Summer Block 6

Position and direction

Small steps

Step 1	Describe position using coordinates
Step 2	Plot coordinates
Step 3	Draw 2-D shapes on a grid
Step 4	Translate on a grid
Step 5	Describe translation on a grid

Describe position using coordinates

Notes and guidance

In this small step, children are introduced to coordinate grids and begin to describe the positions of points on a grid.

Explain that the x-axis is horizontal and the y-axis is vertical. Show that the point where the axes meet has the coordinates (0, 0) and the numbers increase on both axes, like number lines. Model how to describe the positions of points using coordinates, emphasising the importance of reading from the x-axis first. This could be modelled on a large grid in the playground. Repeat with a range of different coordinates, including where one of the numbers is zero. Once confident with giving coordinates of points, children could begin to explore finding the coordinates of the vertices of shapes.

The focus of this step is reading coordinates and children do not plot points on a coordinate grid until the next step.

Things to look out for

- Children may confuse the x- and y-values of the coordinates and read them in the wrong order.
- Children may need support to read coordinates of points on the axes.
- Children may think that coordinates refer to a whole square rather than a point.

Key questions

- What is the name of the horizontal/vertical axis?
- What is the same and what is different about the x-axis and the y-axis?
- Which axis do you look at first when finding the coordinates of a point?
- In what order do you read the coordinates of a point?
- What are the coordinates of the point?
- Why are there two values in a pair of coordinates?

Possible sentence stems

- Look at the _____-axis before the _____-axis.
- The first value in a pair of coordinates is the _____-value and the second value is the _____-value.
- The coordinates of point A are (_____, _____).

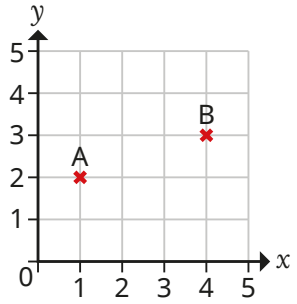
National Curriculum links

- Describe positions on a 2-D grid as coordinates in the first quadrant

Describe position using coordinates

Key learning

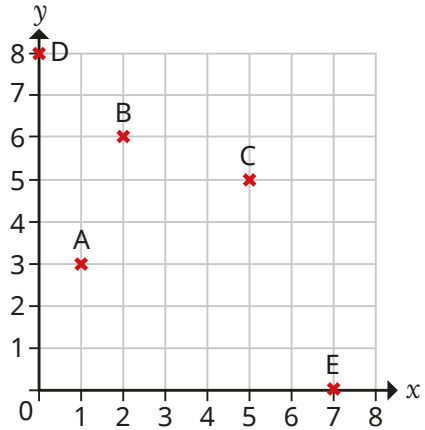
- Here is a coordinate grid.



  - The coordinates of point A are (1, 2).

    What do the numbers 1 and 2 represent?
  - What are the coordinates of point B?

- Write the coordinates of each point.



What do you notice about points D and E?

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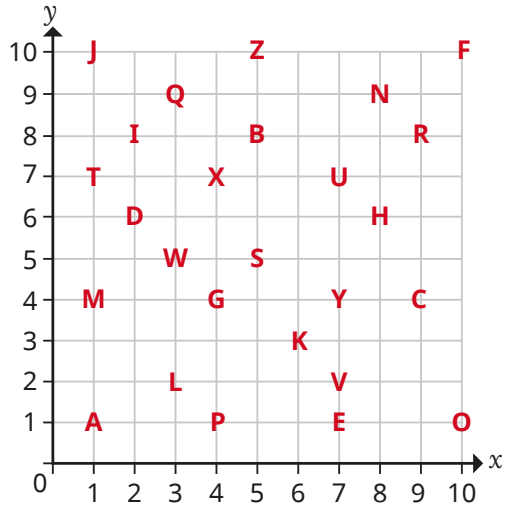
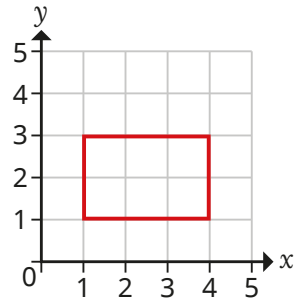


  - What are the coordinates of the letter Y?
  - What word do the letters at these coordinates spell?

(1, 4)	(1, 1)	(1, 7)	(8, 6)	(5, 5)

  - Write the coordinates of the letters that spell your name.

