11. **a.** First, find the coordinates of $\triangle A'B'C'$. Since $y = 4$ is parallel to the x-axis, only the y-coordinates of the triangle change. Reflect the y-coordinates so that they are at an equal distance from and on the opposite side of $y = 4$.

Start with A.

$A\,(6,7) \rightarrow A'\,(6, y_2)$

$$y_1 - 4 = 4 - y_2$$

$$-7 - 4 = 4 - y_2$$

$$1 = y_2$$

Now use A and A' to find the mapping.

$$-y_1 + n = y_2$$

$$(-7) + n = 1$$

$$n = 8$$

So, the reflection maps $(x, y) \rightarrow (x, 8 - y)$.

$A\,(6,7) \rightarrow A'\,(6,1)$
$B\,(9,3) \rightarrow B'\,(9,5)$
$C\,(4,-2) \rightarrow C'\,(4,10)$

Repeat the procedure to find the coordinates of $\triangle A''B''C''$. Since $x = 3$ is parallel to the y-axis, only the x-coordinates of the triangle change. Reflect the x-coordinates so that they are at an equal distance from and on the opposite side of $x = 3$.

Start with A'.

$A'\,(6,1) \rightarrow A''\,(x_3, 1)$

$$x_2 - 3 = 3 - x_3$$

$$6 - 3 = 3 - x_3$$

$$0 = x_3$$

Now use A' and A'' to find the mapping.

$$-x_2 + n = x_3$$

$$-(6) + n = 0$$

$$n = 6$$

So, the reflection maps $(x, y) \rightarrow (6 - x, y)$.

$A'\,(6, 1) \rightarrow A''\,(0, 1)$
$B'\,(9, 5) \rightarrow B''\,(-3, 5)$
$C\,(4, 10) \rightarrow C''\,(2, 10)$

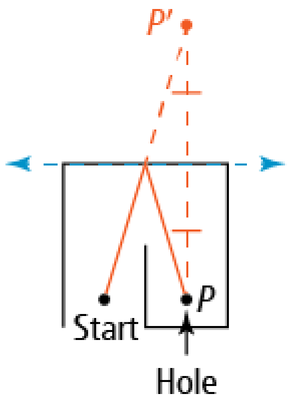
b. $\mathrm{R}_{x=3}\,(x, y) \rightarrow (6 - x, y)$

$R_{y=4}\,(x, y) \rightarrow (x, 8 - y)$

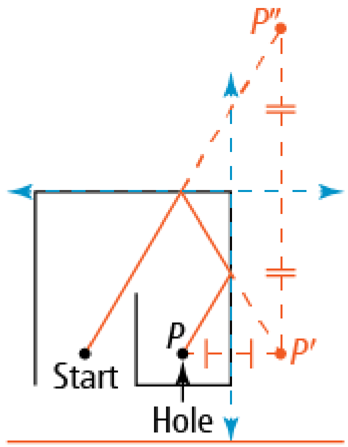
12. Yes; squares have the same angle measures because they are right angles and the size of sides are the same length.

13. Jacob is incorrect. He should reflect the Hole P over the back wall at P'. Then connect the Start

point with P'. Jacob should aim at the intersection of the back wall with this second line.



14.



17. Yes; all corresponding angles and sides appear to be the same size.

18. No; corresponding sides do not appear to be the same.

19. A reflection about the x-axis maps $y \to -y$.

$$A\,(9,-3) \to A'\,(9,3)$$
$$B\,(6,4) \to B'\,(6,-4)$$
$$C\,(-1,-5) \to C'\,(-1,5)$$

20. A reflection about the y-axis maps $x \to -x$.

$$A\,(9,-3) \to A'\,(-9,-3)$$
$$B\,(6,4) \to B'\,(-6,4)$$
$$C\,(-1,-5) \to C'\,(1,-5)$$

21. First, find the coordinates of A'. Since $x = -5$ is parallel to the y-axis, only the x-coordinates of the triangle change. Reflect the x-coordinates so that they are at an equal distance from and on the opposite side of $x = -5$.

Start with A.

$A\,(9, -3) \rightarrow A'\,(x_2, -3)$

$$x_1 - (-5) = -5 - x_2$$

$$9 + 5 = -5 - x_2$$

$$-19 = x_2$$

Now use A and A' to find the mapping.

$$x_1 + n = x_2$$

$$-(9) + n = -19$$

$$n = -10$$

So, the reflection maps $(x, y) \rightarrow (-10 - x, y)$.

$A\,(9, -3) \rightarrow A'\,(-19, -3)$
$B\,(6, 4) \rightarrow B'\,(-16, 4)$
$C\,(-1, -5) \rightarrow C'\,(-9, -5)$

22. First, find the coordinates of A'. Since $y = 1$ is parallel to the x-axis, only the y-coordinates of the triangle change. Reflect the y-coordinates so that they are at an equal distance from and on the opposite side of $y = 1$.

