



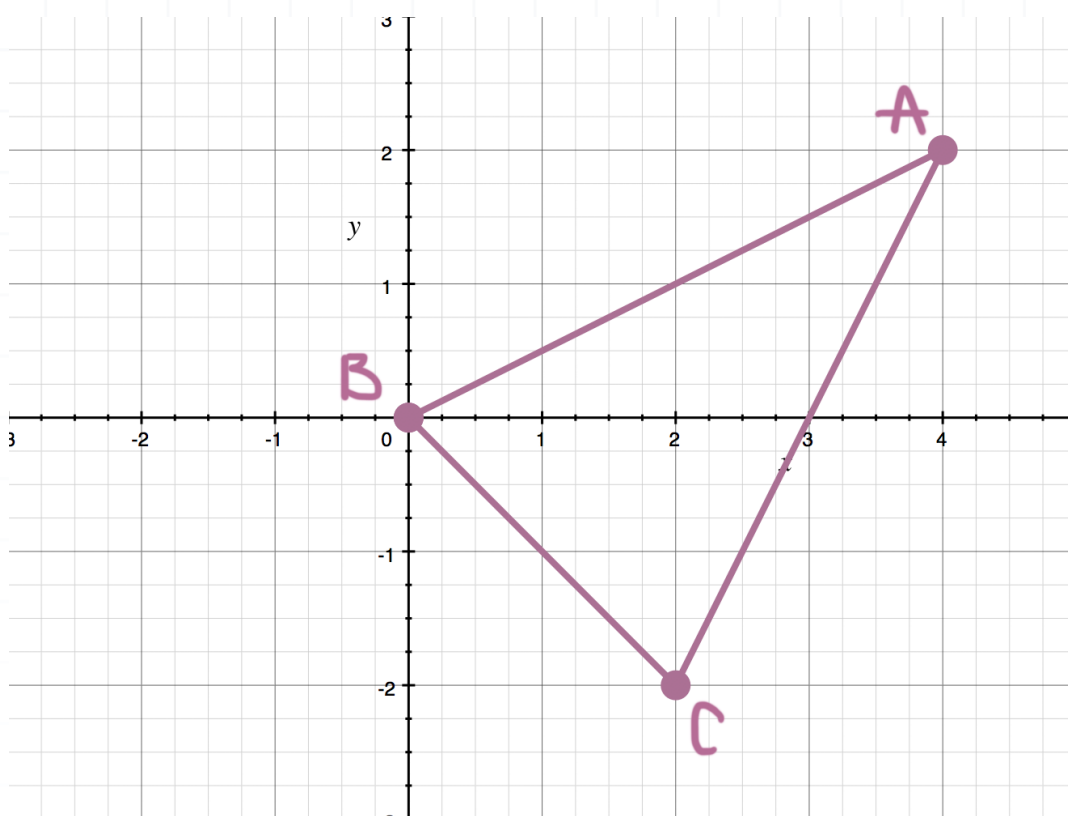
Geometry Workbook Solutions

Transformations

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MATH

TRANSLATING FIGURES IN COORDINATE SPACE

- 1. Find the new coordinates of $\triangle ABC$ under a translation of $(x, y) \rightarrow (x + 3, y - 2)$.



Solution:

$A'(7, 0)$, $B'(3, -2)$, $C'(5, -4)$. Translating each vertex of the triangle gives the vertices of the translated triangle.