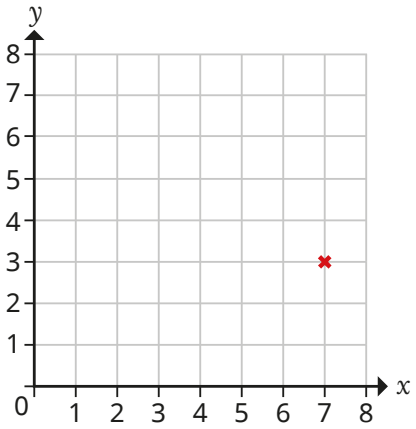
- Write the coordinates of the vertices of the rectangle.

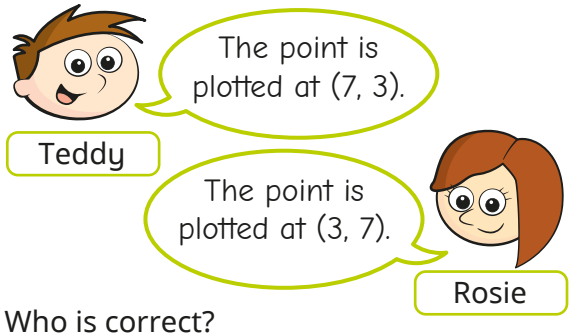


Describe position using coordinates

Reasoning and problem solving

A point is plotted on a coordinate grid.



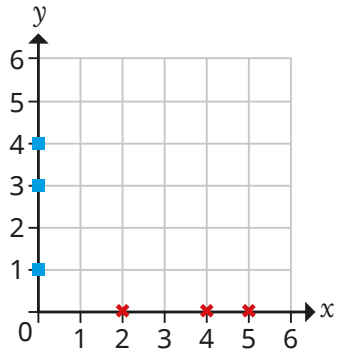


Who is correct?

What mistake has the other person made?

Teddy

Points are plotted on a coordinate grid as crosses or squares.



What do you notice about all the points marked with crosses (✖)?

What do you notice about all the points marked with squares (■)?

If the grid was larger, what could you say about these points?

(12, 0) (0, 12) (9, 0) (42, 0) (0, 17)

They are all on the x-axis, and the y-value of their coordinates is 0

They are all on the y-axis, and the x-value of their coordinates is 0

(12, 0), (9, 0) and (42, 0) on x-axis

(0, 12) and (0, 17) on y-axis

Plot coordinates

Notes and guidance

In this small step, children use their understanding from the previous step to plot points with given coordinates on a grid.

Recap the axes of a coordinate grid and how these relate to the values in a set of coordinates, with the x-value coming first. Then model plotting a point from given coordinates. Ask children how they know which coordinate corresponds to which axis. This could be modelled on a large grid in the playground, asking children to go and stand at points with given coordinates by moving horizontally from (0, 0) and then vertically. Ensure that children see that points are plotted on the lines and not in the spaces between the lines.

Discuss how it can be known where coordinates will go on a grid without plotting them first. For example, if two coordinates have the same x-value, then they are on the same vertical line, or if one of the coordinates is zero, then the point is on one of the axes.

Things to look out for

- Children may confuse the x- and y-values of the coordinates and plot them in the wrong order.
- Children may use coordinates to identify a square rather than a point.

Key questions

- Which value in a pair of coordinates tells you how far horizontally/vertically the point is?
- Do you plot a point on the line or in the space between the lines?
- Does the order of the numbers in a pair of coordinates matter? Why?
- How far along the x-axis is the point (_____, _____)?
- How far up the y-axis is the point (_____, _____)?
- Where does the point (_____, _____) go on the grid?

Possible sentence stems

- The first value in a pair of coordinates tells me how far along the _____-axis the point is.
- The second value in a pair of coordinates tells me how far up the _____-axis the point is.

National Curriculum links

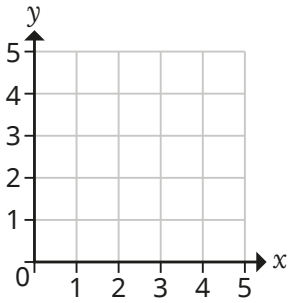
- Describe positions on a 2-D grid as coordinates in the first quadrant
- Plot specified points and draw sides to complete a given polygon

Plot coordinates

Key learning

- Follow Mo's instructions for plotting the point (4, 1) on the grid.

