28. [Location / Transformation]

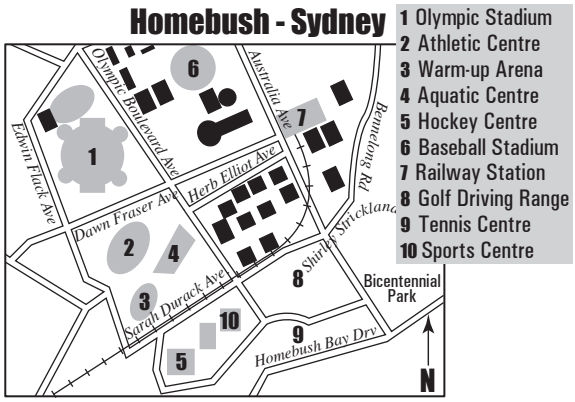
Skill 28.1 Following directions and using compass bearings to describe location on a map.

MM4.2 1 1 2 2 3 3 4 4
MM5.1 1 1 2 2 3 3 4 4

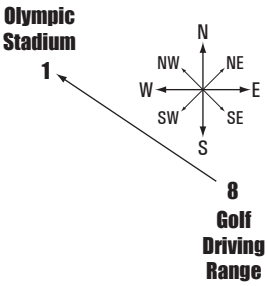
- Follow the directions one at a time.

Hints: A compass showing North will allow you to find your bearings.
Clockwise from North, "Never Eat Sea Weed" is one way to remember the 4 point compass.

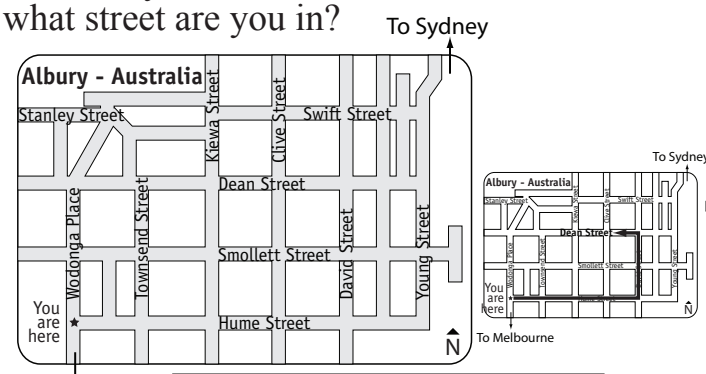
Q. At Homebush, in which direction is the Olympic Stadium from the Golf Driving Range?



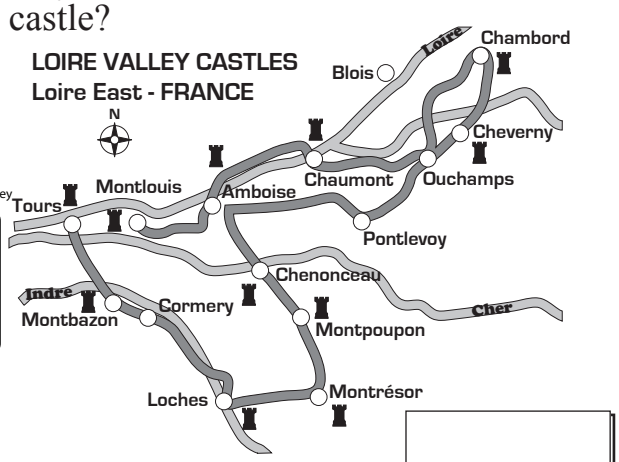
A. *NW* Focus on the relevant information.



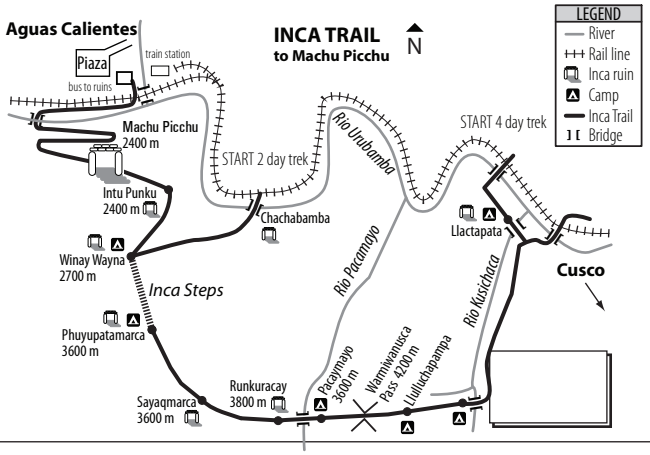
a) From where you are, travel east until you reach David Street. Then walk north. If you take the second turn left, what street are you in?



b) From Montrésor castle, which direction do you have to drive to reach Loches castle?

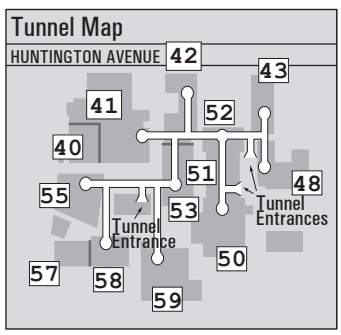


c) From the northern most bridge over Rio Kusichaca you travel south-east on the Inca Trail until the T intersection. Then you turn right and follow the Inca Trail to the Inca Steps. How many more bridges do you cross?



d) Using the closest tunnel entrance to building 58, take the first turn right, then turn left. Turn right and walk to the end of the tunnel. If you turn left again, which building are you facing?

Northeastern University - Boston, MA



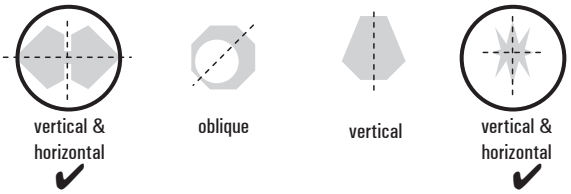
40 Barletta Natatorium
41 Cabot Physical Education Centre
42 Richards Hall
43 Dodge Hall
48 Mugar Life Sciences Building
50 Curry Student Centre
51 Blackman Auditorium
52 Ell Hall
53 Hayden Hall
55 Forsyth Building
57 Dana Research Centre
58 Snell Engineering Centre
59 Snell Library

Skill 28.2 Identifying and classifying symmetry in two-dimensional shapes.

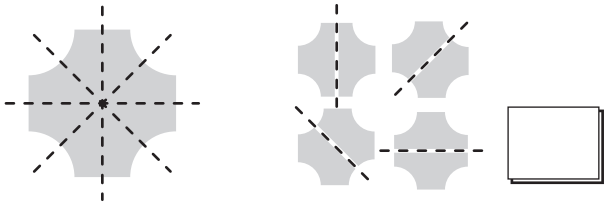
- Imagine a line along which the shape can be folded to have one part fit exactly over the other part.

