

**Translations, Reflections, and Rotations.**

1. The vertices of  $\triangle ABC$  are  $A(2, 3)$ ,  $B(-1, 2)$ , and  $C(0, 1)$ . What are the new points if  $\triangle ABC$  is translated using the vector  $\langle 1, -4 \rangle$ ?

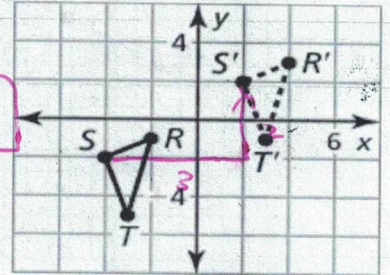
$A'(3, -1)$   $B'(0, -2)$   $C'(1, -3)$

2. Find the component form of the vector that translates  $A(3, -2)$  to  $A'(-1, 4)$ .



3. Write a rule for the translation of  $\triangle RST$  to  $\triangle R'S'T'$ .

$(x, y) \rightarrow (x+3, y+2)$   
 NOT  $(x-3, y-2)$



In Exercises 4-6, use the translation  $(x, y) \rightarrow (x + 1, y - 3)$  to find;

4. The image of  $Q(5, 9)$

$Q'(6, 6)$

5. The preimage of  $R'(0, 7)$

$R(-1, 10)$

6. The image of  $M(-3, -8)$

$M'(-2, -11)$

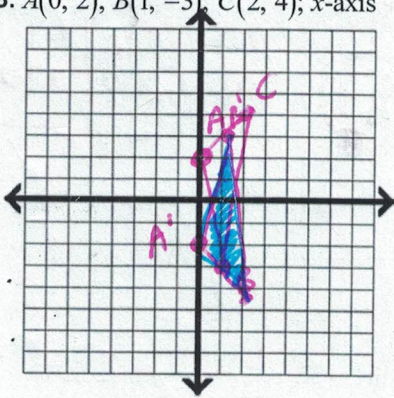
7. Point  $P(4, -2)$  undergoes a translation given by  $(x, y) \rightarrow (x + 3, y - a)$ , followed by another translation  $(x, y) \rightarrow (x - b, y + 7)$  to produce the image of  $P''(-5, 8)$ . Find the values of  $a$  and  $b$  and point  $P'$ .

$P(4, -2) \rightarrow P'(7, -2-a) \rightarrow P''(7-b, 5-a)$   
 $P''(-5, 8)$

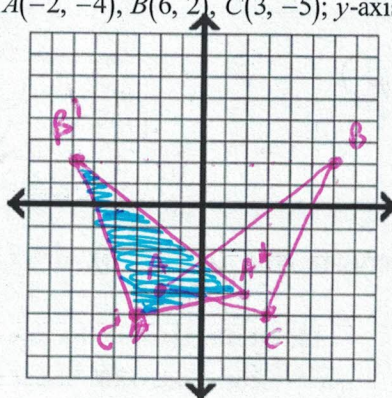
$7-b = -5$   
 $b = 12$   
 $5-a = 8$   
 $a = -3$

In Exercises 8-10,  $\triangle ABC$  is given. Find its image after a reflection in the given line.

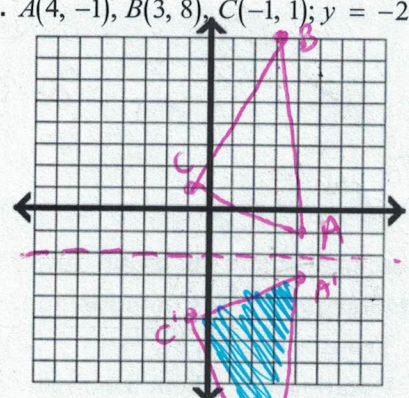
8.  $A(0, 2)$ ,  $B(1, -3)$ ,  $C(2, 4)$ ;  $x$ -axis



9.  $A(-2, -4)$ ,  $B(6, 2)$ ,  $C(3, -5)$ ;  $y$ -axis

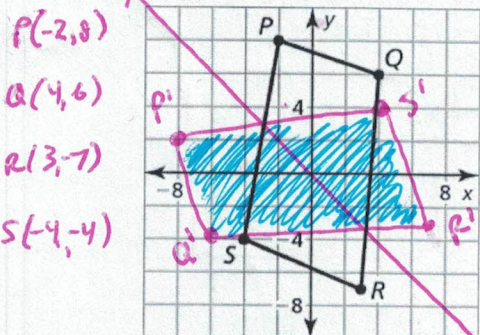


10.  $A(4, -1)$ ,  $B(3, 8)$ ,  $C(-1, 1)$ ;  $y = -2$



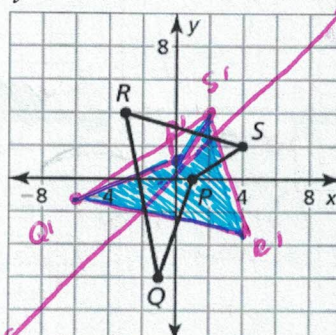
In Exercises 11 and 12, graph the image after a reflection in the given line.