1. Find 4 on the x-axis and draw a vertical line.
2. Find 1 on the y-axis and draw a horizontal line.
3. Where the two lines meet, draw a cross.



How could you plot the point without drawing lines?

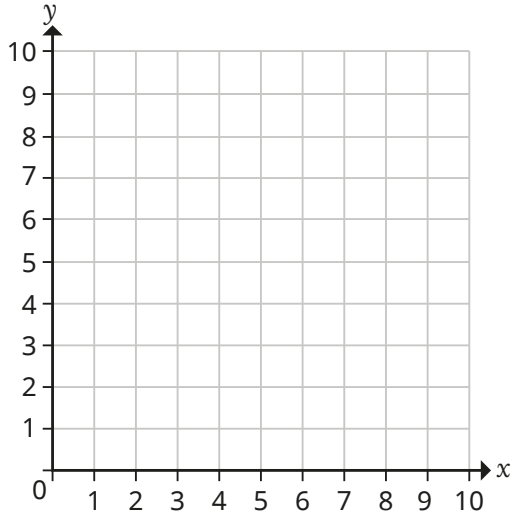
- Plot and label the points on the grid.

A (2, 1)

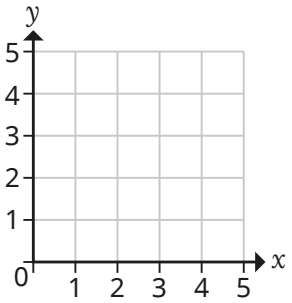
B (6, 5)

C (10, 2)

D (2, 10)



- Plot and label the points on the grid.



A (2, 0)

B (0, 3)

- Plot the points on a coordinate grid.

(0, 5) (4, 5) (7, 5) (10, 5)

Join up the points. What do you notice?

Could you have known this before plotting the points on the grid?

- Plot the points (3, 3) and (7, 3) on a coordinate grid.

Draw a straight line between them.

Plot the points (5, 5) and (5, 1) on the same grid.

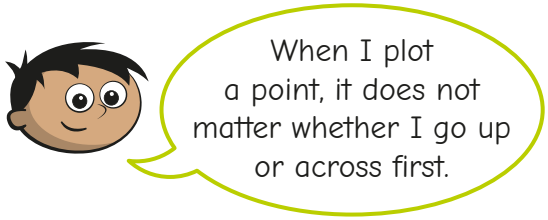
Draw a straight line between them.

What are the coordinates where the lines cross?

Plot coordinates

Reasoning and problem solving

Amir is plotting points on a coordinate grid.



Is Amir correct?

Explain your answer.

No

Sam has plotted the point (4, 5).

Tommy has plotted the point (5, 8).

Eva has plotted the point (4, 8).

Which two children have plotted a point on the same grid line?

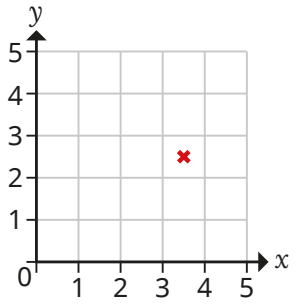
Is there more than one answer?

Is there a way of knowing this without plotting the points on a grid?

Sam and Eva: same vertical line

Tommy and Eva: same horizontal line

Jo is plotting the point (3, 2) on the grid.



What mistake has Jo made?

Explain your answer.

Jo has plotted the point in the square rather than on the grid lines.

Is the statement always true, sometimes true or never true?

> If one of the values in a set of coordinates is zero, then the point must be plotted on the x-axis.

Explain your answer to a partner.

sometimes true

Draw 2-D shapes on a grid

Notes and guidance

In this small step, children gain more experience of reading and plotting points by drawing 2-D shapes on a coordinate grid.

Children can begin by plotting given points and joining the points with lines to form a polygon. Then show them examples where three out of four vertices of a rectangle are already on a grid and ask where the fourth vertex will be. Discuss any connections between the coordinates of the missing vertex and the coordinates of the vertices that it shares a side with. Children can also explore more open examples where just two vertices are given and the other vertices could be in multiple positions. Once they have drawn simple squares and rectangles, children draw shapes with specific properties, such as an isosceles triangle or a variety of quadrilaterals.

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 not recognise shapes drawn on grids in non-standard orientations and/or may think that a shape is impossible to draw, for example a square if the sides are not horizontal and vertical.

