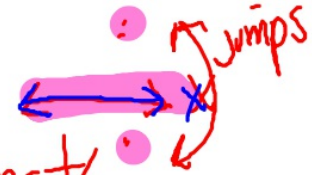
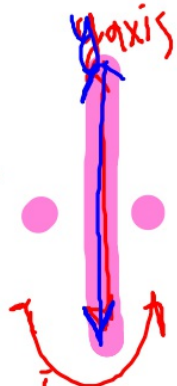
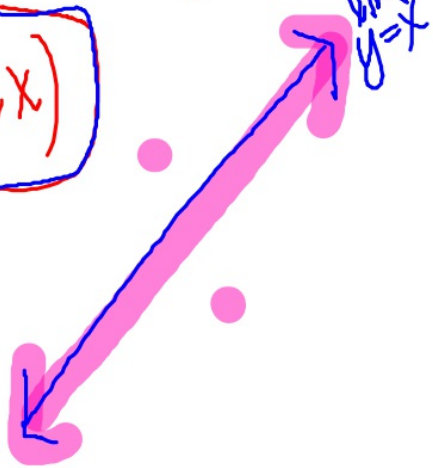
Reflections (3 types)

1. across x axis → y value changes +/− (up & down) → $(x, -y)$
2. across y axis → x value changes +/− (right & left) → $(-x, y)$
3. across lines $y = x$ → change both x and y places → (y, x)







① over x axis $P(3, 2)$ → $P'(3, -2)$

② over y axis $Q(-1, -5)$ → $Q'(1, -5)$

③ over $y = x$ $R(-3, 4)$ → $R'(+4, -3)$

Translations

Vector (direction magnitude) $\langle -2, 3 \rangle$

Rule is $(x-2, y+3)$

IF POINTS

$P(5,0)$ $P'(-2,4)$

What is the vector? $\langle -7, 4 \rangle$

changes (x) $x_2 - x_1 = -2 - 5 = -7$

(y) $y_2 - y_1 = 4 - 0 = 4$

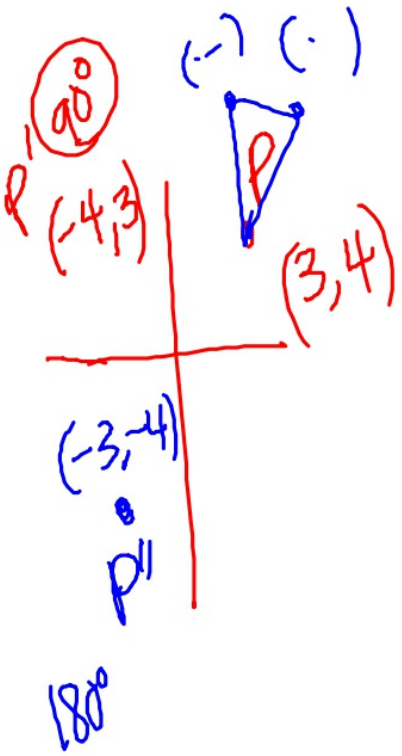
Rotations (two types) for quiz 2

counterclockwise

① 90°

$(-y, x)$

change y sign and switch spots



② 180°

$(-x, -y)$

Change both signs

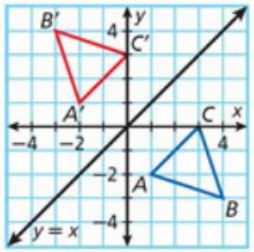
9-1 Reflections

EXAMPLE

- **Reflect the figure with the given vertices across the given line.**

  $A(1, -2), B(4, -3), C(3, 0); y = x$

  To reflect across the line $y = x$, interchange the x- and y-coordinates of each point. The images of the vertices are $A'(-2, 1)$, $B'(-3, 4)$, and $C'(0, 3)$.



