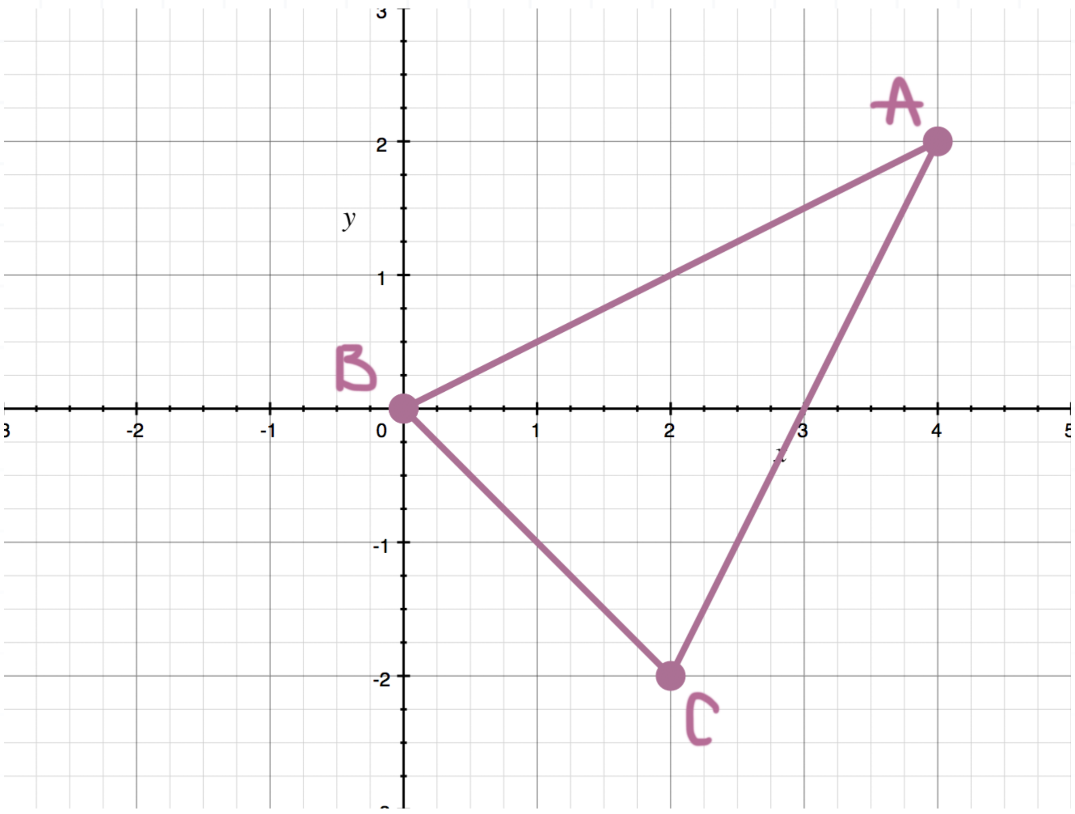
Geometry Workbook Solutions

Transformations

krista king MATH

TRANSLATING FIGURES IN COORDINATE SPACE

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



Solution:

