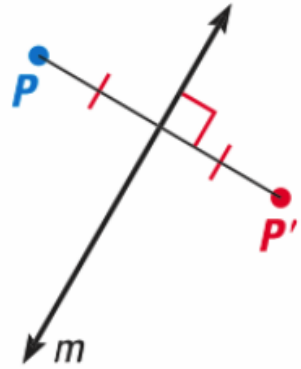
9.3 Perform Reflections

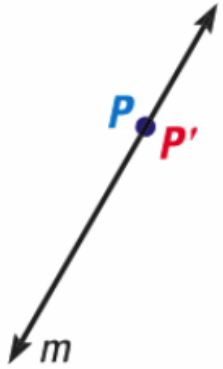
In Lesson 4.8, you learned that a *reflection* is a transformation that uses a line like a mirror to reflect an image. The mirror line is called the **line of reflection**.

A reflection in a line m maps every point P in the plane to a point P', so that for each point one of the following properties is true:

- If P is not on m, then m is the perpendicular bisector of $\overline{PP'}$, or
- If P is on m, then $P = P'$.



Point *P* not on *m*

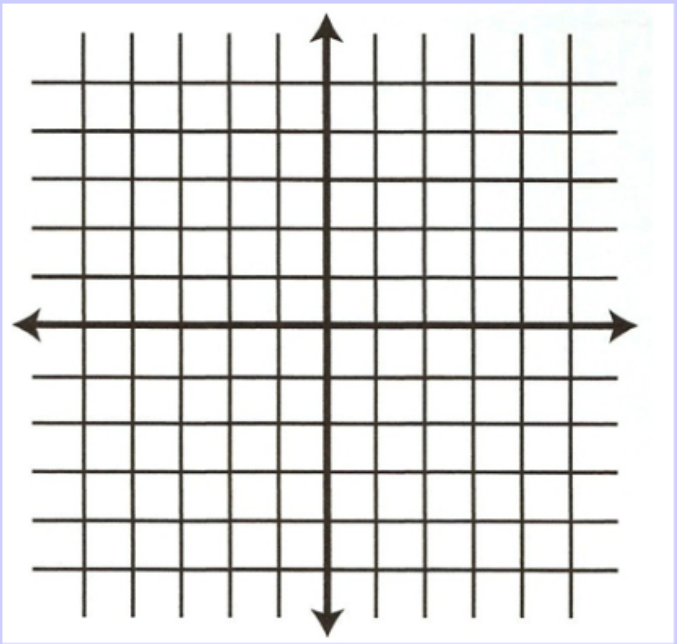


Point *P* on *m*

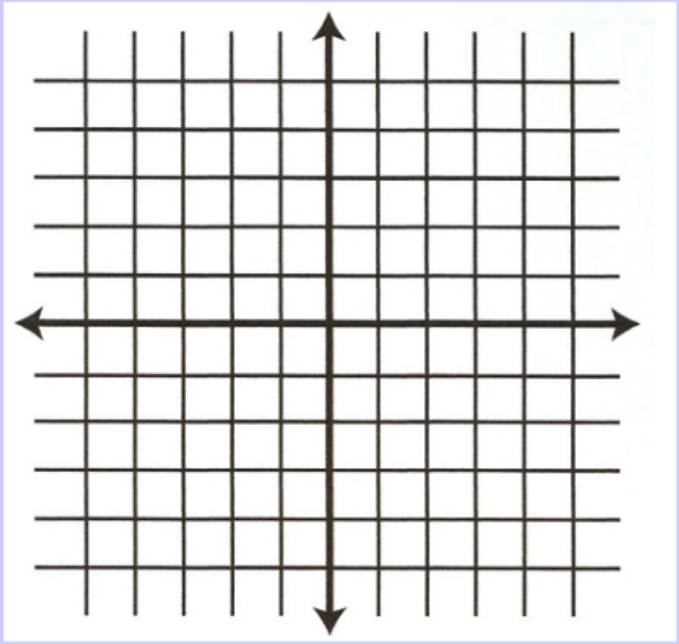
EXAMPLE 1 Graph reflections in horizontal and vertical lines