Key questions

- Which value in a pair of coordinates tells you how far horizontally/vertically the point is?
- Do you plot a point on the line or in the space between the lines?
- Does the order of the numbers in a pair of coordinates matter? Why?
- What polygon have you made? How can you tell?
- Is there more than one place the vertex could be?
- What does "isosceles" mean?
- How can you tell that the quadrilateral is a _____?
- How many sides have you drawn so far? What do you know about the sides of a _____?

Possible sentence stems

- Read the _____-value before the _____-value.
- Two points on a horizontal/vertical line have the same _____-value.

National Curriculum links

- Plot specified points and draw sides to complete a given polygon

Draw 2-D shapes on a grid

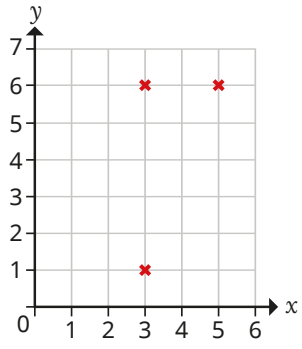
Key learning

- Three vertices of a rectangle have been plotted on a coordinate grid.

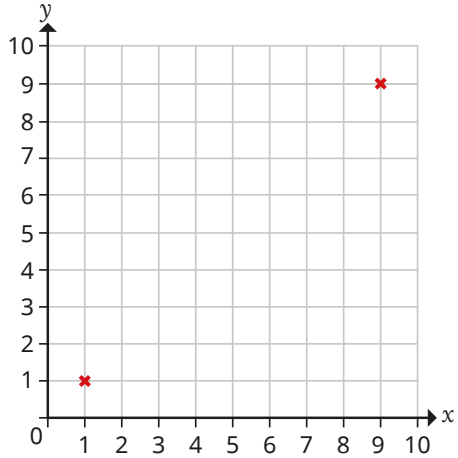
  Draw the fourth vertex.

  What are its coordinates?

  What do you notice about the coordinates of the four vertices?



- Dani plots two vertices of a square on a coordinate grid.



  Draw two more points to complete the square.

  What are the coordinates of your points?

  What do you notice about the coordinates of your points and the ones that Dani plotted?

- Plot the points on a grid and join them up.

(2, 4)	(4, 2)	(5, 8)	(7, 6)

  What shape have you made?

- Draw an isosceles triangle on a grid.

  Write the coordinates of each vertex.

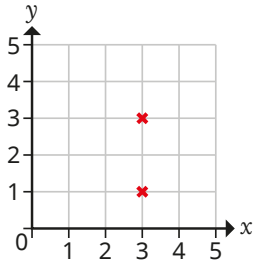
  How do you know that the triangle is isosceles?

- Three vertices of a rectangle have the coordinates (4, 6), (9, 6) and (4, 8).

  Find the coordinates of the fourth vertex of the rectangle.

  Is it possible to work this out without drawing on a grid?

- Two vertices of a square are plotted on the coordinate grid.

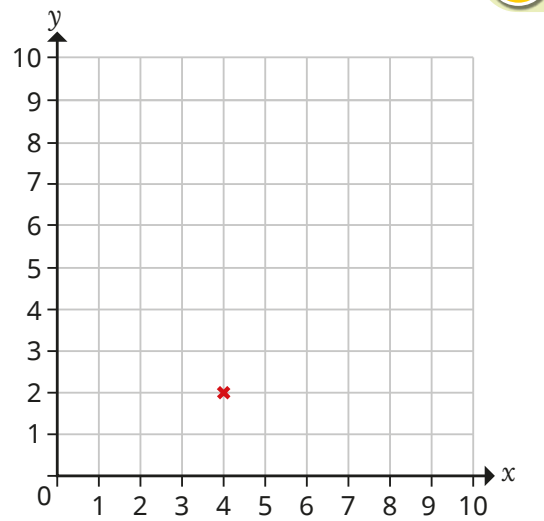


  What could the coordinates of the other two vertices be?

Draw 2-D shapes on a grid

Reasoning and problem solving

Huan plots a point on a coordinate grid.

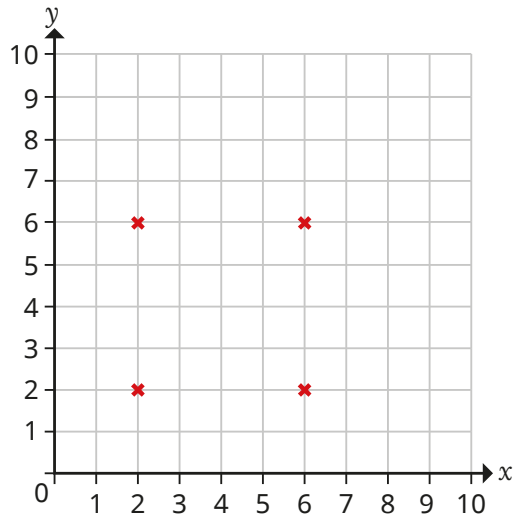


What polygons could Huan make, using the given point and three other points?