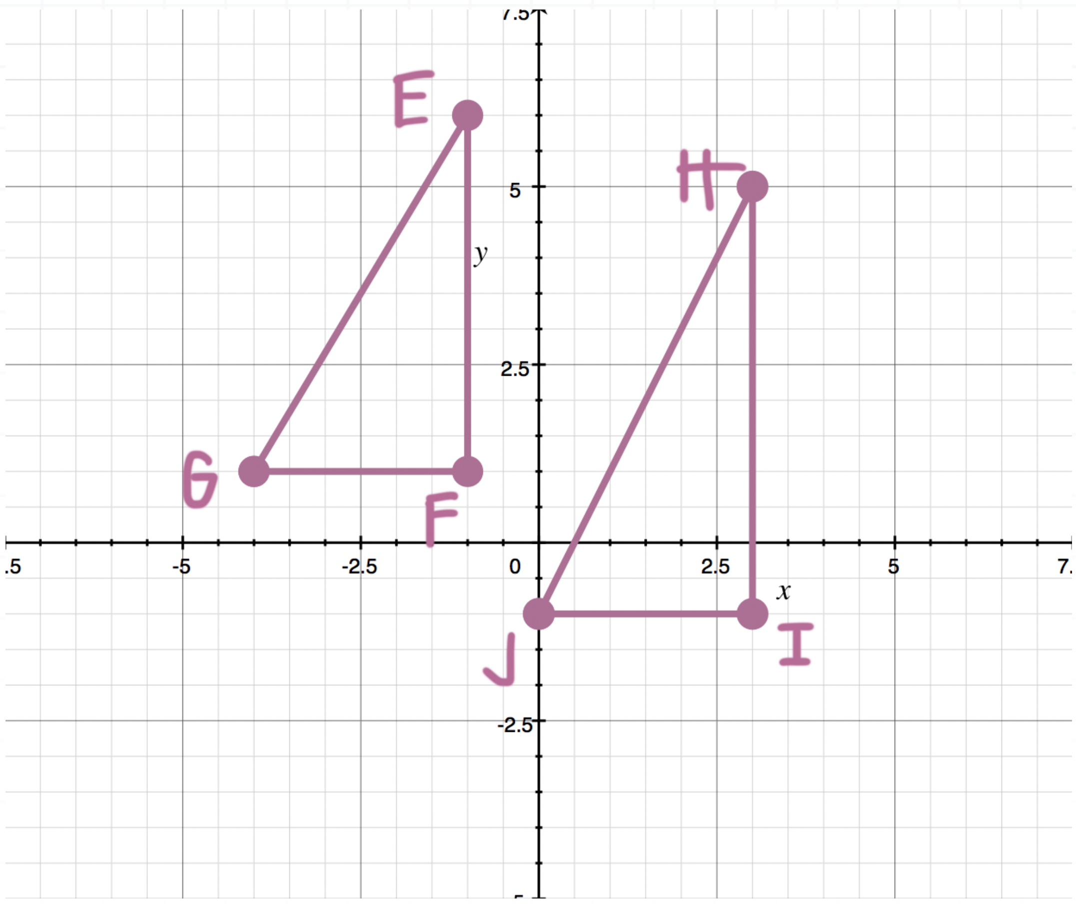
$A'(7,0)$, $B'(3,-2)$, $C'(5,-4)$. Translating each vertex of the triangle gives the vertices of the translated triangle.

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

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

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

■ 2. Is $\triangle EFG$ is 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 $(x, y) \to (x-5, y-4)$.

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:

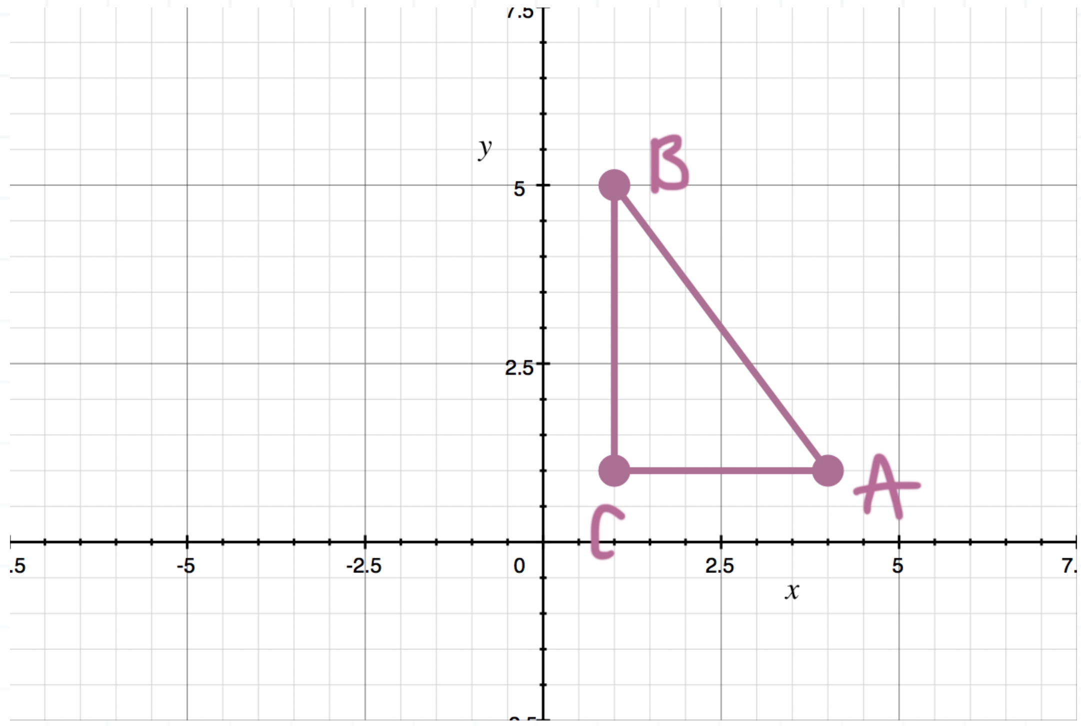
270°

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

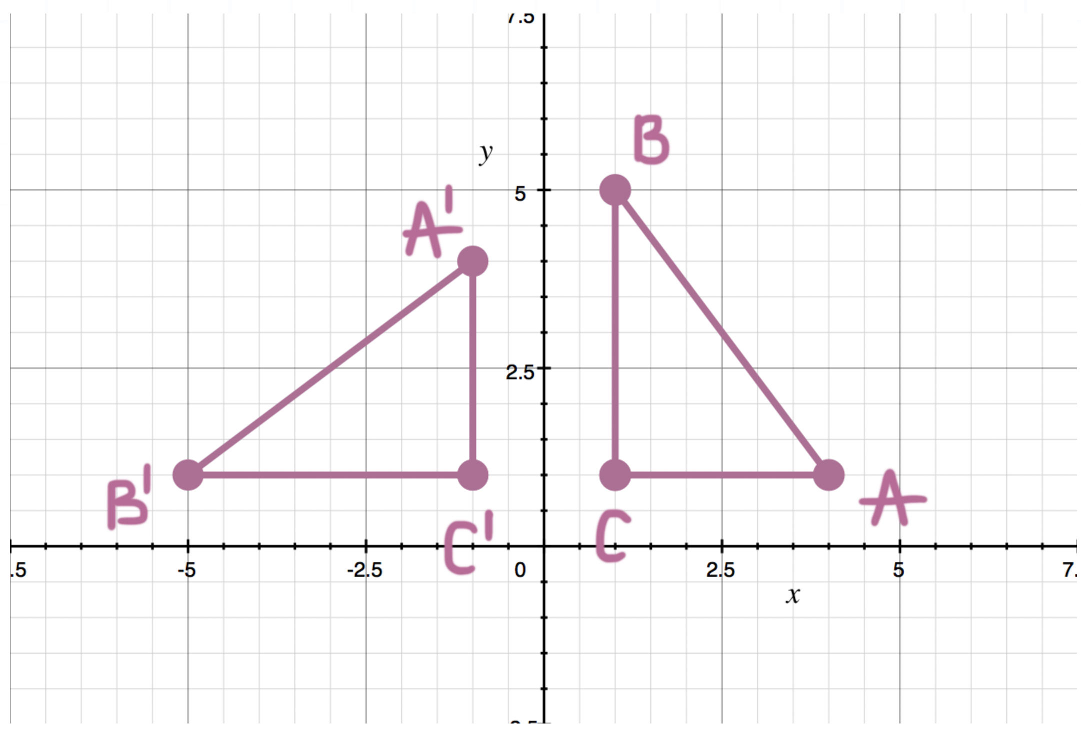
Solution:

$B'(3,1)$. 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

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

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.

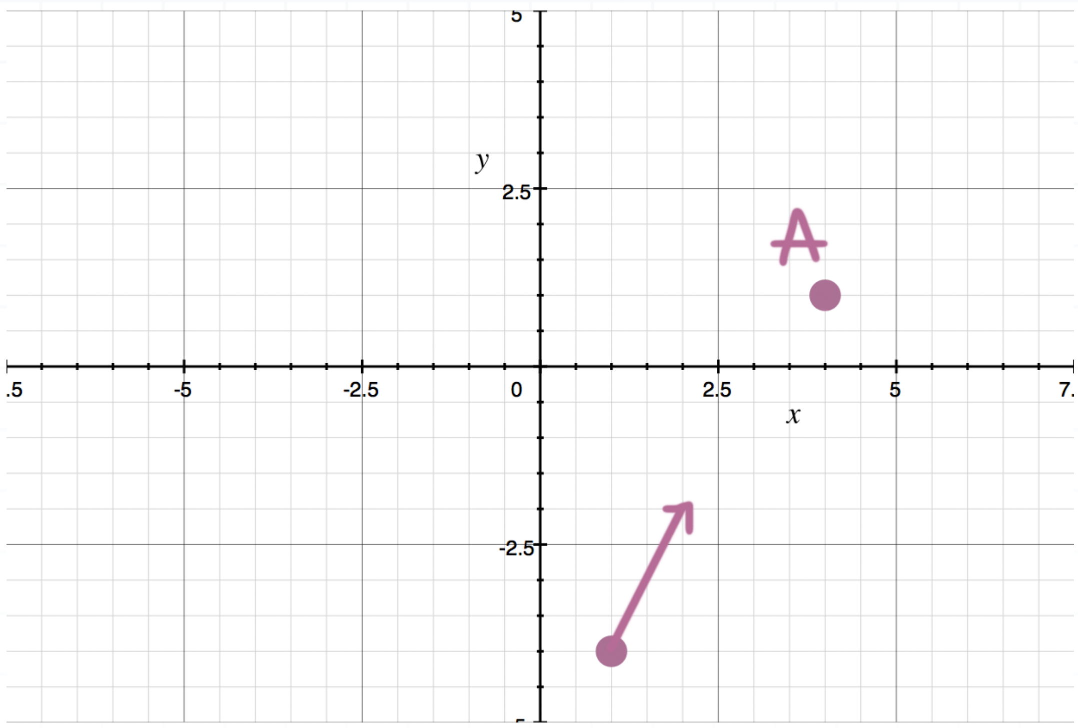
■ 4. Find the coordinates of $P(5, -2)$ under a reflection over the line $y = x$.