The vertices of $\triangle ABC$ are $A(1, 3)$, $B(5, 2)$, and $C(2, 1)$. Graph the reflection of $\triangle ABC$ described.

a. In the line n: $x = 3$

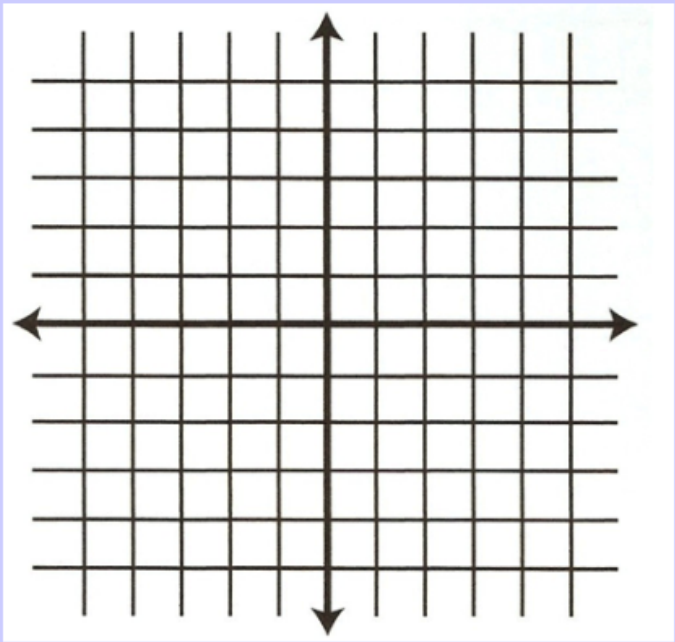


b. In the line m: $y = 1$



EXAMPLE 2 Graph a reflection in $y = x$

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



COORDINATE RULES You can use coordinate rules to find the images of points reflected in four special lines.

KEY CONCEPT

For Your Notebook

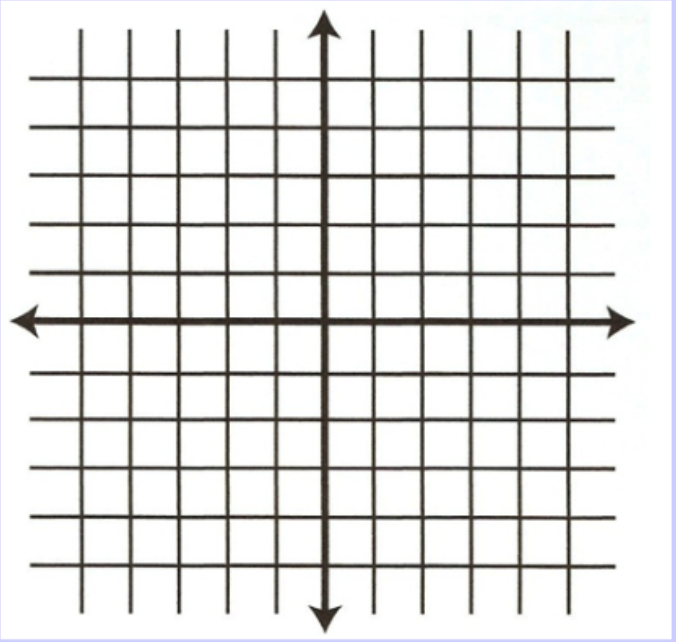
Coordinate Rules for Reflections

- If (a, b) is reflected in the x-axis, its image is the point $(a, -b)$.
- If (a, b) is reflected in the y-axis, its image is the point $(-a, b)$.
- If (a, b) is reflected in the line $y = x$, its image is the point (b, a).
- If (a, b) is reflected in the line $y = -x$, its image is the point $(-b, -a)$.