Q. Draw the axes of symmetry for these shapes. Circle the shapes that are both horizontally and vertically symmetrical.

A.



a) Draw all the axes of symmetry for this shape. How many axes of symmetry does this shape have?



b) Draw all the axes of symmetry for this shape. How many axes of symmetry does this shape have?

c) Draw all the axes of symmetry for this shape. How many axes of symmetry does this shape have?

d) Draw all the axes of symmetry for this shape. How many axes of symmetry does this shape have?

e) Draw the axes of symmetry for these shapes. Circle the shapes that have horizontal symmetry.

f) Draw the axes of symmetry for these shapes. Circle the shapes that are both horizontally and vertically symmetrical.

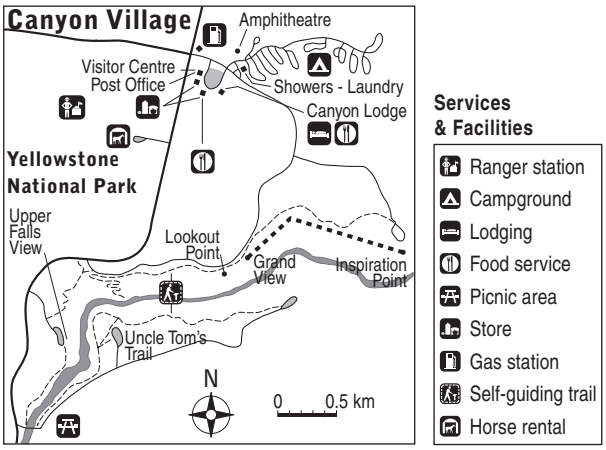
g) Draw the axes of symmetry for these shapes. Circle the shapes that have vertical symmetry.

h) Draw the axes of symmetry for these shapes. Circle the shapes that are both horizontally and vertically symmetrical.

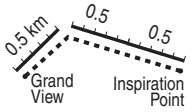
Skill 28.3 Using a scale to calculate distance on a map.

- Place a piece of paper against the scale matching the starting points.
- Slide the paper across the length of the scale marking the start and end points as you go.
- Add together the scale lengths covered.

Q. You walk from the Inspiration Point to Grand View, along the marked path. What distance did you travel in kilometres?



A. $0.5 + 0.5 + 0.5$
$= \mathbf{1.5\ km}$



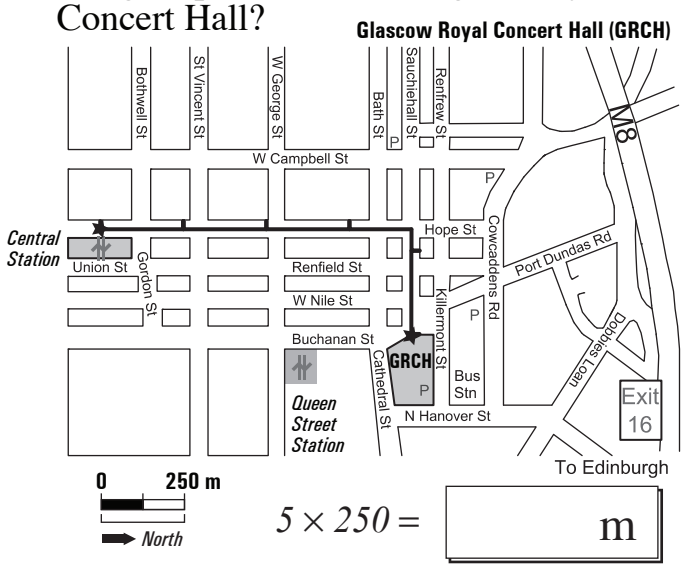
There are 2 distances to be measured.

Mark the start of the first distance and the turning point on paper. Rotate the paper to match the second distance and then mark the end.

Check the paper against the scale.

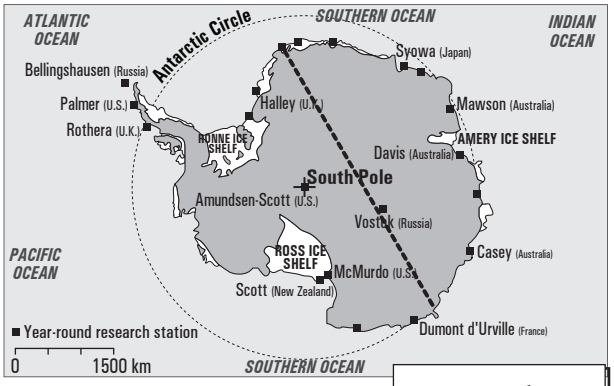
Slide the paper along the scale as necessary.

a) How far is it from Central Station, along Hope St. to the Glasgow Royal Concert Hall?



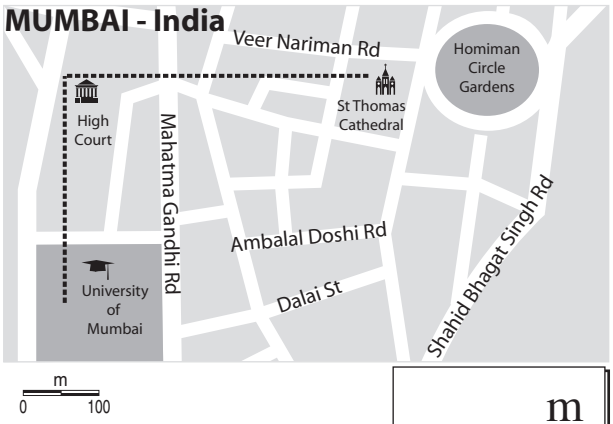
$5 \times 250 =$ ____ m

b) Using the scale, what is the marked distance on this map of Antarctica?