Solution:

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

TRANSLATION VECTORS

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

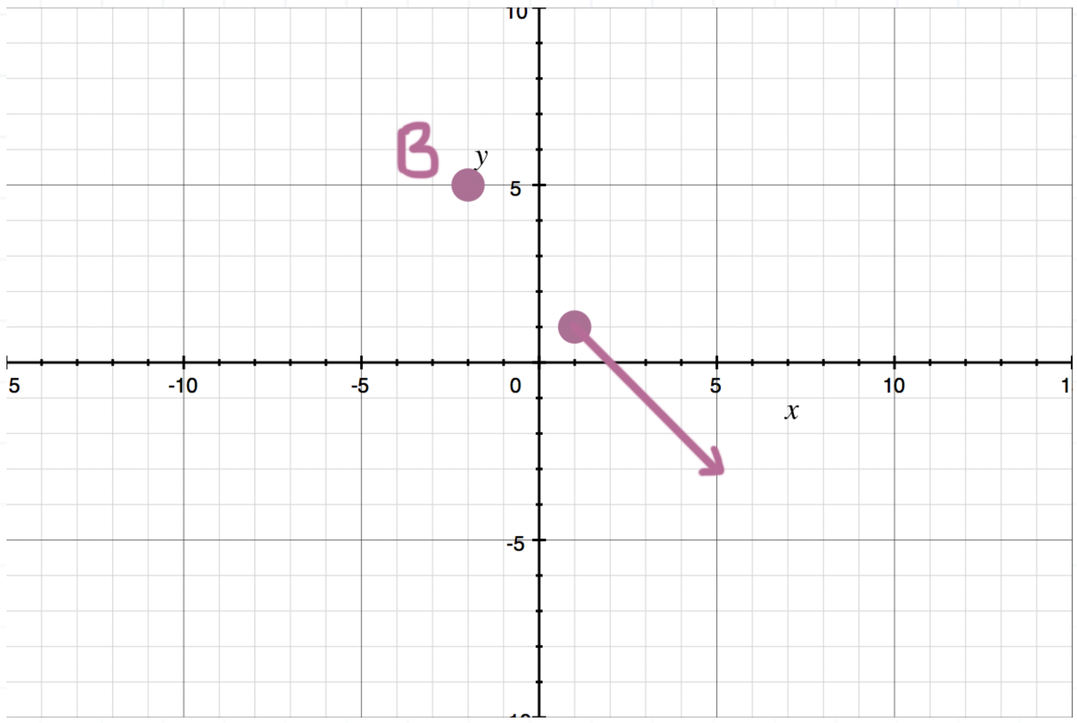


Solution:

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

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

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

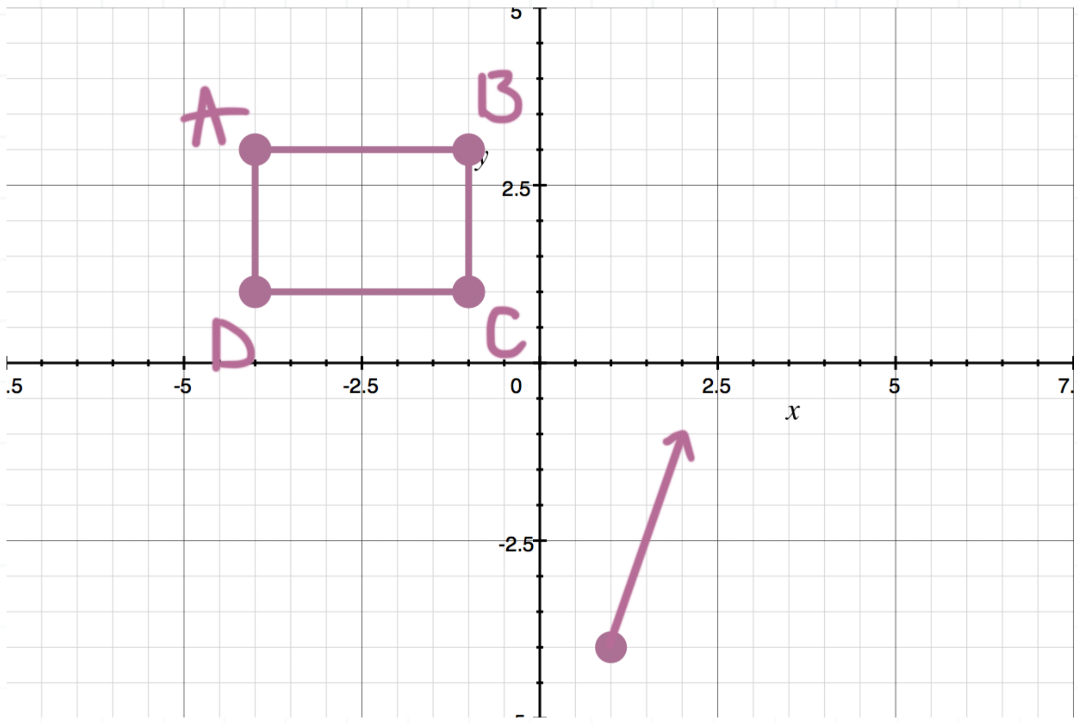


Solution:

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

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

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

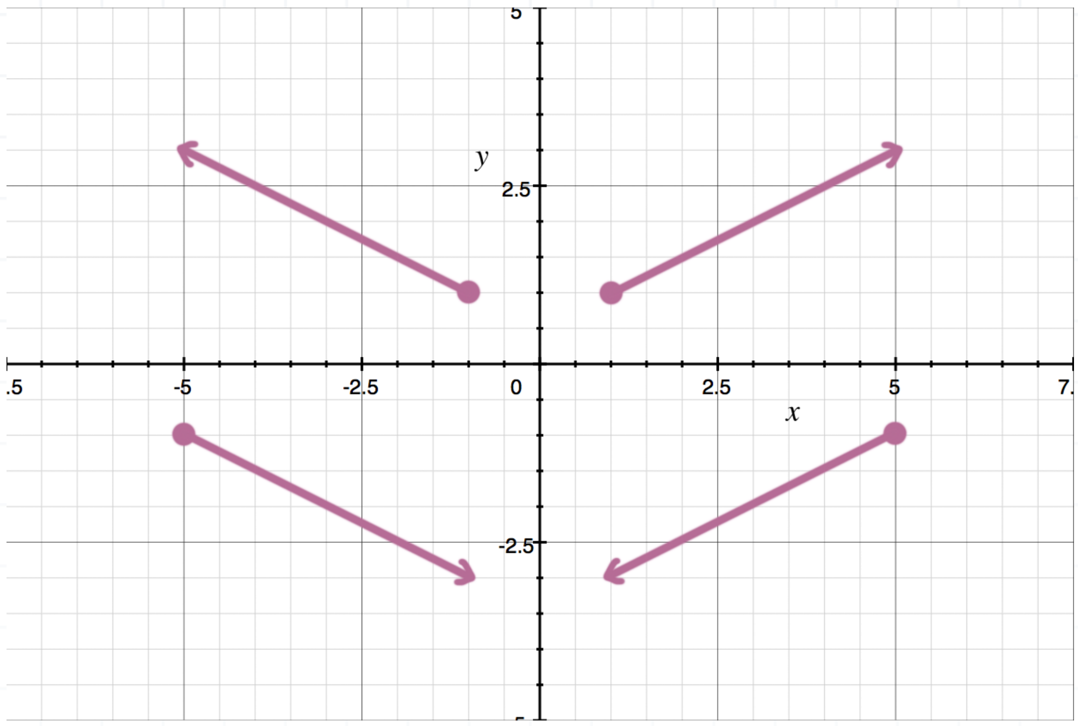


Solution:

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

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

■ 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.

W W W . K R I S T A K I N G M A T H . C O M