EXAMPLE 3 Graph a reflection in $y = -x$

Reflect $\overline{FG}$ from Example 2 in the line $y = -x$. Graph $\overline{FG}$ and its image.

The endpoints of $\overline{FG}$ are $F(-1, 2)$ and $G(1, 2)$.



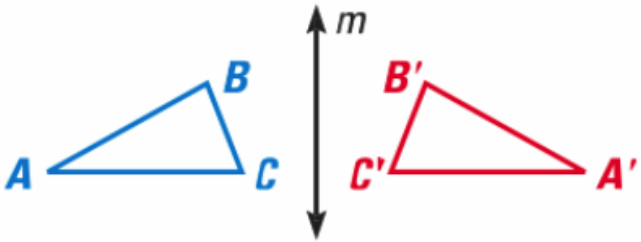
REFLECTION THEOREM You saw in Lesson 9.1 that the image of a translation is congruent to the original figure. The same is true for a reflection.

THEOREM

For Your Notebook

THEOREM 9.2 Reflection Theorem

A reflection is an isometry.

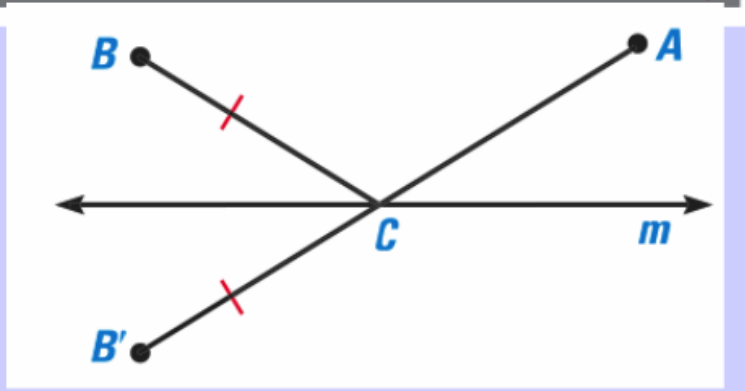


Proof: Exs. 35–38, p. 595

$\triangle ABC \cong \triangle A'B'C'$

EXAMPLE 4 Find a minimum distance

PARKING You are going to buy books. Your friend is going to buy CDs. Where should you park to minimize the distance you both will walk?



Assignment:

9.3 ws

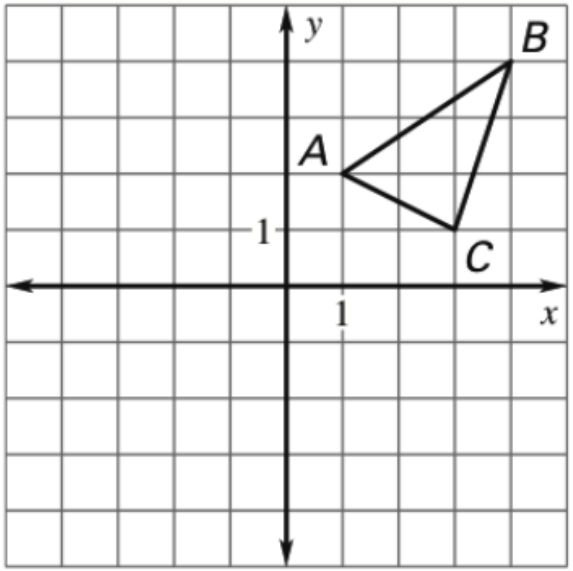
LESSON 9.3

Practice

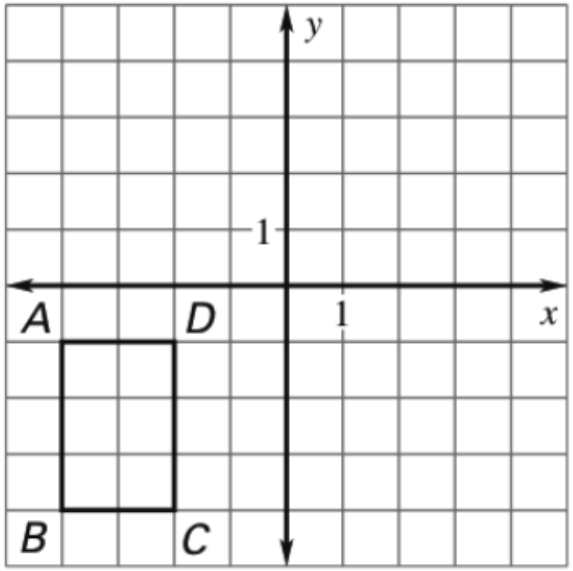
For use with pages 588–596

Graph the reflection of the polygon in the given line.

