

**Part I: Multiple Choice.**

1) The point  $A(-7, 3)$  is translated onto  $A'$  by the translation  $(x, y) \rightarrow (x + 5, y - 4)$ . The coordinates of  $A'$  are \_\_\_\_\_.

$(-7+5, 3-4)$

- [A]  $(-2, -1)$       [B]  $(-12, 7)$       [C]  $(2, -7)$       [D]  $(5, -4)$

2) The point  $(5, -9)$  is the **image** under the translation  $(x, y) \rightarrow (x + 3, y + 2)$ . What is the preimage?

$(5-3, -9-2)$

- [A]  $(2, -11)$       [B]  $(8, -7)$       [C]  $(2, -7)$       [D]  $(8, -11)$

3) What is the reflection image of  $(5, -3)$  across the line  $y = -x$ ?  $(x, y) \rightarrow (-y, -x)$

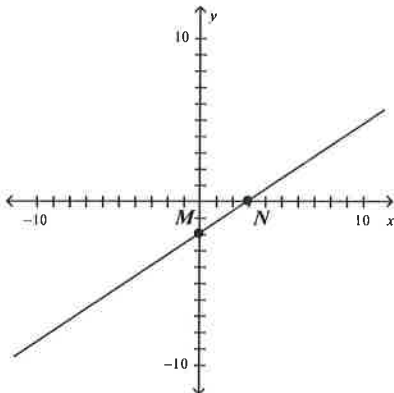
- [A]  $(-3, 5)$       [B]  $(-3, -5)$       [C]  $(3, -5)$       [D]  $(-5, 3)$

4) The vertices of  $\triangle PQR$  are  $P(3, -1)$ ,  $Q(-2, 7)$  and  $R(6, 5)$ . Find the reflection of  $\triangle P'Q'R'$  in the line  $y = x$ .  $(x, y) \rightarrow (y, x)$

$P'(-1, 3)$     $Q'(7, -2)$     $R'(5, 6)$

5) The graph of  $\overleftrightarrow{MN}$  below represents the equation  $y = \frac{2}{3}x - 2$ . If  $\overleftrightarrow{MN}$  is rotated counterclockwise  $270^\circ$   $(x, y) \rightarrow (y, -x)$  about the origin, what will be the new coordinates of point N?

$N(3, 0) \rightarrow (0, -3)$



- [A]  $(-3, 0)$       [B]  $(0, 3)$

- [C]  $(3, 0)$       [D]  $(0, -3)$

**Part II: Skills Check.**

6)  $\triangle A'B'C'$  is the image of  $\triangle ABC$  after a translation.

a) Write the rule for the translation.

$A \rightarrow A'$  : x-values: Right 5

y-values: Up 3

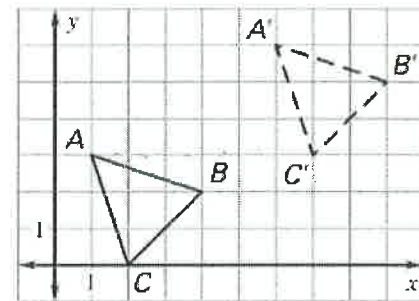
$\Rightarrow (x, y) \rightarrow (x+5, y+3)$

b) Suppose  $\triangle ABC$  is translated using the rule  $(x, y) \rightarrow (x - 5, y + 1)$ . What are the coordinates of the vertices of its image?

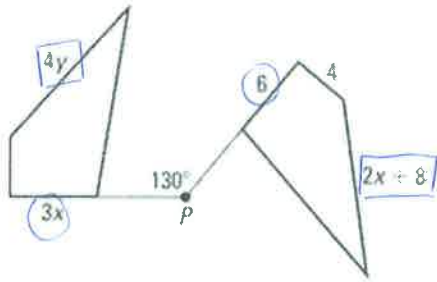
$A(1, 3) \rightarrow A'(-4, 4)$

$B(4, 2) \rightarrow B'(-1, 3)$

$C(2, 0) \rightarrow C'(-3, 1)$



7) In the diagram, the quadrilateral is rotated about point P. What is the value of  $y$ ?