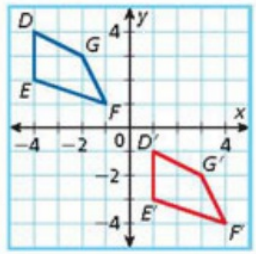
9-2 Translations

EXAMPLE

- **Translate the figure with the given vertices along the given vector.**

  $D(-4, 4), E(-4, 2), F(-1, 1), G(-2, 3); \langle 5, -5 \rangle$

  To translate along $\langle 5, -5 \rangle$, add 5 to the x-coordinate of each point and add -5 to the y-coordinate of each point. The vertices of the image are $D'(1, -1)$, $E'(1, -3)$, $F'(4, -4)$, and $G'(3, -2)$.



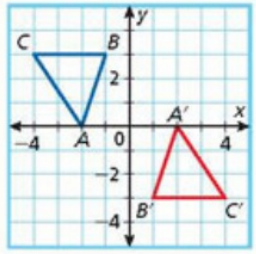
9-3 Rotations

EXAMPLE

- **Rotate the figure with the given vertices about the origin using the given angle of rotation.**

  $A(-2, 0), B(-1, 3), C(-4, 3); 180°$

  To rotate by 180°, find the opposite of the x- and y-coordinate of each point. The vertices of the image are $A'(2, 0)$, $B'(1, -3)$, and $C'(4, -3)$.



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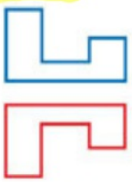
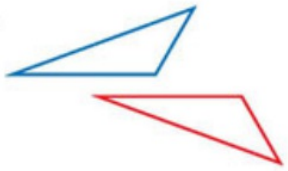
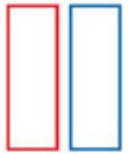
EXERCISES

Tell whether each transformation appears to be a reflection.

5. 

6. 

7. 

8. 

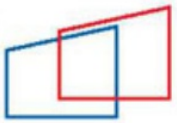
Reflect the figure with the given vertices across the given line.

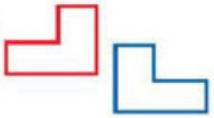
9. $E(-3, 2)$, $F(0, 2)$, $G(-2, 5)$; x-axis
10. $J(2, -1)$, $K(4, -2)$, $L(4, -3)$, $M(2, -3)$; y-axis
11. $P(2, -2)$, $Q(4, -2)$, $R(3, -4)$; $y = x$
12. $A(2, 2)$, $B(-2, 2)$, $C(-1, 4)$; $y = x$

EXERCISES

Tell whether each transformation appears to be a translation.

13. 

14. 

15. 

16. 

Translate the figure with the given vertices along the given vector.

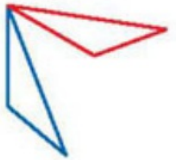
17. $R(1, -1)$, $S(1, -3)$, $T(4, -3)$, $U(4, -1)$; $\langle -5, 2 \rangle$ vector
18. $A(-4, -1)$, $B(-3, 2)$, $C(-1, -2)$; $\langle 6, 0 \rangle$
19. $M(1, 4)$, $N(4, 4)$, $P(3, 1)$; $\langle -3, -3 \rangle$
20. $D(3, 1)$, $E(2, -2)$, $F(3, -4)$, $G(4, -2)$; $\langle -6, 2 \rangle$

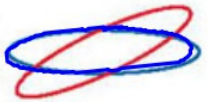
(17) $1-5$ $-1+2$

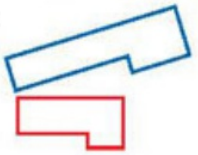
$R'(-4, 1)$

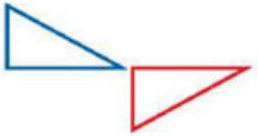
EXERCISES

Tell whether each transformation appears to be a rotation.

21. 

22. 

23. 

24. 

Rotate the figure with the given vertices about the origin using the given angle of rotation.

25. $A(1, 3)$, $B(4, 1)$, $C(4, 4)$; 90°
26. $A(1, 3)$, $B(4, 1)$, $C(4, 4)$; 180°
27. $M(2, 2)$, $N(5, 2)$, $P(3, -2)$, $Q(0, -2)$; 90°
28. $G(-2, 1)$, $H(-3, -2)$, $J(-1, -4)$; 180°

$A'(-3, 1)$ $B'(-1, 4)$