Draw the polygons and write the coordinates of their vertices.

Compare answers as a class.

Dora plots four vertices of a pentagon on a coordinate grid.



Where could the coordinates of the fifth vertex be?

Are there some parts of the grid where the vertex could not go?

The fifth vertex could be "inside" or "outside" the other four vertices, but not on the horizontal or vertical lines that the points lie on.

Translate on a grid

Notes and guidance

In this small step, children translate points and shapes on a coordinate grid for the first time.

Children start by translating one point horizontally or vertically. They understand that the word "translate" in this context means "move", but that the points can only move along grid lines. Once they are confident in translating a point either left/right or up/down, introduce the idea of translating a point both left/right and up/down. Model following the first instruction, marking lightly on the grid, then following the second instruction. In this case, they see that both the x- and y-values of the coordinates change. Finally, children translate simple 2-D shapes on a grid. Show that by translating one vertex at a time, the translated shape looks identical to the original shape, but is in a different position.

Things to look out for

- When translating a shape or point, children may count the point it is on as "1" and not translate enough spaces.
- When translating shapes, children may translate just one vertex and then draw the shape, leading to incorrect corresponding vertices.

Key questions

- What are the coordinates of point A?
- What does "translation" mean?
- What will the coordinates of point A be if the point is translated _____ squares to the left/right/up/down?
- What do you notice about the coordinates of a point when it is translated up/down **or** left/right?
- What do you notice about the coordinates of a point when it is translated up/down **and** left/right?
- When translating a shape, do you translate one vertex at a time? How else could you translate the shape?

Possible sentence stems

- When translating a point _____, the _____-value stays the same.
- Point A translates _____ squares to the left/right and _____ squares up/down.
  The new coordinates of point A are _____

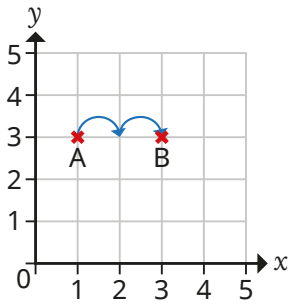
National Curriculum links

- Describe movements between positions as translations of a given unit to the left/right and up/down

Translate on a grid

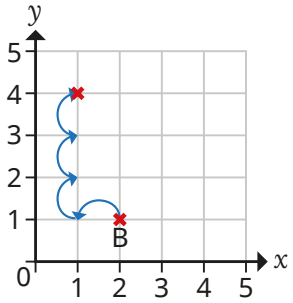
Key learning

- Annie has translated point A 2 squares to the right and labelled it B.



  - What are the coordinates of point B? What do you notice about the coordinates of point A and point B?
  - Translate point A 2 squares down and label it C. What do you notice about the coordinates of point C?

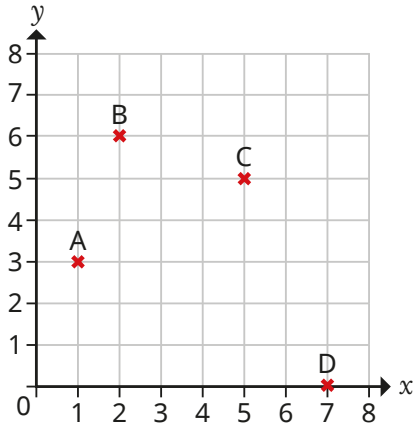
- Max has translated point B 1 square left and 3 squares up.



What are the coordinates of point B now?

What do you notice?

- Translate the points.
  - point A 3 squares to the right
  - point B 5 squares down
  - point C 2 squares to the left and 1 square down
  - point D 5 squares to the left and 7 squares up

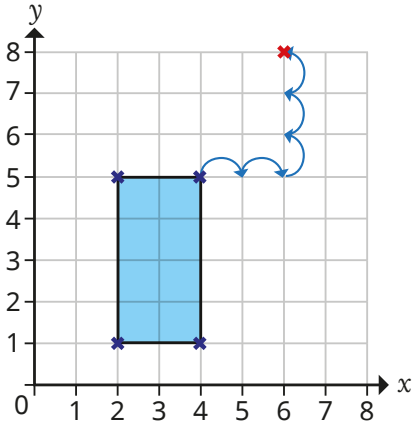


- Whitney is translating the rectangle 2 squares to the right and 3 squares up.