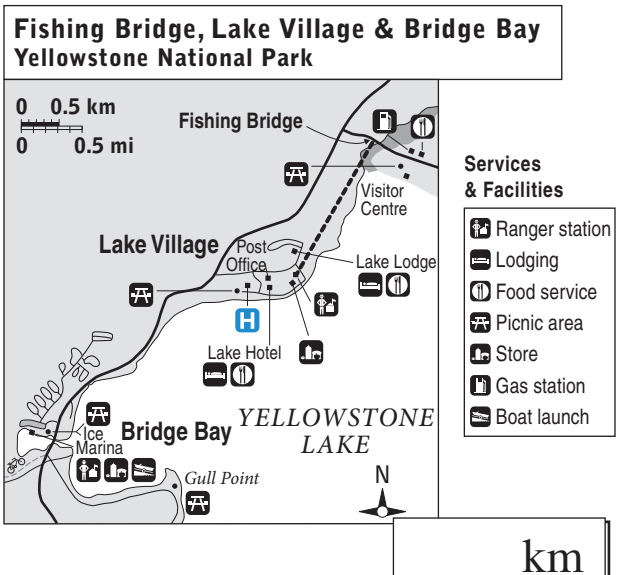
____ km

c) Using the scale, what is the marked distance from the University via the High Court to the Homiman Circle Gardens?



____ m

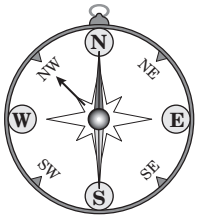
d) Using the scale, what is the marked distance from the ranger station closest to Lake Hotel to Fishing Bridge?



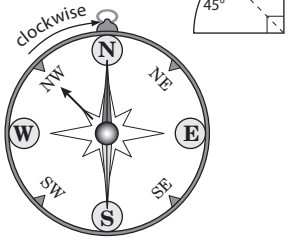
____ km

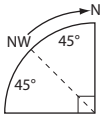
Skill 28.4 Describing rotations of two-dimensional shapes.

Q. According to the compass, you are facing north-west. How many degrees clockwise must you turn to face north?



A. *45°*

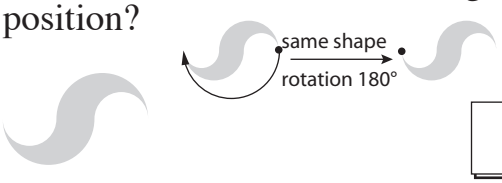




Find the North direction.

Calculate the number of degrees by picturing a circle.

a) By how many degrees must this shape be rotated to first match the original position?



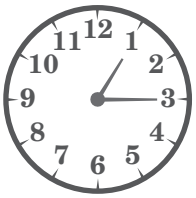
b) By how many degrees must this shape be rotated to first match the original position?

c) By how many degrees must this shape be rotated to first match the original position?

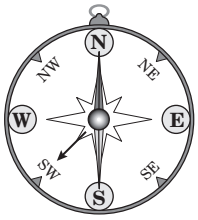
d) By how many degrees must this shape be rotated to first match the original position?

e) By how many degrees must the big hand of this clock rotate to show exactly 11:05?

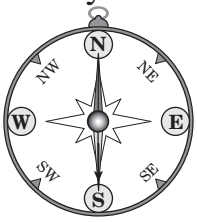
f) By how many degrees must the big hand of this clock rotate to show exactly 2:00?



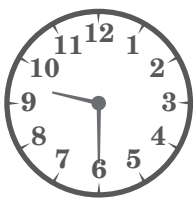
g) This compass shows that you are facing south-west. How many degrees clockwise must you turn to face north?



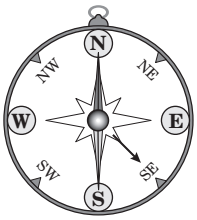
h) This compass shows that you are facing south. How many degrees anticlockwise must you turn to face north-west?



i) How many degrees must the big hand of this clock turn to show exactly 9:45?



j) According to the compass, you are facing south-east. How many degrees clockwise must you turn to face west?



Skill 28.5 Drawing translations, reflections and rotations of objects on a grid (1).

Translation (slide)

- Move the shape up (positive, vertically), down (negative, vertically), left (negative, horizontally) or right (positive, horizontally) on the grid, without flipping, turning or changing its size.

Reflection (like in a mirror)

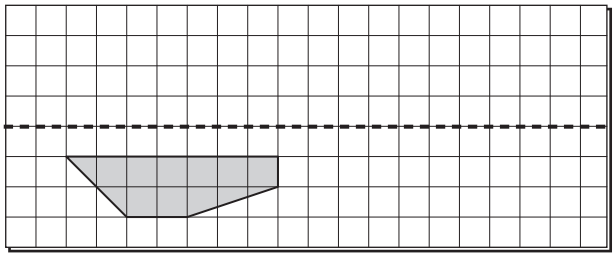
- Draw a perpendicular line to the mirror line from each vertex of the shape.
- Extend the perpendicular line beyond the mirror line by the same distance.
- Plot and join the reflected points.

Rotation (turning about a point or centre of rotation)

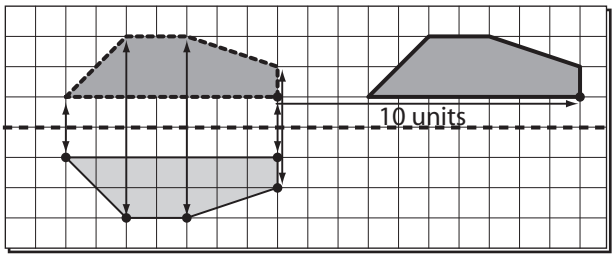
- Rotate each vertex by the given angle, in the given direction.
- Plot and join the rotated points.

Hint: The resulting shapes are always congruent to the original shapes (same size and shape).

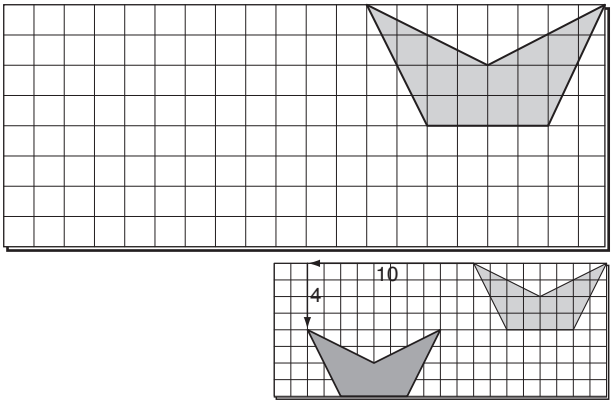
Q. Redraw this shape after reflecting it in the horizontal dotted line and then translating it 10 units to the right.



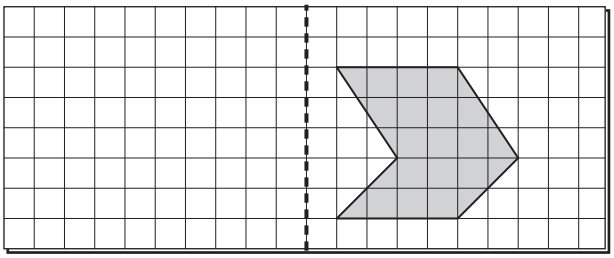
A.