$$3x = 6$$

$$x = 2$$

$$4y = 2x + 8$$

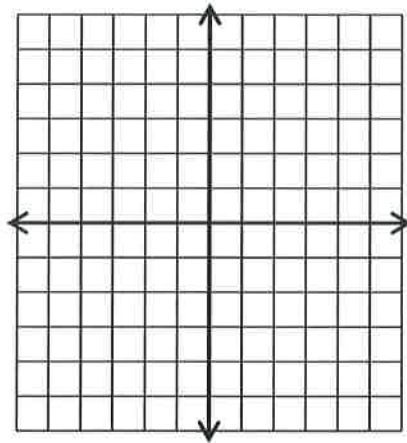
$$4y = 2(2) + 8$$

$$4y = 4 + 8$$

$$4y = 12$$

$$y = 3$$

8) Line  $p$  passes through points  $J(2,5)$  and  $K(-14,13)$ . Line  $q$  is the image of line  $p$  after line  $p$  is reflected in the  $x$ -axis. Find the slope of line  $q$ .



$$J(2,5) \rightarrow J'(2,-5)$$

$$K(-14,13) \rightarrow K'(-14,-13)$$

$$m = \frac{-13 - (-5)}{-14 - 2} = \frac{-13 + 5}{-16} = \frac{-8}{-16} = \frac{1}{2}$$

$$m = \frac{1}{2}$$

9) Identify the coordinates of  $(-1, 3)$  after a  $180^\circ$  counter-clockwise rotation about the origin and then a  $90^\circ$  clockwise rotation about the origin. ← same as  $270^\circ$  CCW

$$(-x, -y) \quad (y, -x)$$

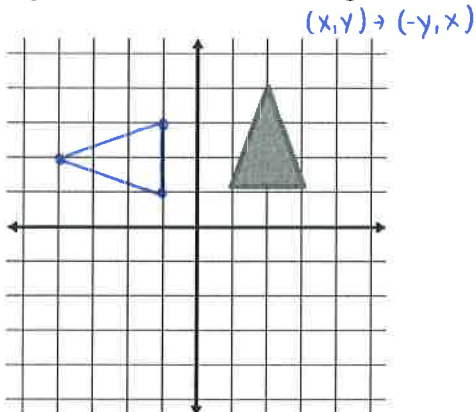
$$(-1, 3) \rightarrow (1, -3) \rightarrow (-3, -1)$$

10) What is the degree of rotation on the minute hand of a clock after 20 minutes have passed?

$$\frac{360}{12} = 30^\circ \text{ in each 5 min interval}$$

$$30^\circ \times 4 \text{ intervals} = 120^\circ$$

11) Draw the figure rotated about the origin  $90^\circ$ .

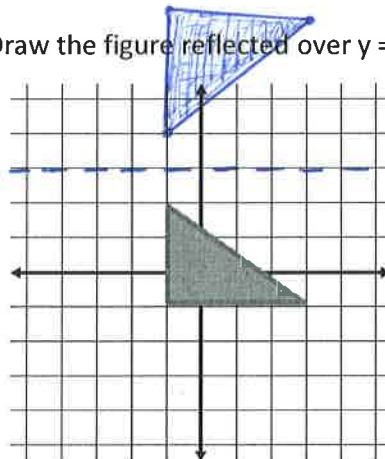


$$(1, 1) \rightarrow (-1, 1)$$

$$(3, 1) \rightarrow (-1, 3)$$

$$(2, 4) \rightarrow (-4, 2)$$

12) Draw the figure reflected over  $y = 3$ .

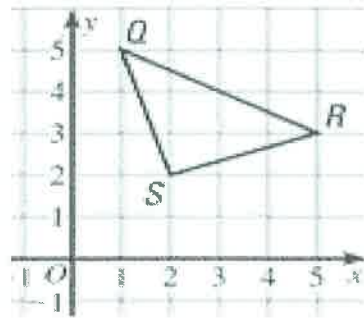


13) What are the coordinates of the image of  $\triangle QRS$  if the triangle is first reflected over the x-axis and then rotated  $180^\circ$ ?