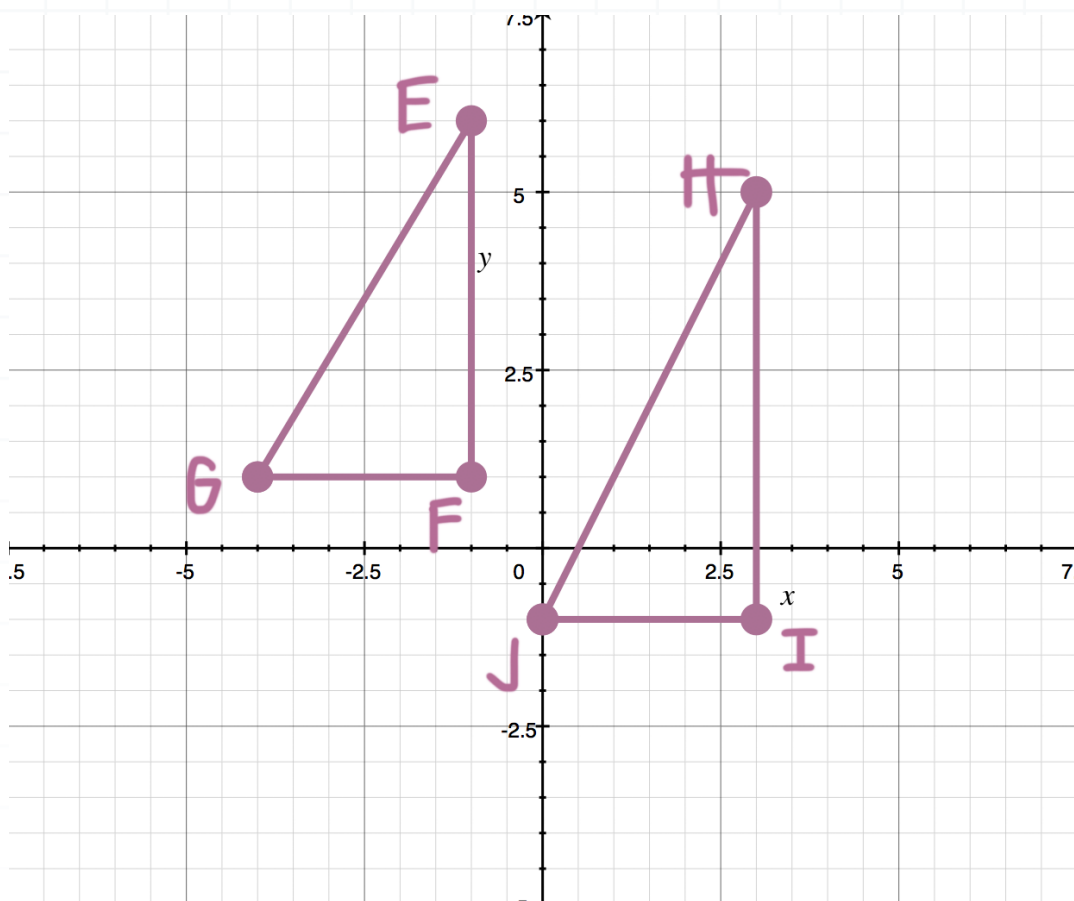
$$A(4, 2) \rightarrow (4 + 3, 2 - 2) \rightarrow (7, 0)$$

$$B(0, 0) \rightarrow (0 + 3, 0 - 2) \rightarrow (3, -2)$$

$$C(2, -2) \rightarrow (2 + 3, -2 - 2) \rightarrow (5, -4)$$



■ 2. Is $\triangle EFG$ a translation of $\triangle HIJ$? Explain why or why not.



Solution:

No, $\triangle EFG$ is not a translation of $\triangle HIJ$. We can see that EF is shorter than HI . For this to be a translation, the triangles must be congruent.

■ 3. $\odot A$ has its center at the origin and radius 3. Find the equation of this circle under a translation of 2 units to the right and 4 units up on the coordinate plane.



Solution:

$$(x - 2)^2 + (y - 4)^2 = 3^2$$

■ 4. A rectangle has a diagonal with endpoints at (5,1) and (14,7). Find the area of this rectangle under the translation $(x, y) \rightarrow (x - 5, y - 4)$.

Solution:

54. The area of the original rectangle is $(9)(6) = 54$. Because this is a translation, the rectangle will not change in size, but rather be moved to a new location in the plane. The area will remain the same.



ROTATING FIGURES IN COORDINATE SPACE

- 1. $X(2,5)$ is rotated clockwise about the origin and its translated coordinate is $X'(-5,2)$. By how many degrees was this point rotated?

Solution:

90°

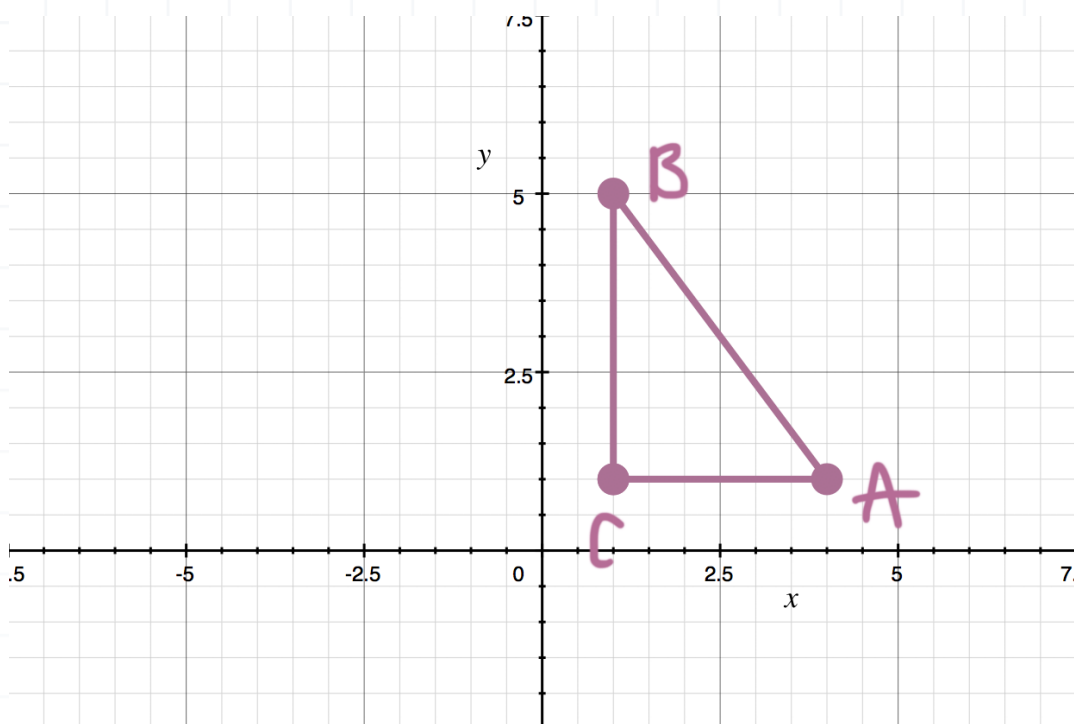
- 2. $B(-3 - 1)$ is rotated 180° counterclockwise about the origin. Find B' .

Solution:

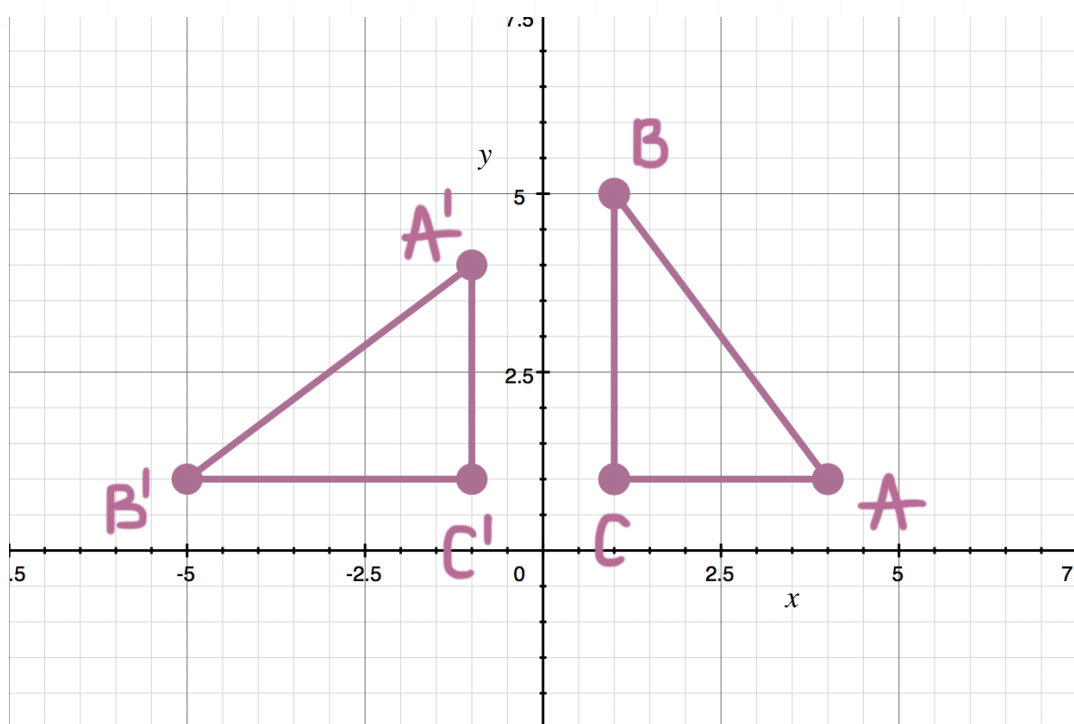
$B'(3,1)$. B must remain the same distance from the origin and move counterclockwise. B is in quadrant III, but will rotate 180° and end up in quadrant I. Its coordinates will therefore be $(3,1)$.