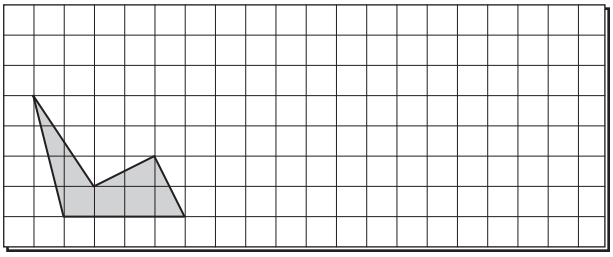
a) Redraw this shape after translating it 10 units to the right and 4 units down.



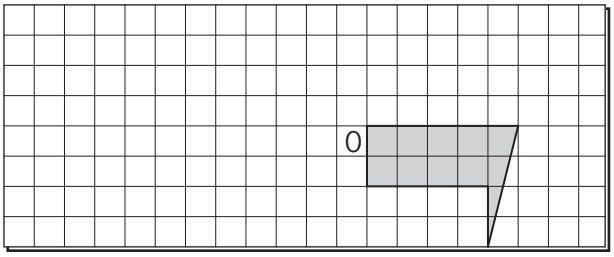
b) Redraw this shape after reflecting it in the vertical dotted line.



c) Redraw this shape after translating it 3 units up and 4 units to the right.

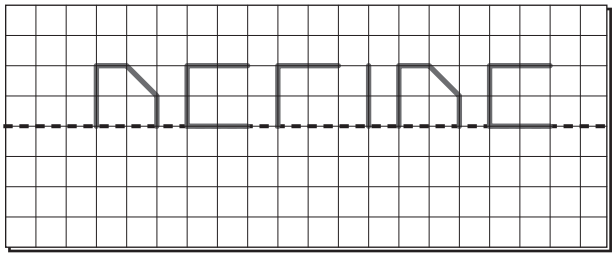


d) Redraw this shape after rotating it 180° about the point O.

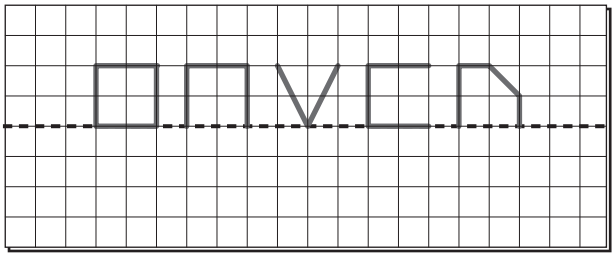


Skill 28.5 Drawing translations, reflections and rotations of objects on a grid (2).

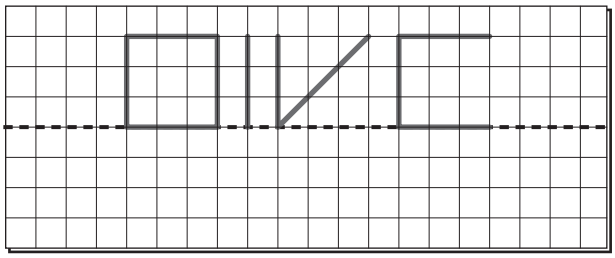
e) Redraw this diagram after reflecting it in the horizontal dotted line.



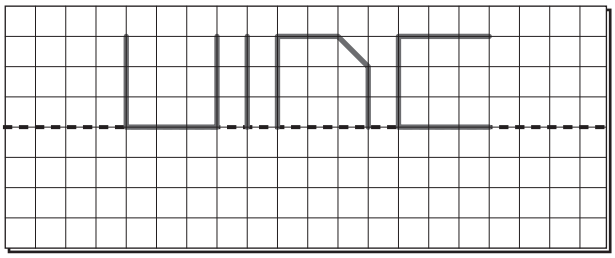
f) Redraw this diagram after reflecting it in the horizontal dotted line.



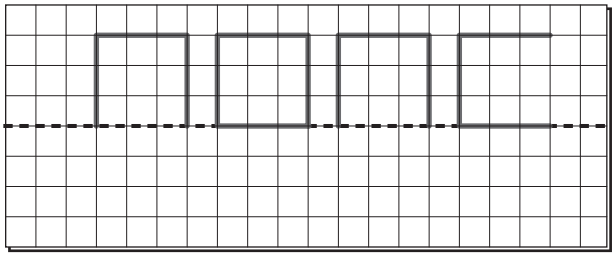
g) Redraw this diagram after reflecting it in the horizontal dotted line.



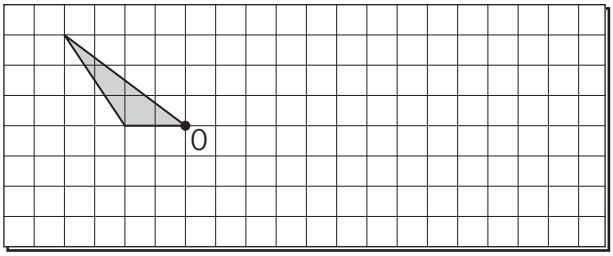
h) Redraw this diagram after reflecting it in the horizontal dotted line.



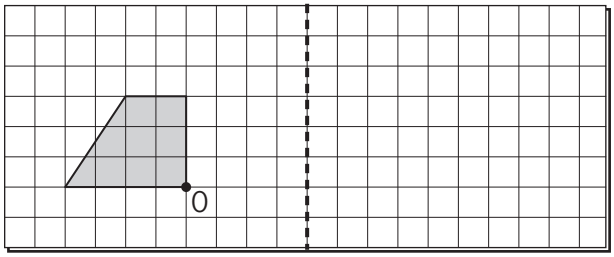
i) Redraw this diagram after reflecting it in the horizontal dotted line.



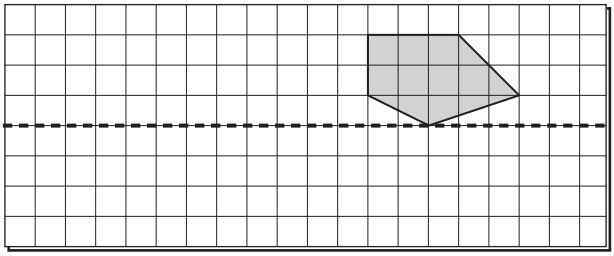
j) Redraw this shape after rotating it 180º about point O and then translating it 2 units up.