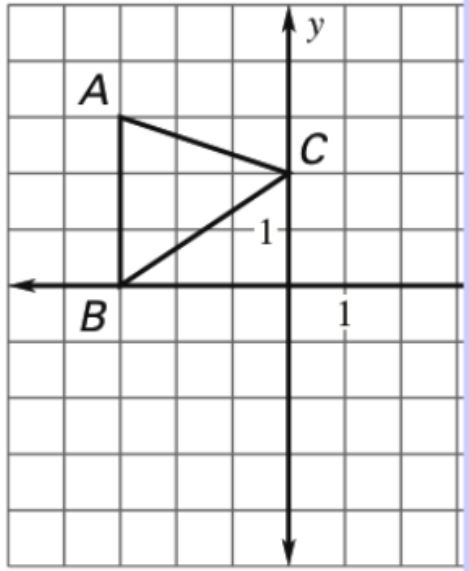
1. x-axis



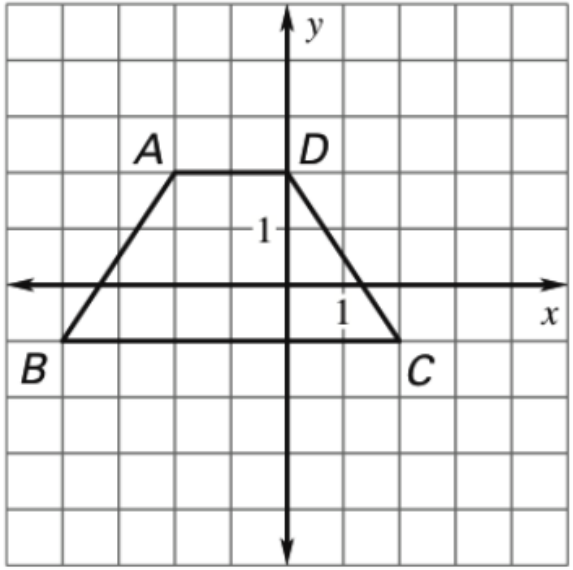
2. y-axis



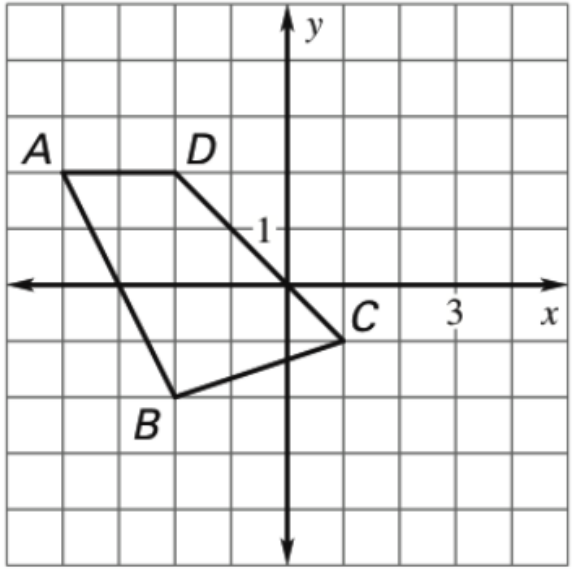
3. $x = -1$



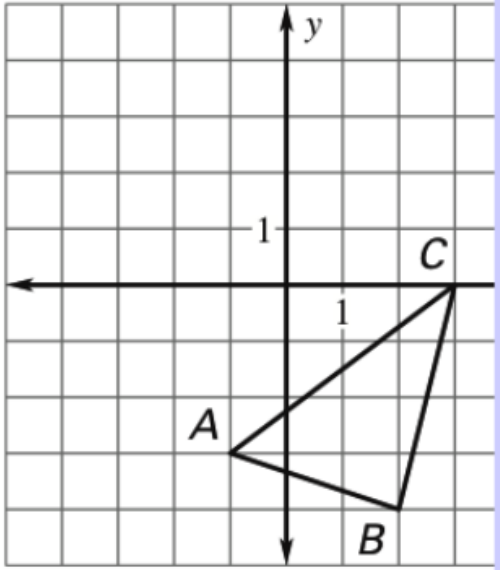
4. $y = 1$



5. $y = -x$

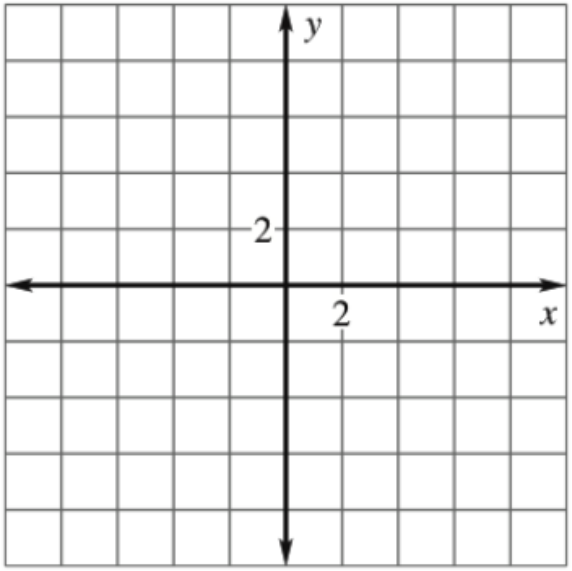


6. $y = x$

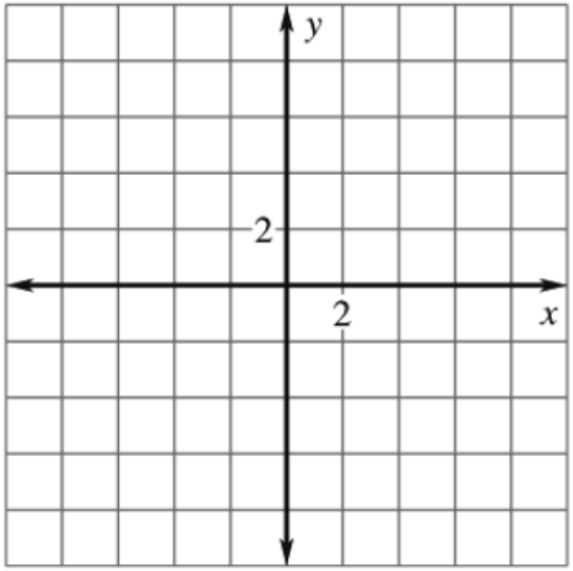


Use matrix multiplication to find the image. Graph the polygon and its image.

7. Reflect $\begin{matrix} A & B & C \\ \end{matrix}$
$\begin{bmatrix} -3 & 1 & 6 \\ 4 & 7 & 2 \end{bmatrix}$ in the x-axis.