  She translates one vertex at a time.

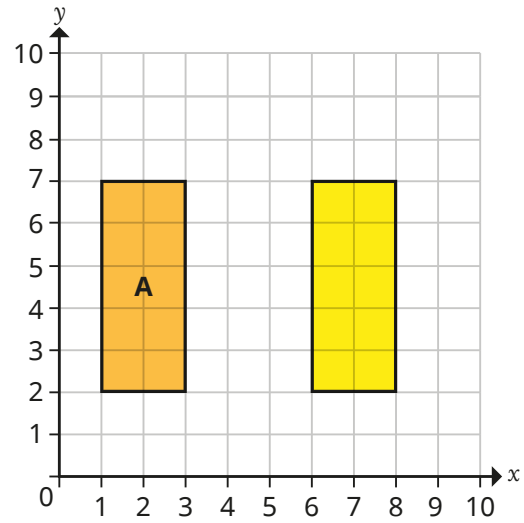
  The first vertex has been done already.

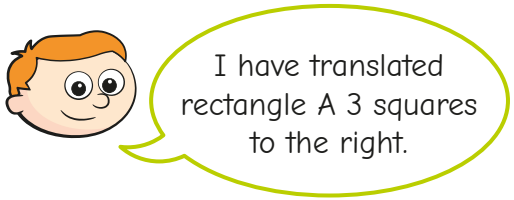
  What are the new coordinates of each vertex of the translated shape?



Translate on a grid

Reasoning and problem solving





What mistake has Ron made?

Draw the correct position of rectangle A after the translation.

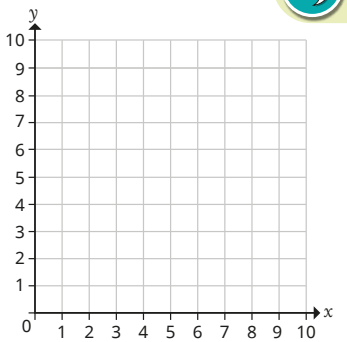
There is a gap of 3 squares between the rectangles, instead of each vertex being translated 3 squares to the right.

The bottom left vertex of the rectangle should be at (4, 2).

Here is a game to play in pairs.

Each player needs:

- one small cube
- one barrier (for example, a mini whiteboard)
- a coordinate grid



Both players hide their grid from each other.

The first player places a cube on a point on their grid. They describe the original position and perform a translation.

The second player listens to the instructions and performs the same translation.

They check to see if they have placed their cube at the same point.

Swap roles and repeat several times.

Translations will vary.

Describe translation on a grid

Notes and guidance

In this small step, children use their understanding from the previous step to describe the translation that has taken place when they are given a pair of points or shapes.

Children begin by looking at a point that has only been translated either up/down or left/right. They see that if it is on the same grid line as the first point, it has only moved in one direction. Encourage children to practise counting how many squares the point has moved, taking care not to count the square the point/shape starts from. Then they move on to points that have moved both left/right and up/down. They should count left/right from the first point, make a small mark on the paper, then count up/down. Finally, children describe translations between shapes, focusing on how one vertex of the shape has been translated to the corresponding vertex on the other shape.

Things to look out for

- Children may count the point a translation starts from as "1".
- When describing the translation of shapes, children may describe the translation between a pair of vertices that are not corresponding.

Key questions

- What does "translation" mean?
- What is the same and what is different about the two shapes?
- How can you describe the translation that has happened from one point to another point?
- Has this point been translated up or down?
  Has it been translated left or right?
  Has it been translated in both directions?
- Which vertex in shape B corresponds to this vertex in shape A?

Possible sentence stems

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

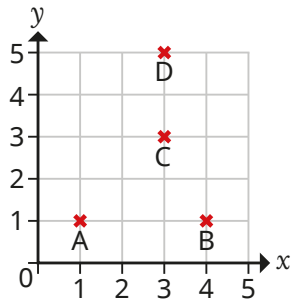
National Curriculum links

- Describe movements between positions as translations of a given unit to the left/right and up/down

Describe translation on a grid

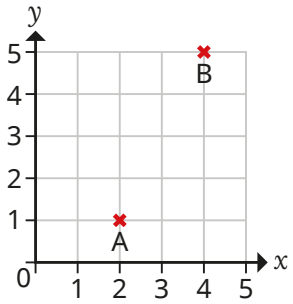
Key learning

- Four points are plotted on a coordinate grid.