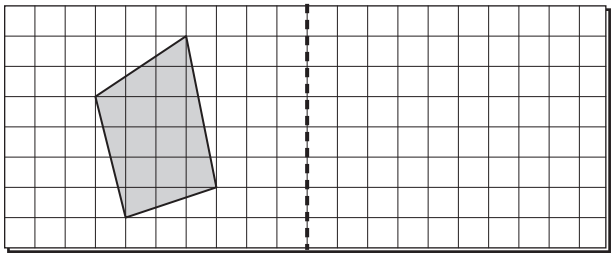
k) Redraw this shape after rotating it 90º clockwise about point O and then reflecting it in the vertical dotted line.



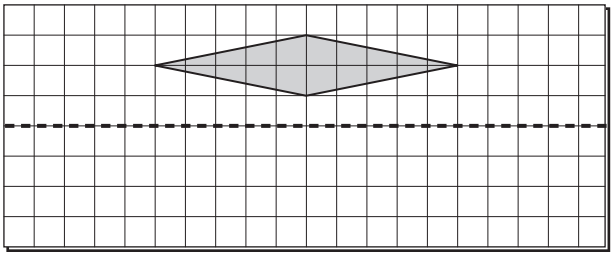
l) Redraw this shape after reflecting it in the horizontal dotted line and then translating it 9 units to the left.



m) Redraw this quadrilateral after reflecting it in the vertical dotted line and then translating it 2 units to the right.



n) Redraw this rhombus after reflecting it in the horizontal dotted line and then translating it 2 units to the left.

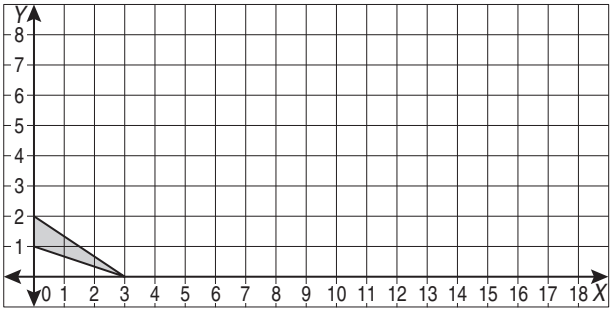


Skill 28.6 Drawing enlargements and reductions on a Cartesian plane.

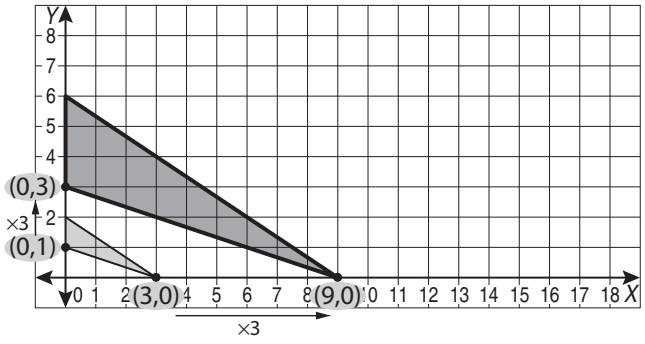
- Multiply or divide the *x*- and *y*-coordinates of the vertices of the given shape.
- Plot the new points.
- Join these points to form a new shape.

Hint: The resulting shape is always similar to the original shape (same shape, but different size).

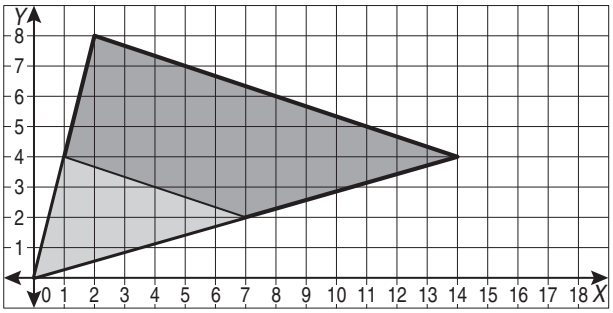
Q. Redraw the shape after multiplying the coordinates of its vertices by 3.



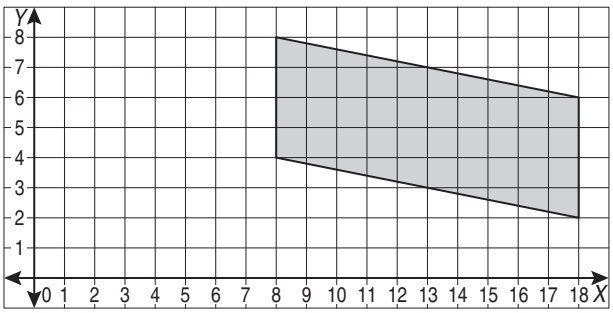
A.



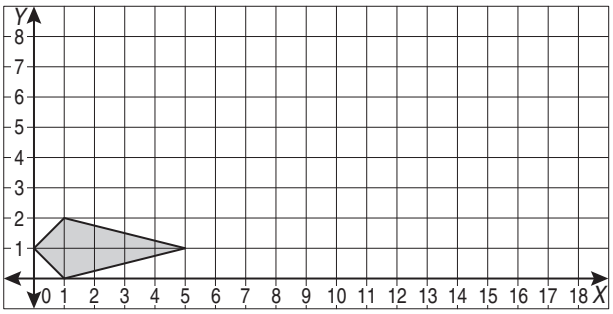
a) Redraw the triangle after doubling the coordinates of its vertices.



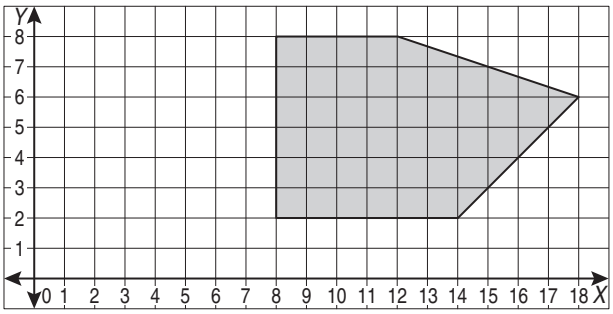
b) Redraw the parallelogram after halving the coordinates of its vertices.



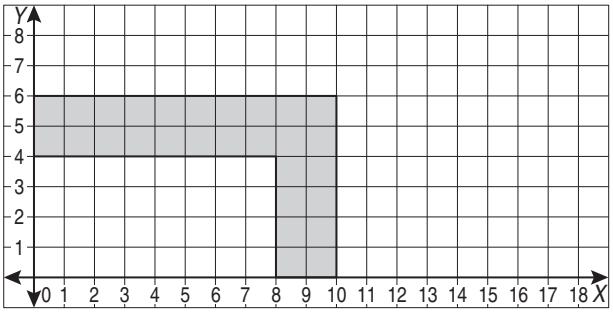
c) Redraw the kite after multiplying the coordinates of its vertices by 3.