Start with A.

$A\,(9, -3) \to A'\,(9, y_2)$

$$1 - y_1 = y_2 - 1$$

$$1 - (-3) = y_2 - 1$$

$$5 = y_2$$

Now use A and A' to find the mapping.

$$-y_1 + n = y_2$$

$$-(-3) + n = 5$$

$$n = 2$$

So, the reflection maps $(x, y) \to (x, 2 - y)$.

$A\,(9, -3) \to A'\,(9, 5)$
$B\,(6, 4) \to B'\,(6, -2)$
$C\,(-1, -5) \to C'\,(-1, 7)$

23. The rule for reflecting across the line $y = x$ is $R_{y=x}\,(x, y) = (y, x)$.

$A\,(9, -3) \to A'\,(-3, 9)$
$B\,(6, 4) \to B'\,(4, 6)$
$C\,(-1, -5) \to C'\,(-5, -1)$

24. First, find the coordinates of A'. Since $y = -2$ is parallel to the x-axis, only the y-coordinates of the triangle change. Reflect the y-coordinates so that they are at an equal distance from and on the opposite side of $y = -2$.

Start with A.

$A\,(9, -3) \rightarrow A'\,(9, y_2)$

$$-2 - y_1 = y_2 - (-2)$$

$$-2 - (-3) = y_2 + 2$$

$$-2 + 3 - 2 = y_2$$

$$-1 = y_2$$

Now use A and A' to find the mapping.

$$-y_1 + n = y_2$$

$$-(-3) + n = -1$$

$$n = -4$$

So, the reflection maps $(x, y) \rightarrow (x, -4 - y)$.

$A\,(9, -3) \rightarrow A'\,(9, 1)$
$B\,(6, 4) \rightarrow B'\,(6, -8)$
$C\,(-1, -5) \rightarrow C'\,(-1, 1)$

25. Examine D and D'. Note that the points have the same y-coordinates. This means that the line of reflection is a vertical line.

Recall that the line of reflection passes through the midpoint of the line segments connecting each point to its image. Since the line is a vertical line, all we need to do is find the x-coordinate of the midpoint of the segment connecting D and D'.

$$\begin{aligned} M_x &= \frac{x_1+x_2}{2} \\ &= \frac{3+1}{2} \\ &= 2 \end{aligned}$$

This means the line of reflection is $x = 2$.

Now use D and D' to find the mapping.

$$\begin{aligned} -x_1 + n &= x_2 \\ -(3) + n &= 1 \\ n &= 4 \end{aligned}$$

So, the reflection maps $(x, y) \rightarrow (4 - x, y)$.

$R_{x=2}(x, y) = (4 - x, y)$

26. Examine G and G'. Note that the points have the same x-coordinates. This means that the line of reflection is a horizontal line.

Recall that the line of reflection passes through the midpoint of the line segments connecting each point to its image. Since the line is a horizontal line, all we need to do is find the y-coordinate of the midpoint of the segment connecting G and G'.

$$\begin{aligned} M_y &= \frac{y_1+y_2}{2} \\ &= \frac{12+(-2)}{2} \\ &= 5 \end{aligned}$$

This means the line of reflection is $y = 5$.

Now use G and G' to find the mapping.

$$\begin{aligned} -y_1 + n &= y_2 \\ -(12) + n &= -2 \\ n &= 10 \end{aligned}$$

So, the reflection maps $(x, y) \rightarrow (x, 10 - y)$.

$R_{y=5}(x, y) = (x, 10 - y)$

27. Examine K and K'. Note that the points have the same x-coordinates. This means that the line of reflection is a horizontal line.

Recall that the line of reflection passes through the midpoint of the line segments connecting each point to its image. Since the line is a horizontal line, all we need to do is find the y-coordinate of the midpoint of the segment connecting K and K'.

$$M_y = \frac{y_1+y_2}{2}$$

$$= \frac{-6+(-4)}{2}$$

$$= -5$$

This means the line of reflection $y = -5$.

Now use K and K' to find the mapping.

$$-y_1 + n = y_2$$

$$-(-6) + n = -4$$

$$n = -10$$

So, the reflection maps $(x, y) \to (x, -10 - y)$.

$R_{y=-5}\,(x, y) = (x, -10 - y)$

28. The line of reflection is $y = -x$. Now, find the mapping. A reflection about a line maps $(x, y) \to (-x, -y)$.

Use the equation for the line to substitute for x and y in the mapping.

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

So, $R_{y=-x}\,(x, y) = (-y, -x)$

29.