$$Q(1,5) \xrightarrow{x\text{-axis}} (1,-5) \xrightarrow{180^\circ} (-1,5) Q''$$

$$R(5,3) \rightarrow (5,-3) \rightarrow (-5,3) R''$$

$$S(2,2) \rightarrow (2,-2) \rightarrow (-2,2) S''$$

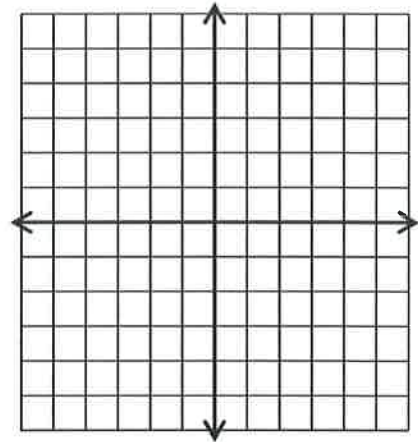


14) The vertices of  $\triangle ABC$  are  $A(-4,4)$ ,  $B(-5,0)$ , and  $C(-1,3)$ . What are the coordinates of the image when  $\triangle ABC$  is first translated using the rule  $(x, y) \rightarrow (x+6, y-1)$  and is then reflected over the y-axis?

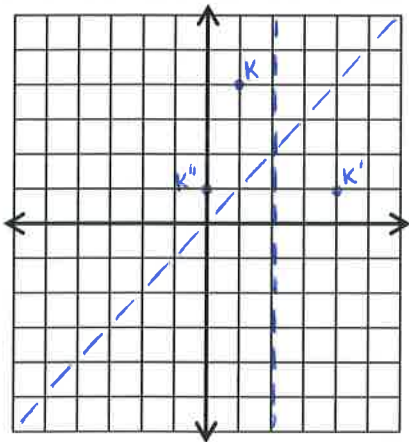
$$A(-4,4) \xrightarrow{(x+6, y-1)} A'(2,3) \xrightarrow{(-x, y)} A''(-2,3)$$

$$B(-5,0) \rightarrow B'(1,-1) \rightarrow B''(-1,-1)$$

$$C(-1,3) \rightarrow C'(5,2) \rightarrow C''(-5,2)$$

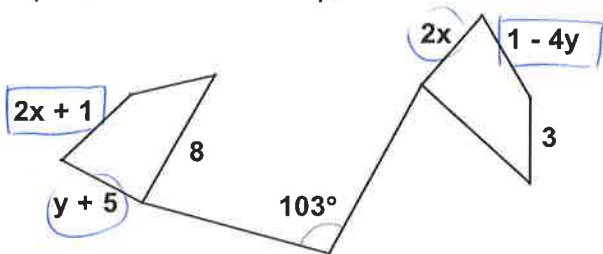


15) Where is the image of point  $K(1,4)$  located if  $K$  is reflected in the line  $y = x$  and then reflected in the line  $x=2$ ?



$$K(1,4) \rightarrow K'(4,1) \rightarrow K''(0,1)$$

16) Please solve for  $x$  and  $y$ .



$$2x = y + 5$$

$$1 - 4y = 2x + 1$$

$$\begin{array}{r} 2x + y = 1 - 4y \\ -x \quad -y \\ \hline 2x = -4y \end{array}$$

$$\begin{array}{r} y + 5 = -4y \\ -y \quad -y \\ \hline 5 = -5y \\ \boxed{y = -1} \end{array}$$

$$\begin{array}{r} 2x = -1 + 5 \\ 2x = 4 \\ \boxed{x = 2} \end{array}$$

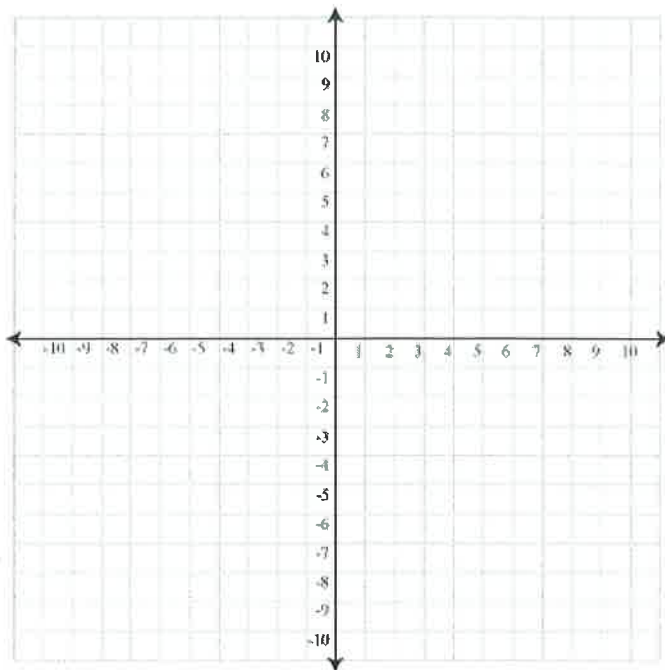
17) Rotate quadrilateral ABCD  $90^\circ$  <sup>↗ same as  $270^\circ$  CCW</sup> clockwise with vertices A(-1,4), B(0,2), C(-3,1), D(-5,3). Then rotate quadrilateral A'B'C'D'  $180^\circ$  about the point (-2,0).  $\rightarrow (0,0)$

