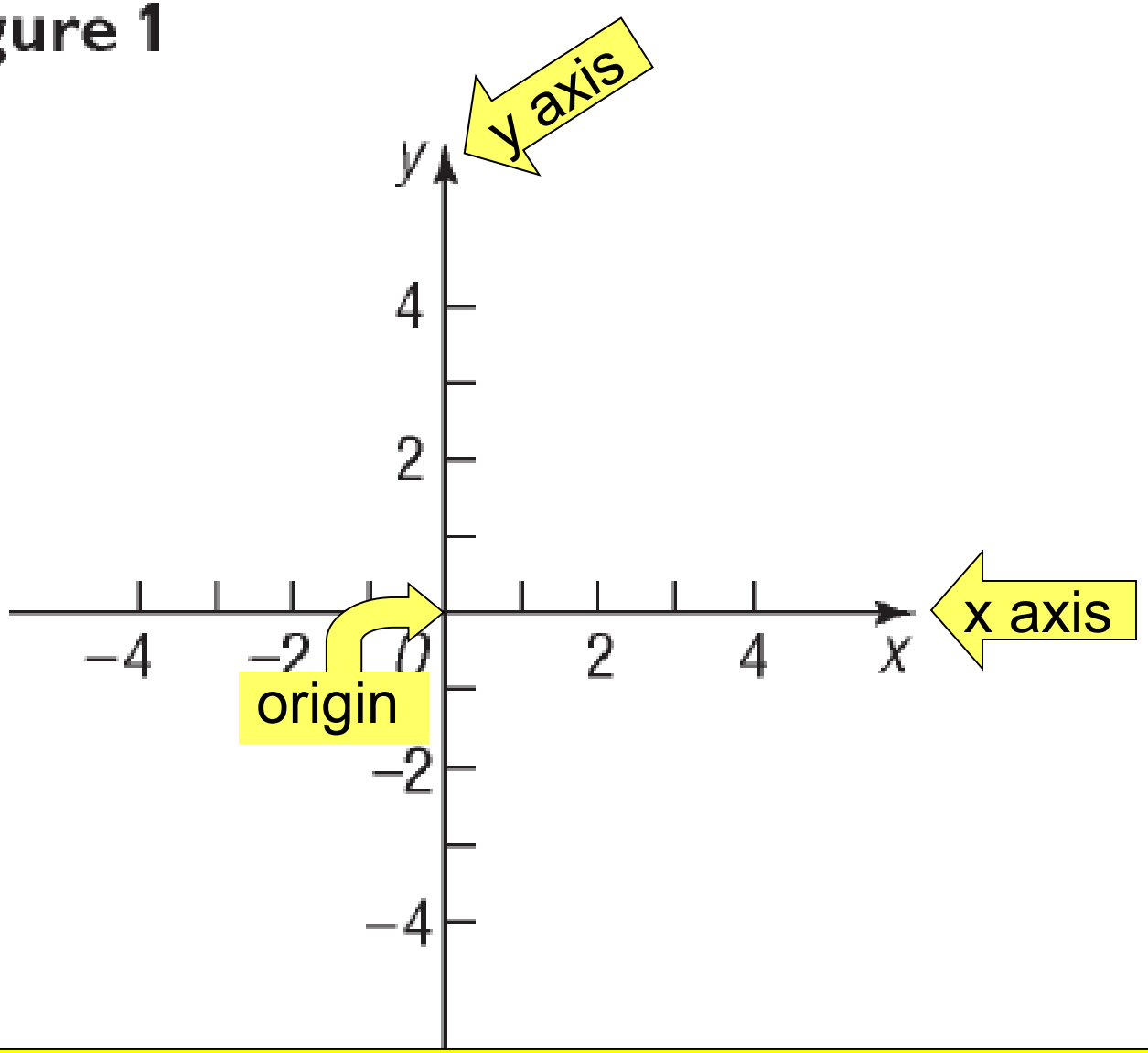
Section 1.1

Rectangular Coordinates; Graphing Utilities

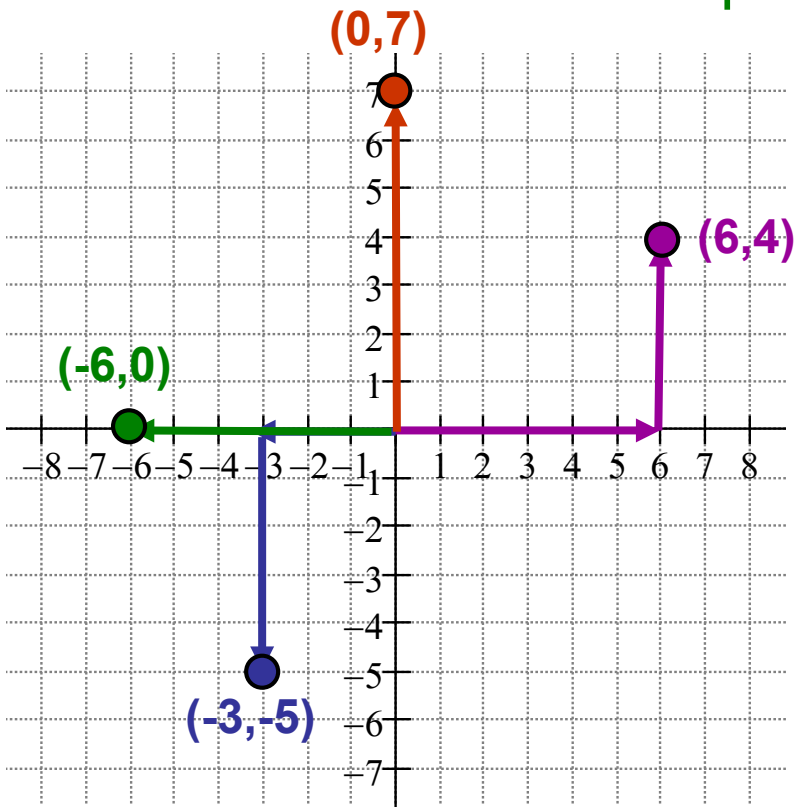
Figure 1



Rectangular or Cartesian Coordinate System