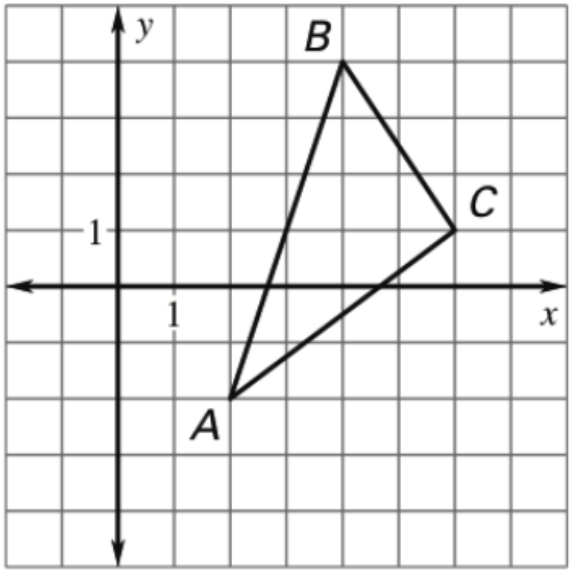


8. Reflect $\begin{matrix} A & B & C & D \end{matrix}$
$\begin{bmatrix} 2 & 5 & 7 & 1 \\ 6 & 4 & -5 & -3 \end{bmatrix}$ in the y-axis.

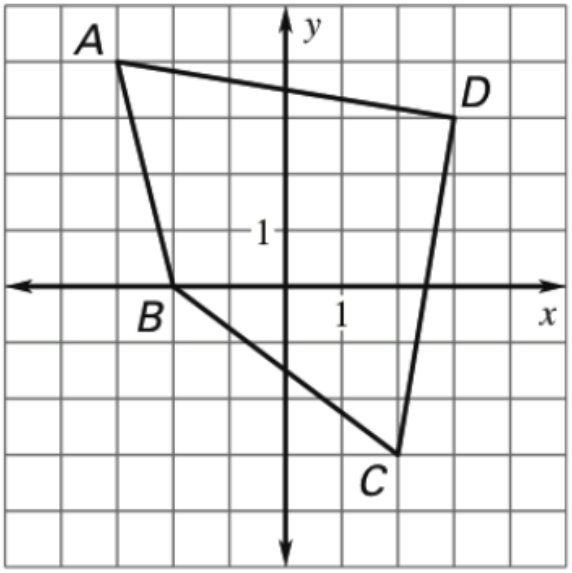


rite a matrix for the polygon. Then find the image matrix that represents e polygon after a reflection in the given line.