$$A(-1,4) \xrightarrow{(y,-x)} A'(4,1) \xrightarrow{x+2} (6,1) \xrightarrow{(-x,-y)} (-6,-1) \xrightarrow{x-2} (-8,-1) A''$$

$$B(0,2) \rightarrow B'(2,0) \rightarrow (4,0) \rightarrow (-4,0) \rightarrow (-6,0) B''$$

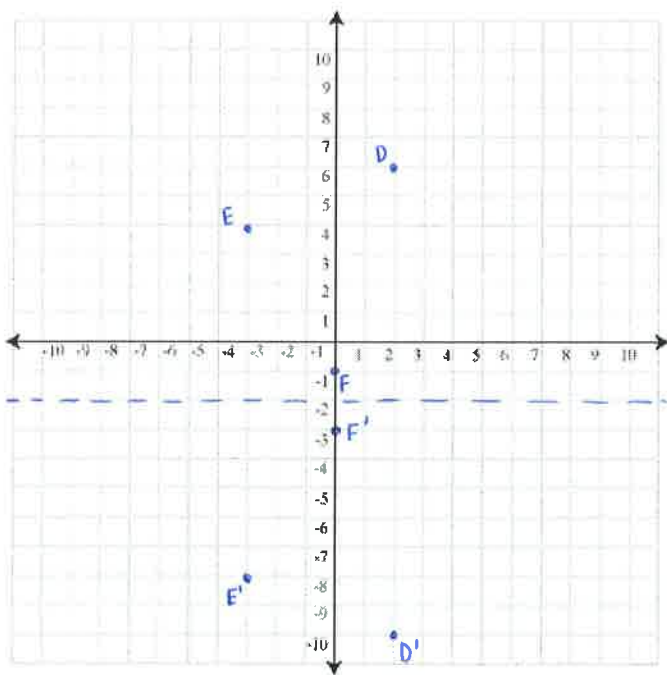
$$C(-3,1) \rightarrow C'(1,3) \rightarrow (3,3) \rightarrow (-3,-3) \rightarrow (-5,-3) C''$$

$$D(-5,3) \rightarrow D'(3,5) \rightarrow (5,5) \rightarrow (-5,-5) \rightarrow (-7,-5) D''$$



18) Reflect  $\triangle DEF$  over the line  $y = -2$  with vertices D(2,6), E(-3,4), and F(0,-1). Then rotate  $\triangle D'E'F'$   $270^\circ$  clockwise <sup>↗ same as  $90^\circ$  CCW</sup> about the point (2, 0).  $\rightarrow (0,0)$

$x-2$



$$D(2,6) \rightarrow D'(2,-2) \xrightarrow{(-y,x)} (2,-2) \xrightarrow{x-2} (0,-2) \xrightarrow{(-y,x)} (2,0) \xrightarrow{x+2} D''(4,0)$$

$$E(-3,4) \rightarrow E'(-3,-6) \xrightarrow{(-y,x)} (-3,-6) \xrightarrow{x-2} (-5,-6) \xrightarrow{(-y,x)} (-6,-5) \rightarrow E''(10,-5)$$

$$F(0,-1) \rightarrow F'(0,-4) \xrightarrow{(-y,x)} (0,-4) \xrightarrow{x-2} (-2,-4) \xrightarrow{(-y,x)} (-4,-2) \rightarrow F''(5,-2)$$