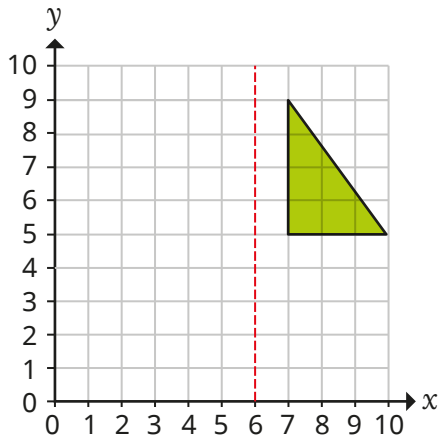
- The rectangle is reflected in the mirror line.



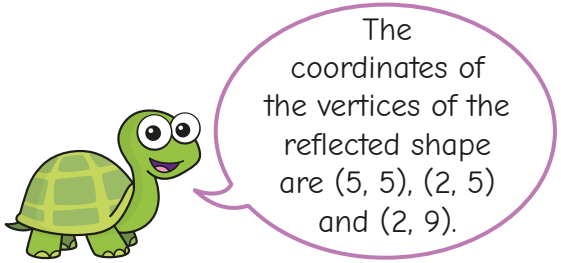
  What are the coordinates of the vertices of the reflected rectangle?

Reflection in horizontal and vertical lines

Reasoning and problem solving



Tiny reflects the shape in the mirror line.

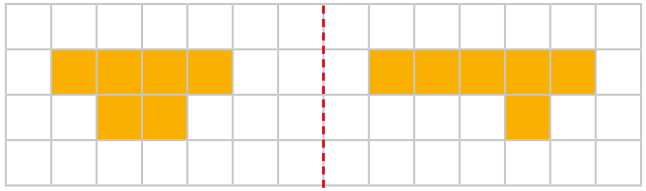


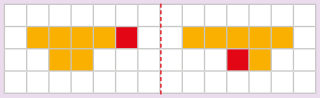
Do you agree with Tiny?

Explain your answer.

No

Shade two more squares to make the reflection correct.



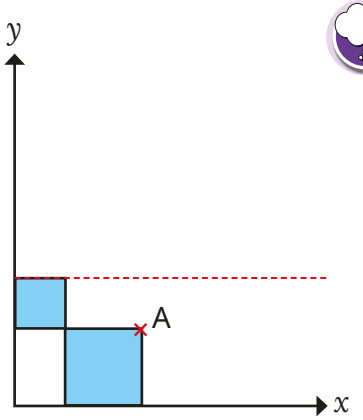


The area of the small square is 4 squares.

The area of the large square is 9 squares.

Both squares are reflected in the mirror line.

What are the new coordinates of vertex A?



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