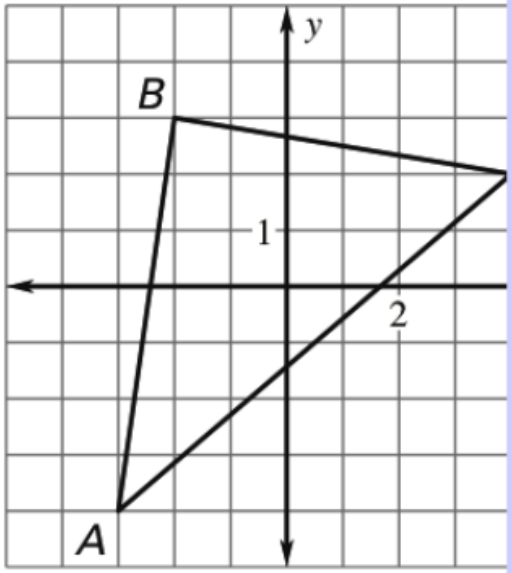
. *x*-axis



10. *y*-axis

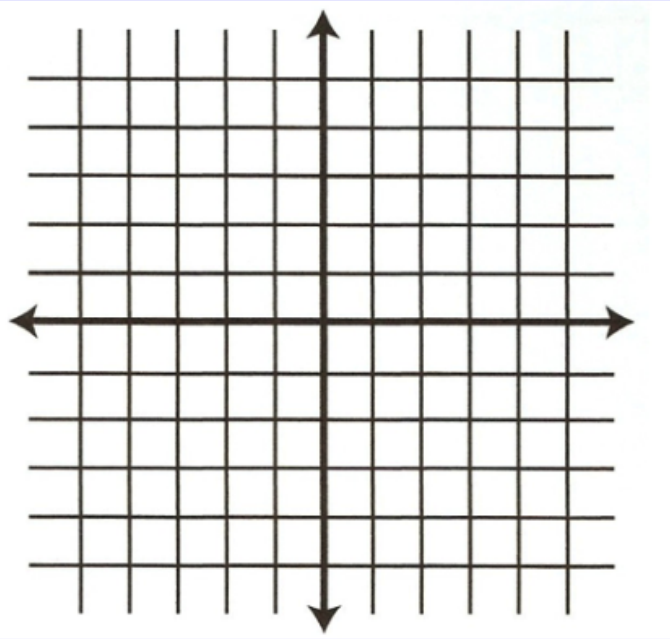


11. *x*-axis

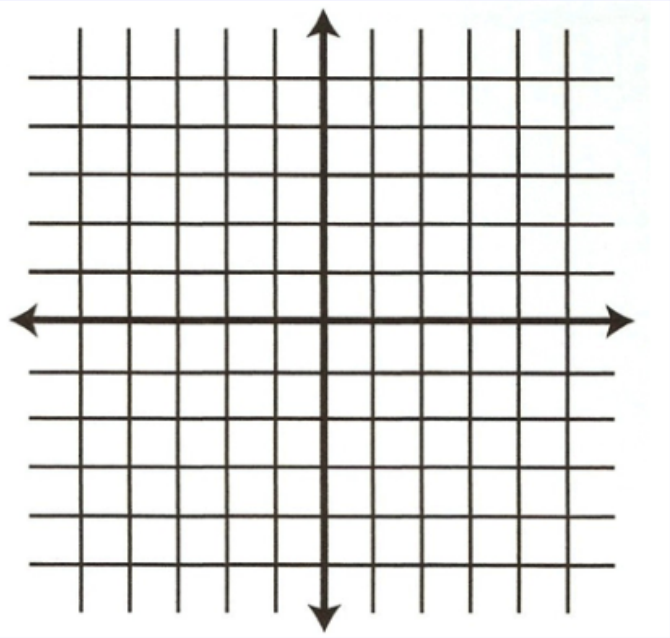


Find point *C* on the *x*-axis so *AC* + *BC* is a minimum.