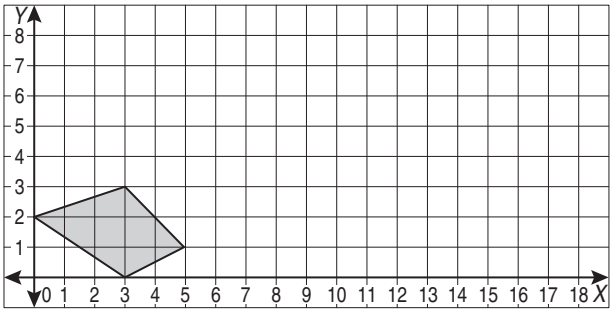
d) Redraw the shape after halving the coordinates of its vertices.



e) Redraw the shape after halving the coordinates of its vertices.

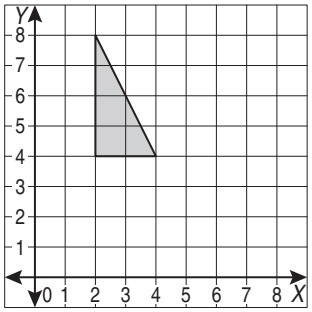


f) Redraw the shape after doubling the coordinates of its vertices.

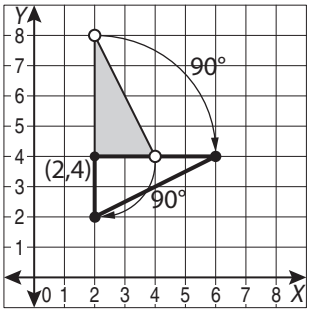


Skill 28.7 Drawing translations, reflections and rotations of objects on a Cartesian plane (1).

Q. Redraw this triangle after rotating it 90° clockwise about the point of coordinates (2,4).



A.



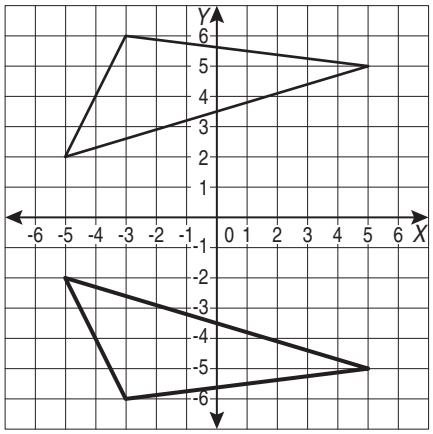
Move each vertex of the triangle by 90° clockwise.

Plot the new points.

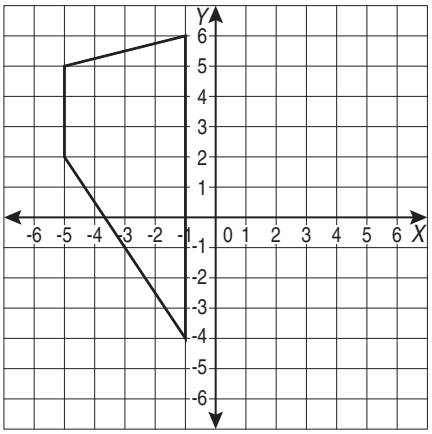
The point of coordinates (2,4) does not move.

Join the new points.

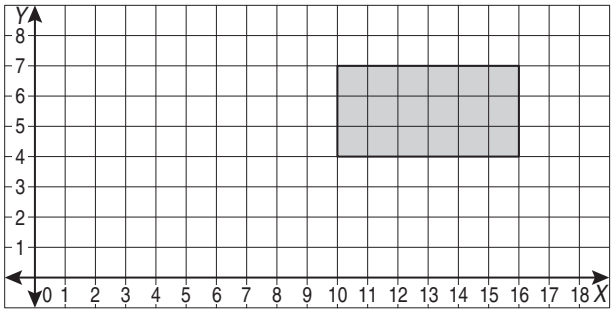
a) Redraw this triangle after reflecting it in the *x*-axis.



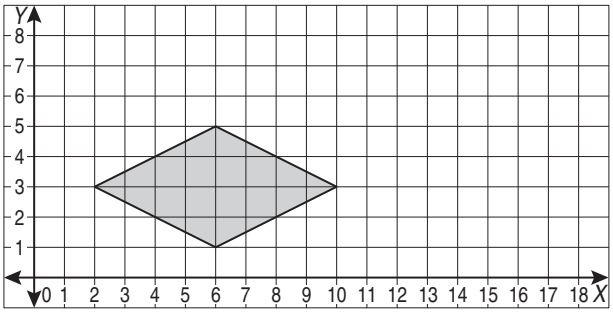
b) Redraw this trapezium after reflecting it in the *y*-axis.



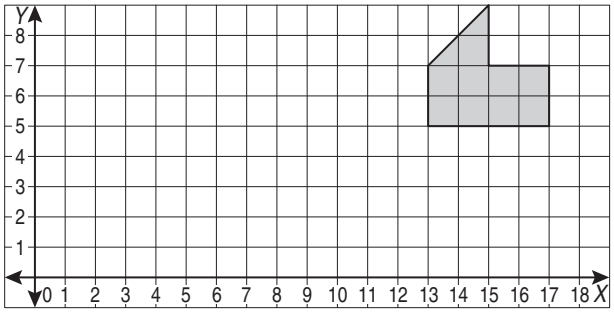
c) Redraw this rectangle after subtracting 4 units from the coordinates of its vertices.



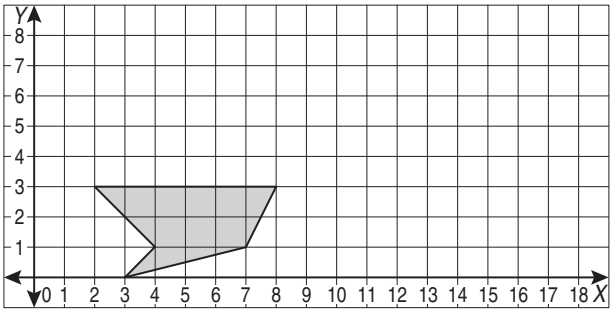
d) Redraw this rhombus after adding 3 units to the coordinates of its vertices.



e) Redraw this shape after subtracting 5 units from the coordinates of its vertices.