11.  $y = -x$



$P(-2, 8)$   
 $Q(4, 6)$   
 $R(3, -7)$   
 $S(-4, -4)$

12.  $y = x$

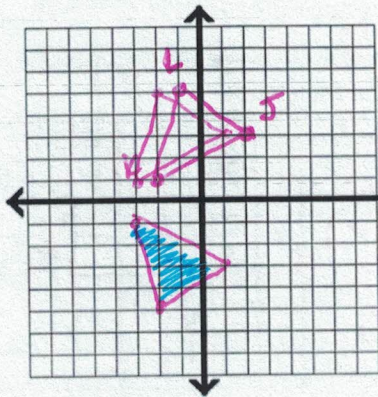


$P(1, 0)$   
 $Q(-1, -6)$   
 $R(-3, 4)$   
 $S(4, 2)$

In Exercises 13 and 14, you are given  $\triangle JKL$  with vertices  $J(2, 3)$ ,  $K(-2, 1)$ , and  $L(-1, 5)$ . Find the final vertices after the composition below.

13. Translation:  $(x, y) \rightarrow (x - 1, y)$  LEFT

Reflection: in the  $x$ -axis

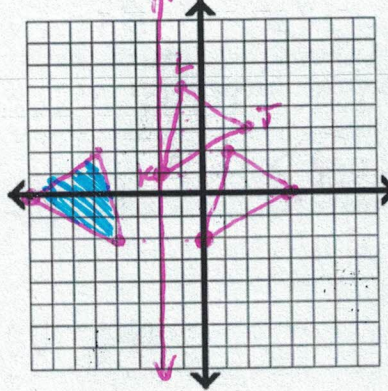


$J'(1, 3)$   
 $K'(-3, 1)$   
 $L'(-2, 5)$

$J''(1, -3)$   
 $K''(-3, -1)$   
 $L''(-2, -5)$

14. Translation:  $(x, y) \rightarrow (x + 2, y - 3)$

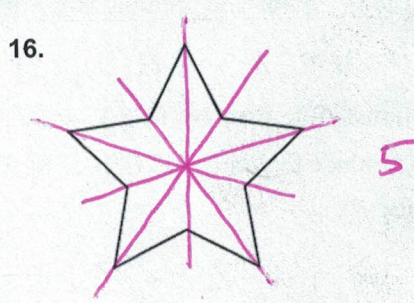
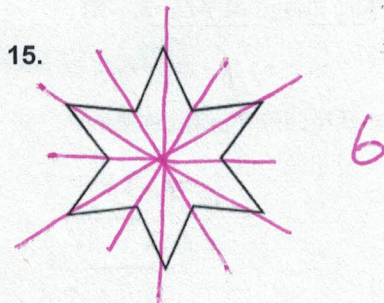
Reflection: in the line  $x = -2$



$J'(4, 0)$   
 $K'(0, -2)$   
 $L'(1, 2)$

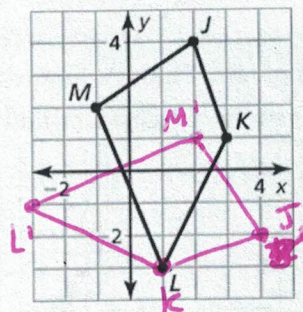
$J''(-8, 0)$   
 $K''(-4, -2)$   
 $L''(-5, 2)$

Determine the number of lines of symmetry for the figure.



17. Graph the image after a  $270^\circ$  rotation about the origin.

CCW  
 $\downarrow$   
 $90^\circ$  CW

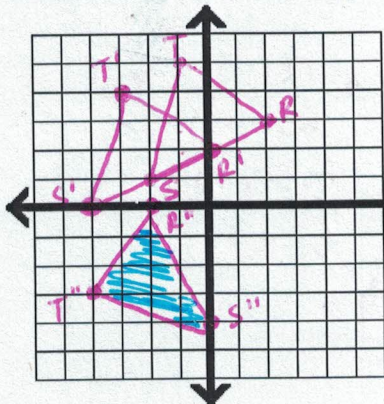


$J(2, 4)$   $J'(4, -2)$   
 $K(3, 1)$   $K'(1, -3)$   
 $L(1, -3)$   $L'(-3, -1)$   
 $M(-1, 2)$   $M'(2, 1)$

In Exercises 18 and 19, graph  $\triangle RST$  with vertices  $R(2, 3)$ ,  $S(-2, 1)$ , and  $T(-1, 5)$  and its image after the composition.

18. Translation:  $(x, y) \rightarrow (x - 2, y - 1)$

Rotation:  $90^\circ$  about the origin CCW

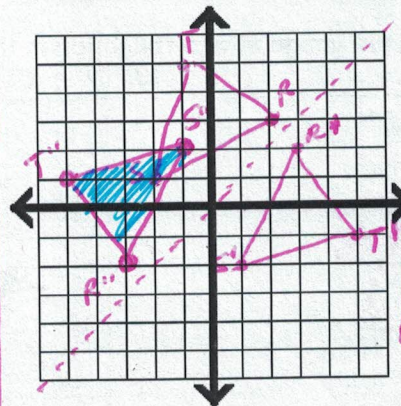


$R'(0, 2)$   
 $S'(-4, 0)$   
 $T'(-3, 4)$

$R''(-2, 0)$   
 $S''(0, -4)$   
 $T''(-4, -3)$

19. Reflection: in the line  $y = x$

Rotation:  $180^\circ$  about the origin



$R'(3, 2)$   
 $S'(1, -2)$   
 $T'(5, -1)$

$R''(-3, 2)$   
 $S''(-1, 2)$   
 $T''(-5, 1)$