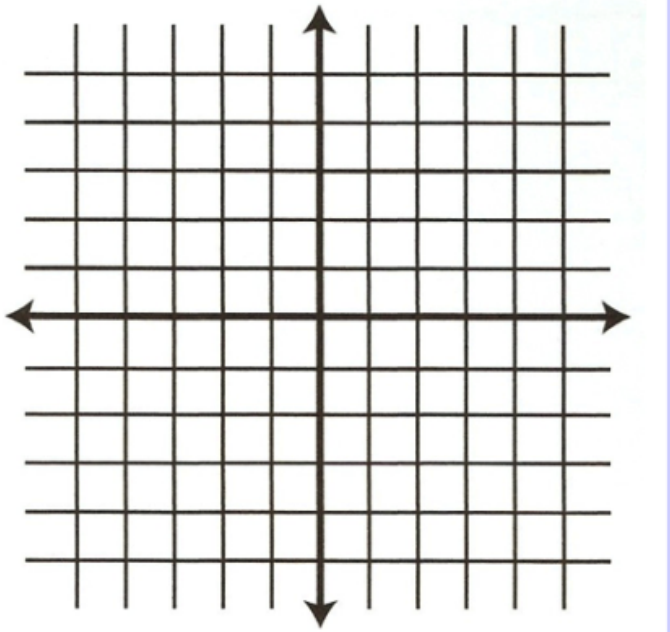
12. $A(2, -2), B(11, -4)$



13. $A(-1, 4), B(6, 3)$

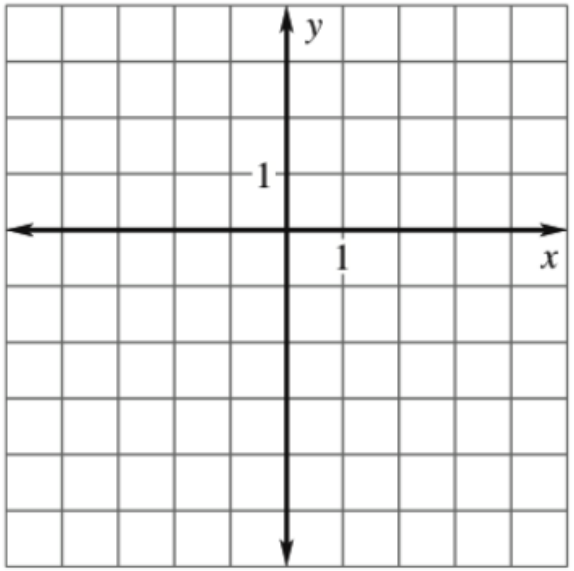


14. $A(-3, 2), B(-6, -4)$

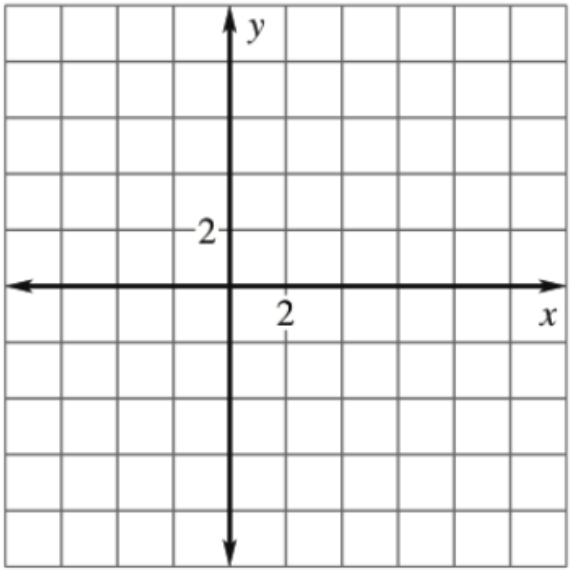


e vertices of $\triangle ABC$ are $A(-2, 1)$, $B(3, 4)$, and $C(3, 1)$. Reflect $\triangle ABC$ the first line. Then reflect $\triangle A'B'C'$ in the second line. Graph $\triangle A'B'C'$ d $\triangle A''B''C''$.

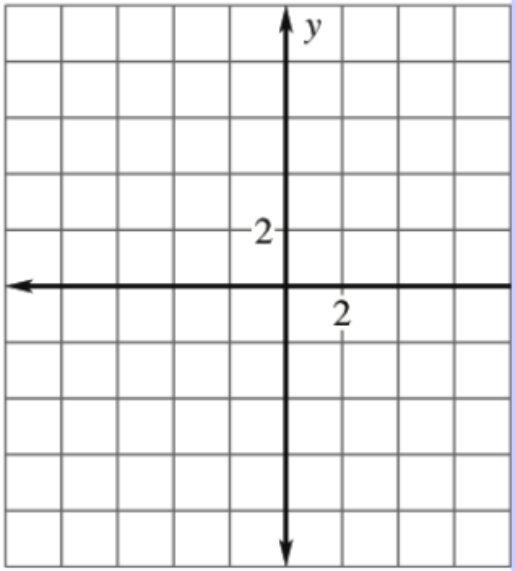
. In $y = 1$, then in $y = -2$



16. In $x = 4$, then in $y = -1$



17. In $y = x$, then in $x = -2$



18. Laying Cable Underground electrical cable is being laid for two new homes. Where along the road (line m) should the transformer box be placed so that there is a minimum distance from the box to each of the homes?