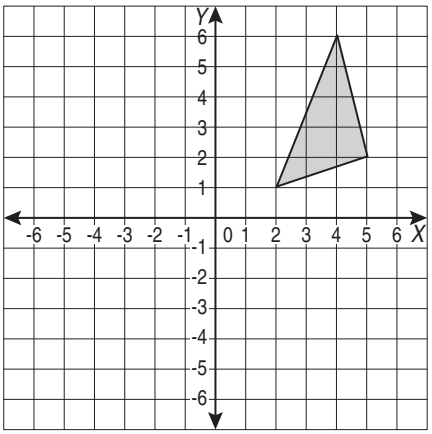


f) Redraw this shape after adding 5 units to the coordinates of its vertices.

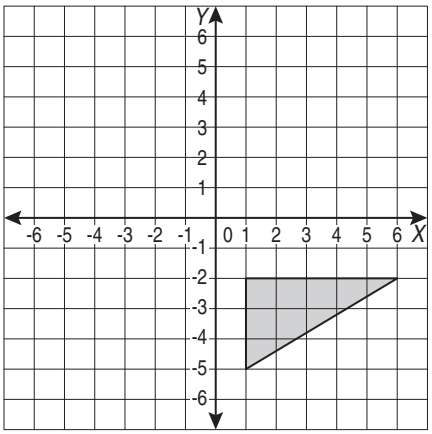


Skill 28.7 Drawing translations, reflections and rotations of objects on a Cartesian plane (2).

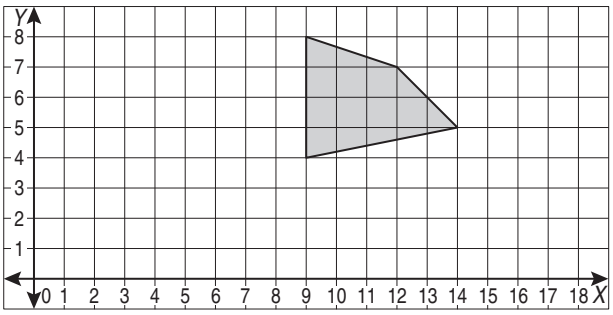
g) Redraw this triangle after subtracting 5 units from the *x*-coordinates and 6 units from the *y*-coordinates of its vertices.



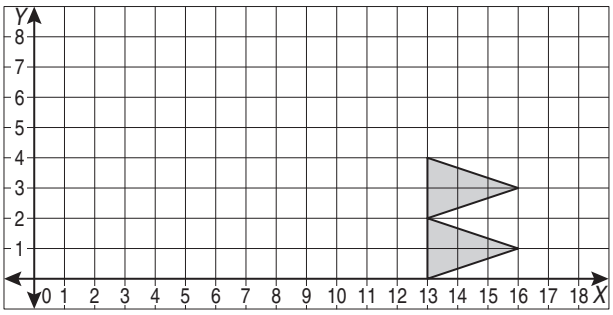
h) Redraw this triangle after adding 4 units to the *x*-coordinates and 7 units to the *y*-coordinates of its vertices.



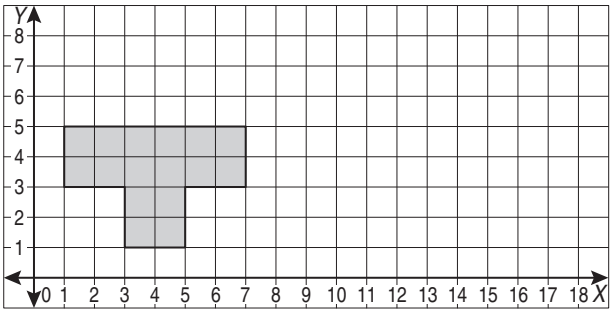
i) Redraw this shape after rotating it 180° about the point of coordinates (9,4).



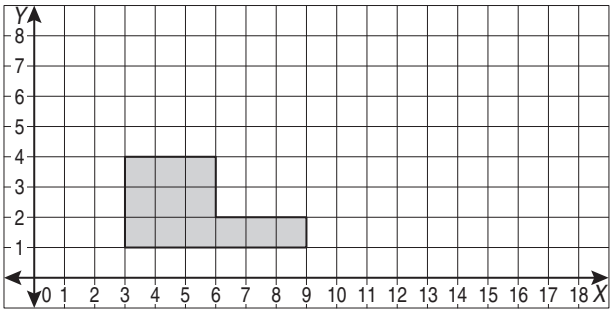
j) Redraw this shape after rotating it 180° about the point of coordinates (13,4).



k) Redraw this shape after rotating it 180° about the point of coordinates (7,5).



l) Redraw this shape after rotating it 90° clockwise about the point of coordinates (9,1).

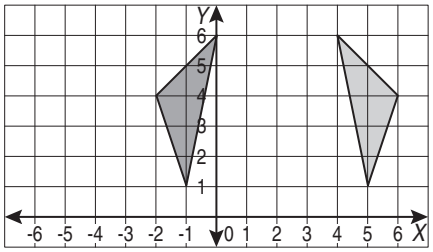


Skill 28.8 Describing transformations on a Cartesian plane.

- The transformation is a **translation** if the two shapes have the same size and orientation.
- The transformation is a **reflection** if the two shapes have the same size and are symmetrical about a vertical or horizontal line.
- The transformation is a **rotation** if the two shapes have the same size, different orientation and are **not** symmetrical about a vertical or horizontal line.

Q. Which transformation has moved the triangle?

A) a translation of –4 along the x-axis
B) a reflection in the line $x = 2$
C) a rotation of 180º



A. *A) the shapes have different orientation ⇒ not a translation*

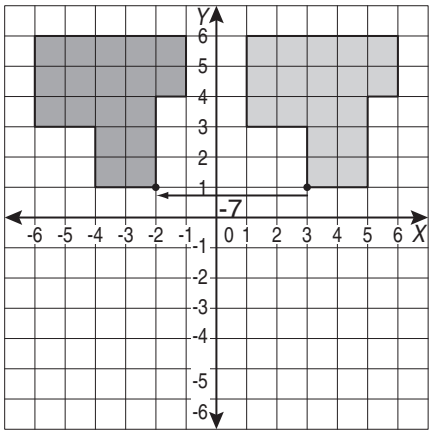
B) the shapes are symmetrical about a vertical line ⇒ a reflection

C) the shapes are symmetrical about a vertical line ⇒ not a rotation

The answer is ***B***.