- 3. Graph $\triangle ABC$ under a rotation of 90° counterclockwise.





Solution:



■ 4. $G(-4, -6)$ is first translated 5 units to the right and 3 units up on the coordinate plane. Then this new coordinate is rotated 90° clockwise about the origin. Find its new coordinate.



Solution:

$(-3, -1)$. The translation gives us

$$G(-4, -6) \rightarrow (-4 + 5, -6 + 3) \rightarrow (1, -3)$$

Under a 90° rotation clockwise, the new coordinate will be $(-3, -1)$.



REFLECTING FIGURES IN COORDINATE SPACE

- 1. Find the coordinates of $A(-4,5)$ under a reflection over the x -axis.

Solution:

$A'(-4, -5)$. Reflecting over the x -axis will move the point from quadrant II to quadrant III, but will keep the point 5 units from the x -axis.

- 2. Find the coordinates of $J(3,4)$ under a reflection over the y -axis.

Solution:

$J'(-3,4)$. Reflecting over the y -axis will move the point from quadrant I to quadrant II, but will keep the point 3 units from the y -axis.

- 3. Find the coordinates of $K(-1,4)$ under a reflection over the line $y = 2$.

Solution:

$K'(-1,0)$. $y = 2$ is a horizontal line running through $y = 2$. K is 2 units above this line and therefore its reflection will be 2 units below this line.



- 4. Find the coordinates of $P(5, -2)$ under a reflection over the line $y = x$.

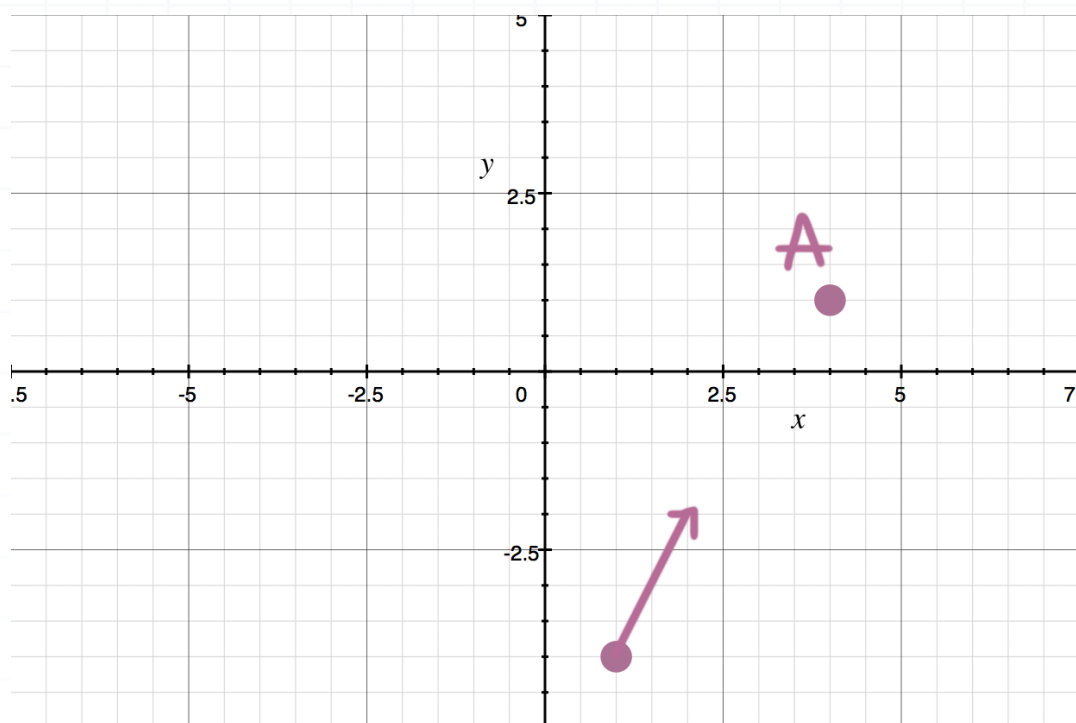
Solution:

$P'(-2, 5)$. When a point is reflected over the line $y = x$, its transformation is $(x, y) \rightarrow (y, x)$.



TRANSLATION VECTORS

- 1. Find A' as directed by the vector shown.