  - Describe the translation from point A to point B.
  - Describe the translation from point C to point D.

- Complete the sentence to describe the translation.

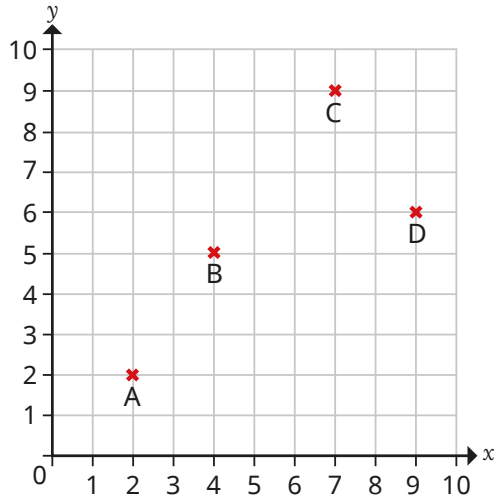


Point A has been translated _____ squares right and _____ squares up.

Is the translation from B to A the same as the translation from A to B?

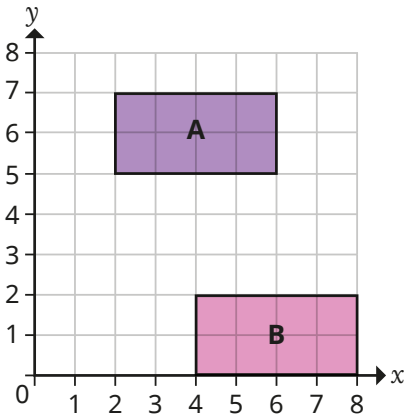
- Describe the translation from:
  - A to D
  - B to C
  - C to D
  - C to B

Plot two new points and describe the translations from point A to the new points.



- Two shapes are drawn on a coordinate grid.
  - Describe the translation of shape A to shape B.
  - Describe the translation of shape B to shape A.

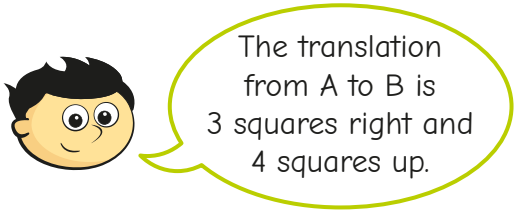
What do you notice?

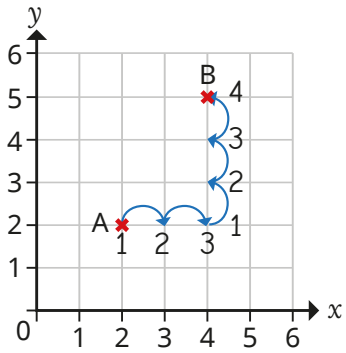


Describe translation on a grid

Reasoning and problem solving

Jack is describing the translation of point A to point B.





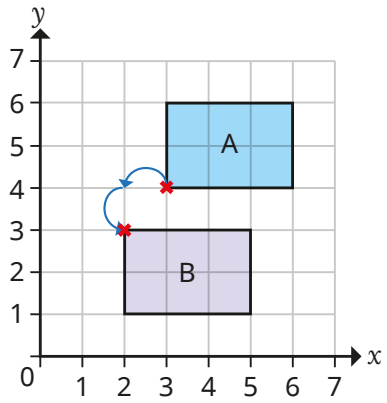
Explain Jack's mistake.

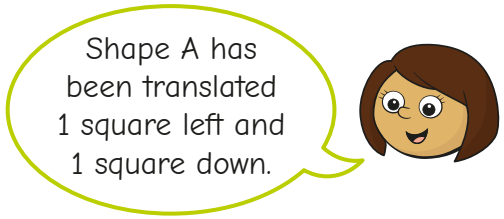
What is the correct translation from A to B?

Jack has included the starting points in his count.

2 squares right and 3 squares up

Kim is describing the translation of the shape.





Explain why Kim is wrong.

What is the correct translation from shape A to shape B?

Kim has not described the translation of corresponding vertices.

1 square to the left and 3 squares down