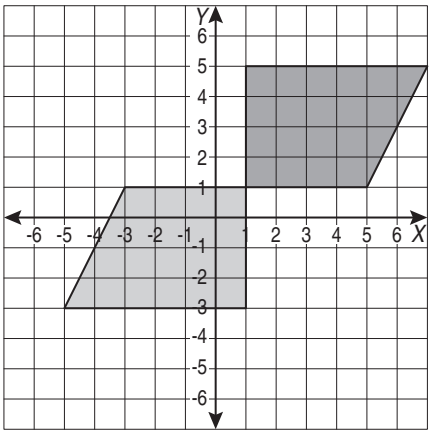
a) Which transformation has moved the shape?

A) a translation of –7 along the x-axis
B) a reflection in the y-axis
C) a rotation of 180º



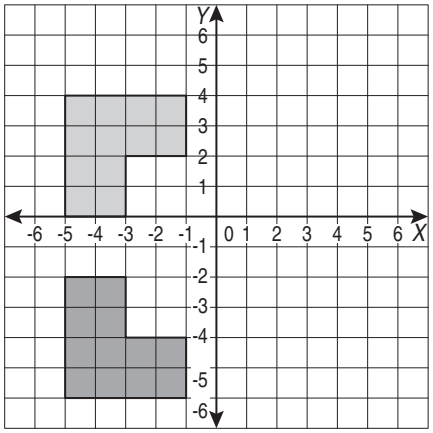
b) Which transformation has moved the trapezium?

A) a translation of 4 along the x-axis
B) a reflection in the line $x = 1$
C) a rotation of 180º



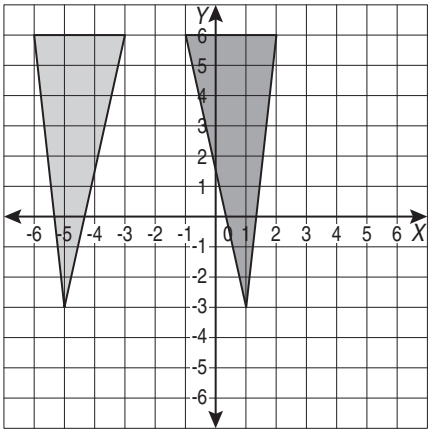
c) Which transformation has moved the shape?

A) a translation of –6 along the y-axis
B) a reflection in the line $x = -1$
C) a rotation of 90º anticlockwise



d) Which transformation has moved the triangle?

A) a translation of –3 along the y-axis
B) a reflection in the line $y = -2$
C) a rotation of 90º clockwise



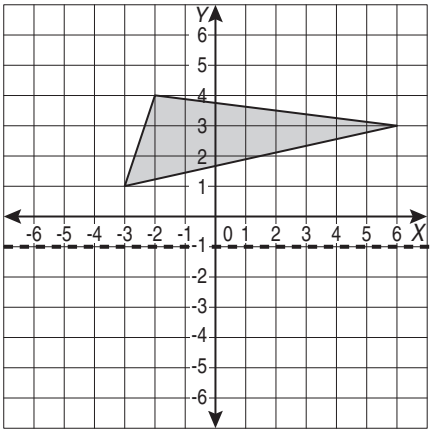
Skill 28.9 Drawing reflections of shapes in lines of given equations on a Cartesian plane.

Reflection (like in a mirror)

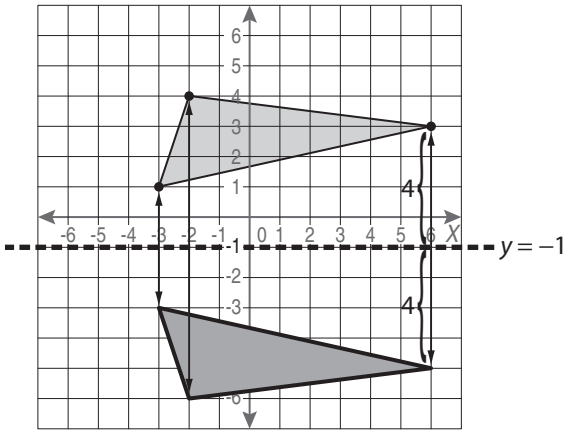
- Draw a perpendicular line to the mirror line from each vertex of the shape.
- Extend the perpendicular line beyond the mirror line by the same number of units.
- Plot and join the reflected points.

Hint: The resulting shapes are always congruent to the original shapes (same size and shape).

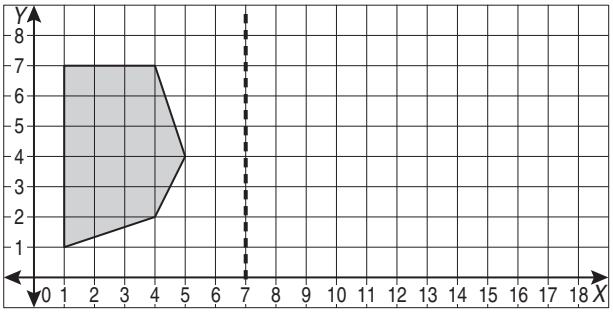
Q. Redraw this triangle after reflecting it in the line of equation $y = -1$



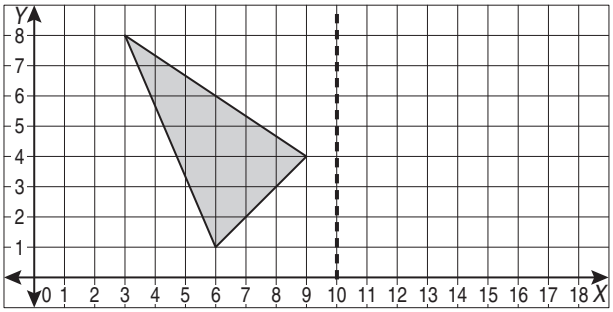
A.



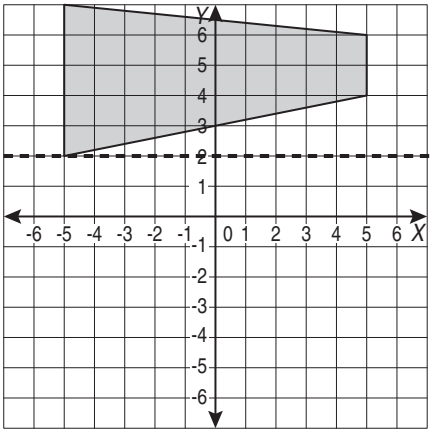
a) Redraw this shape after reflecting it in the line of equation $x = 7$



b) Redraw this triangle after reflecting it in the line of equation $x = 10$



c) Redraw this trapezium after reflecting it in the line of equation $y = 2$



d) Redraw this triangle after reflecting it in the line of equation $y = -2$