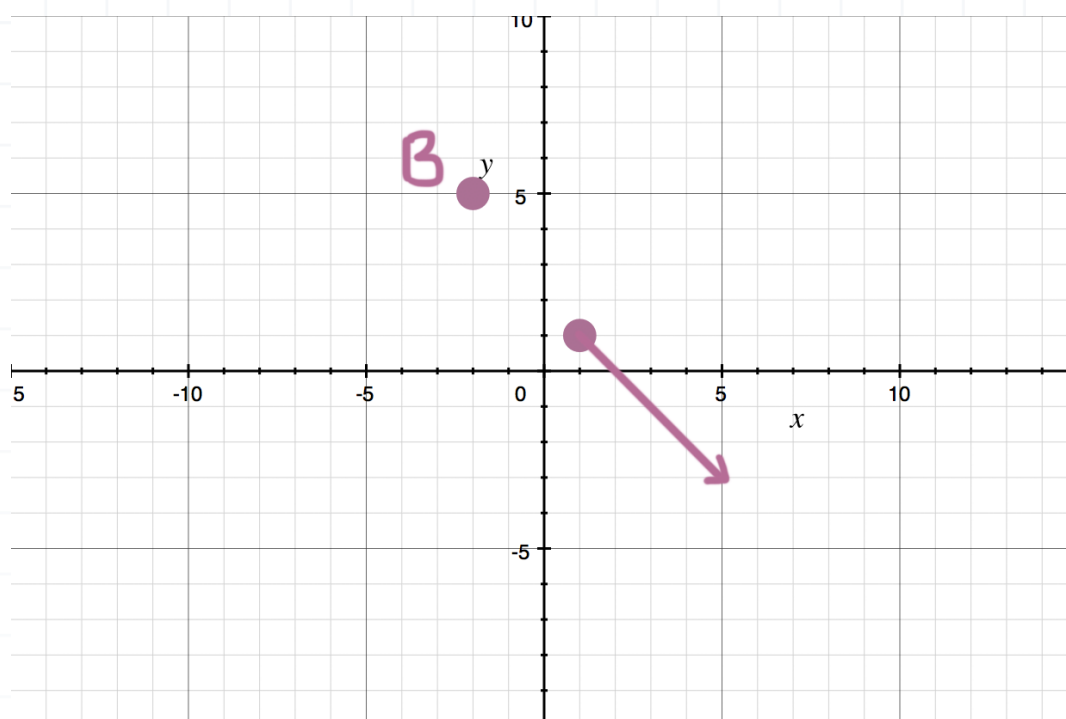
Solution:

$A'(5,3)$. The vector shows a translation of 1 unit in the x -direction and 2 units in the y -direction.

$$A(4,1) \rightarrow (4 + 1, 1 + 2) \rightarrow (5,3)$$

- 2. Find B' as directed by the vector shown.





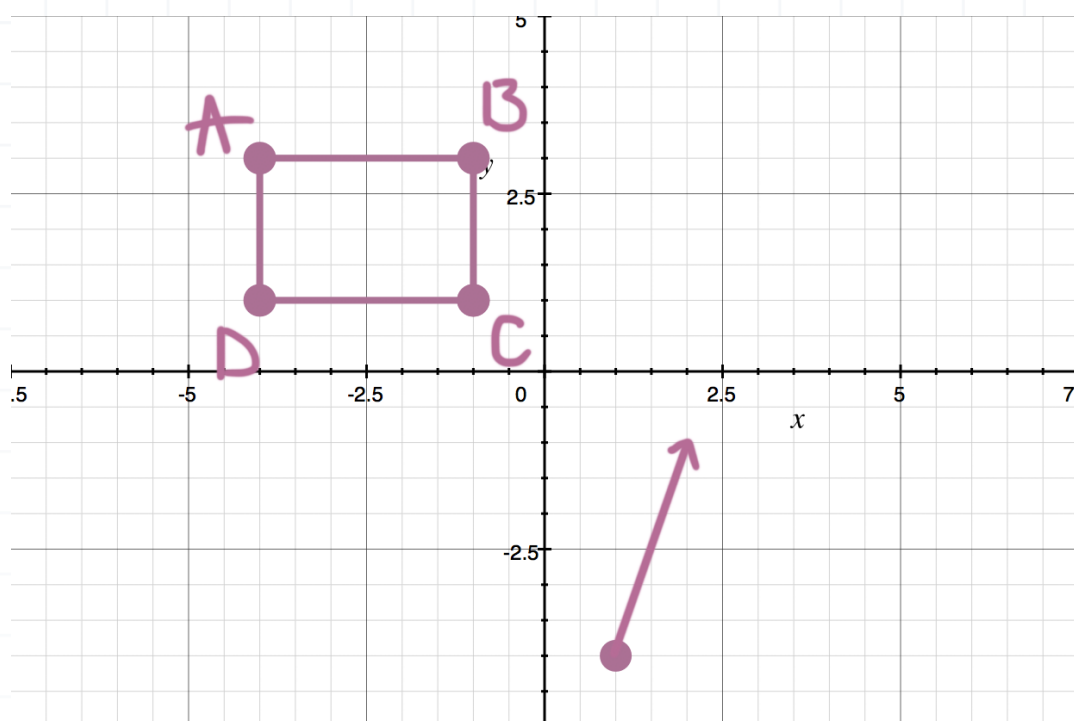
Solution:

$B'(2,1)$. The vector shows a translation of 4 units in the x -direction and -4 units in the y -direction.

$$B(-2,5) \rightarrow (-2 + 4, 5 - 4) \rightarrow (2,1)$$

■ 3. Find D' as directed by the vector shown.





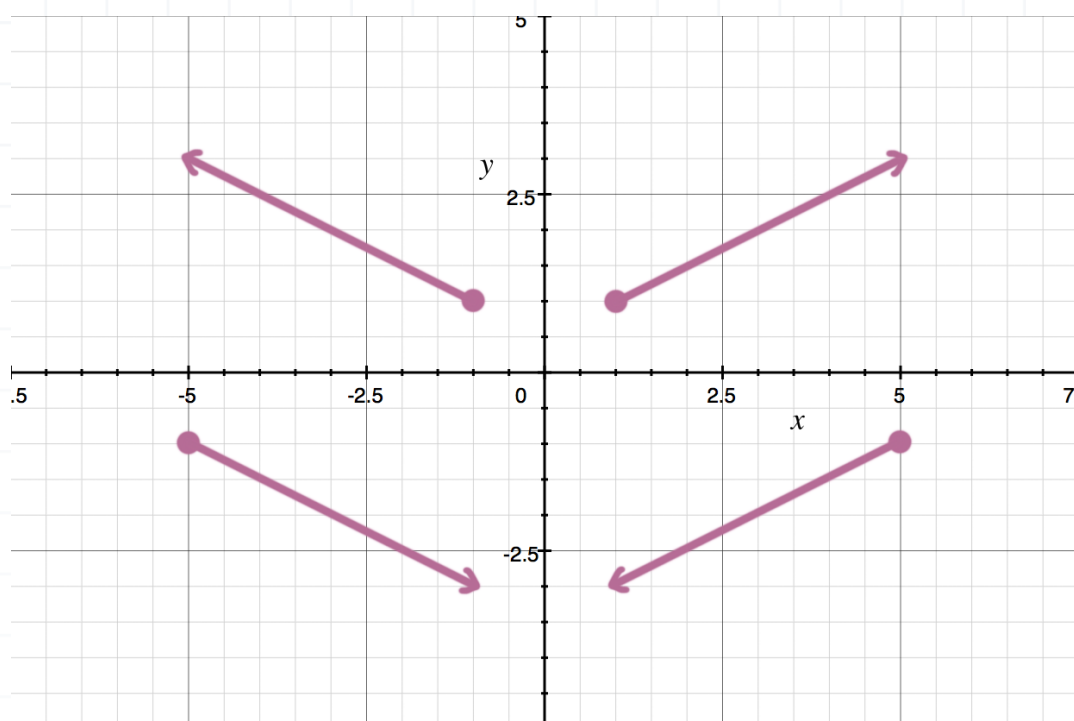
Solution:

$D'(-3,4)$. The vector shows a translation of 1 unit in the x -direction and 3 units in the y -direction.

$$D(-4,1) \rightarrow (-4 + 1, 1 + 3) \rightarrow (-3,4)$$

■ 4. $M(3,1)$ is rotated 90° counterclockwise about the origin. Which translation vector (name the quadrant that contains the vector) would translate M to the correct location on the coordinate plane?





Solution:

The vector in the quadrant II. This vector is the one that translates the point $M(3,1)$ to a location 90° in the counterclockwise direction to the point $M'(-1,3)$. If we sketch a vector from (3,1) to $(-1,3)$, we see that it has the same length and direction as the vector in quadrant II.



