LESSON 9.3

Study Guide
For use with pages 588–596

GOAL   **Reflect a figure in any given line.**

Vocabulary

A **reflection** is a transformation that uses a line like a mirror to reflect an image.

A **line of reflection** is a line that acts like a mirror to reflect an image.

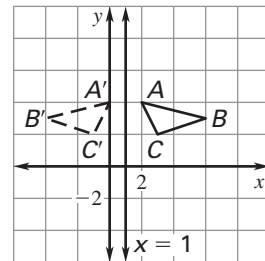**Theorem 9.2 Reflection Theorem:** A reflection is an isometry.

EXAMPLE 1   **Graph reflections in horizontal and vertical lines**

The vertices of △ABC are A(2, 4), B(6, 3), and C(3, 2). Graph the reflection of △ABC described.

   a. In the line n: $x = 1$
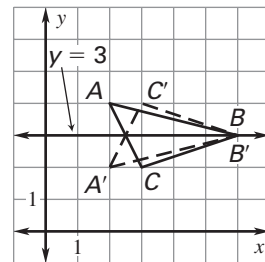
Solution

Point A is 1 unit to the right of n, so its reflection A' is 1 unit to the left of n at $(0, 4)$. Also, B' is 5 units left of n at $(-4, 3)$, and C' is 2 units left of n at $(-1, 2)$.

   b. In the line m: $y = 3$

Solution

Point A is 1 unit above m, so its reflection A' is 1 unit below m at $(2, 2)$. Also, B' is on m at $(6, 3)$, and C' is 1 unit above m at $(3, 4)$.

Exercises for Example 1

The vertices of △ABC are A(2, 4), B(6, 3), and C(3, 2). Graph the reflection of △ABC in the given line.

   1. $y = 5$

   2. $x = -2$

   3. $y = -1$

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EXAMPLE 2 **Graph a reflection in $y = x$**

The endpoints of $\overline{FG}$ are $F(-2, 1)$ and $G(2, 3)$.
Reflect the segment in the line $y = x$.
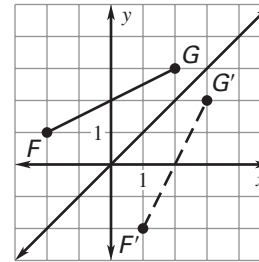Graph $\overline{FG}$ and its image.

Solution

Use the coordinate rule for reflecting in $y = x$.

$(a, b) \rightarrow (b, a)$
$F(-2, 1) \rightarrow F'(1, -2)$
$G(2, 3) \rightarrow G'(3, 2)$

EXAMPLE 3 **Use matrix multiplication to reflect a polygon**

The vertices of $\triangle DEF$ are $D(2, 3)$, $E(4, 4)$, and $F(5, 1)$. Find the reflection
of $\triangle DEF$ in the y-axis using matrix multiplication. Graph $\triangle DEF$ and
its image.

Solution

STEP 1 **Multiply** the polygon matrix by the matrix for a reflection in the y-axis.

$$
\begin{bmatrix} -1 & 0 \\ 0 & 1 \end{bmatrix}
\overset{\begin{matrix} D & E & F \end{matrix}}{\begin{bmatrix} 2 & 4 & 5 \\ 3 & 4 & 1 \end{bmatrix}}
=
\begin{bmatrix} -1(2) + 0(3) & -1(4) + 0(4) & -1(5) + 0(1) \\ 0(2) + 1(3) & 0(4) + 1(4) & 0(5) + 1(1) \end{bmatrix}
$$

$$
=
\overset{\begin{matrix} D' & E' & F' \end{matrix}}{\begin{bmatrix} -2 & -4 & -5 \\ 3 & 4 & 1 \end{bmatrix}}
$$

STEP 2 **Graph** $\triangle DEF$ and $\triangle D'E'F'$.
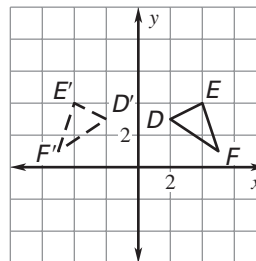
Exercises for Examples 2 and 3

4. Graph $\triangle ABC$ with vertices $A(4, 2)$, $B(5, 6)$, and $C(7, 3)$. Reflect $\triangle ABC$ in the
line $y = x$. Graph the image.

5. The vertices of $\triangle LMN$ are $L(-4, 2)$, $M(0, 1)$, and $N(-3, -1)$. Find the
reflection of $\triangle LMN$ in the x-axis using matrix multiplication.