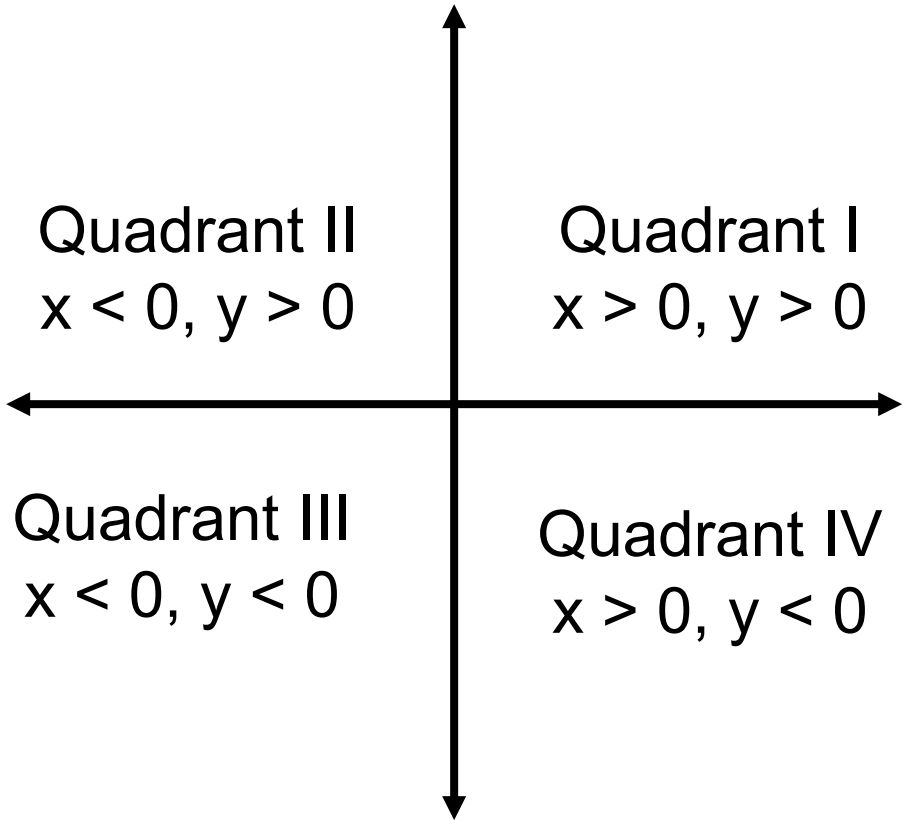
Let's plot the point (6,4)

Let's plot the point (-6,0)

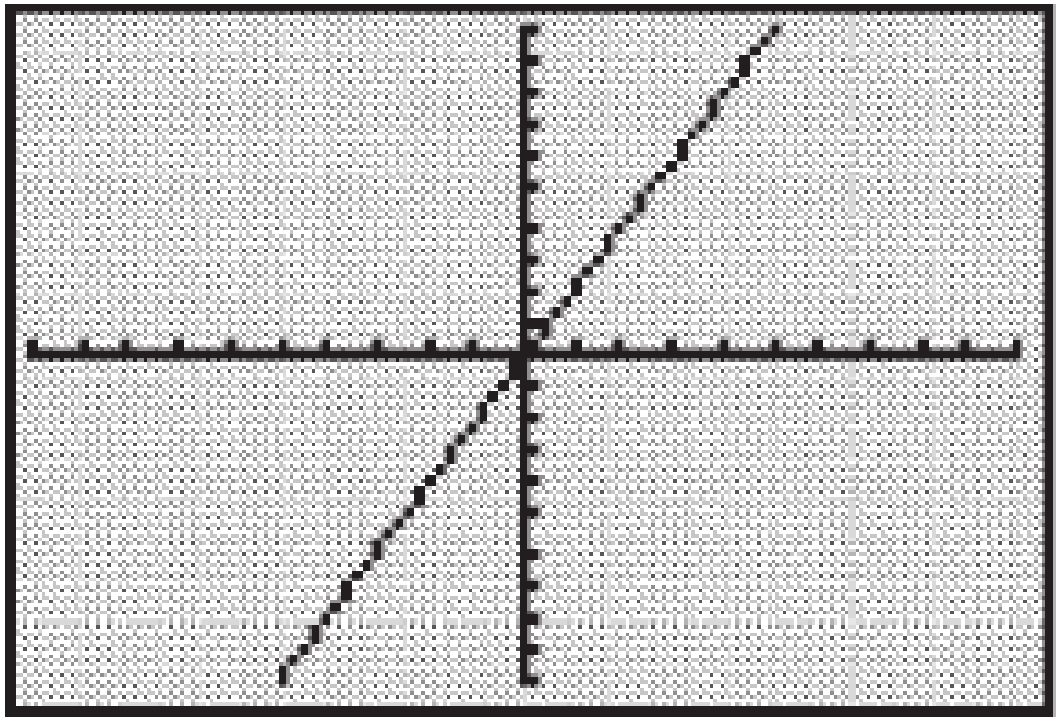


Let's plot the point (-3,-5)

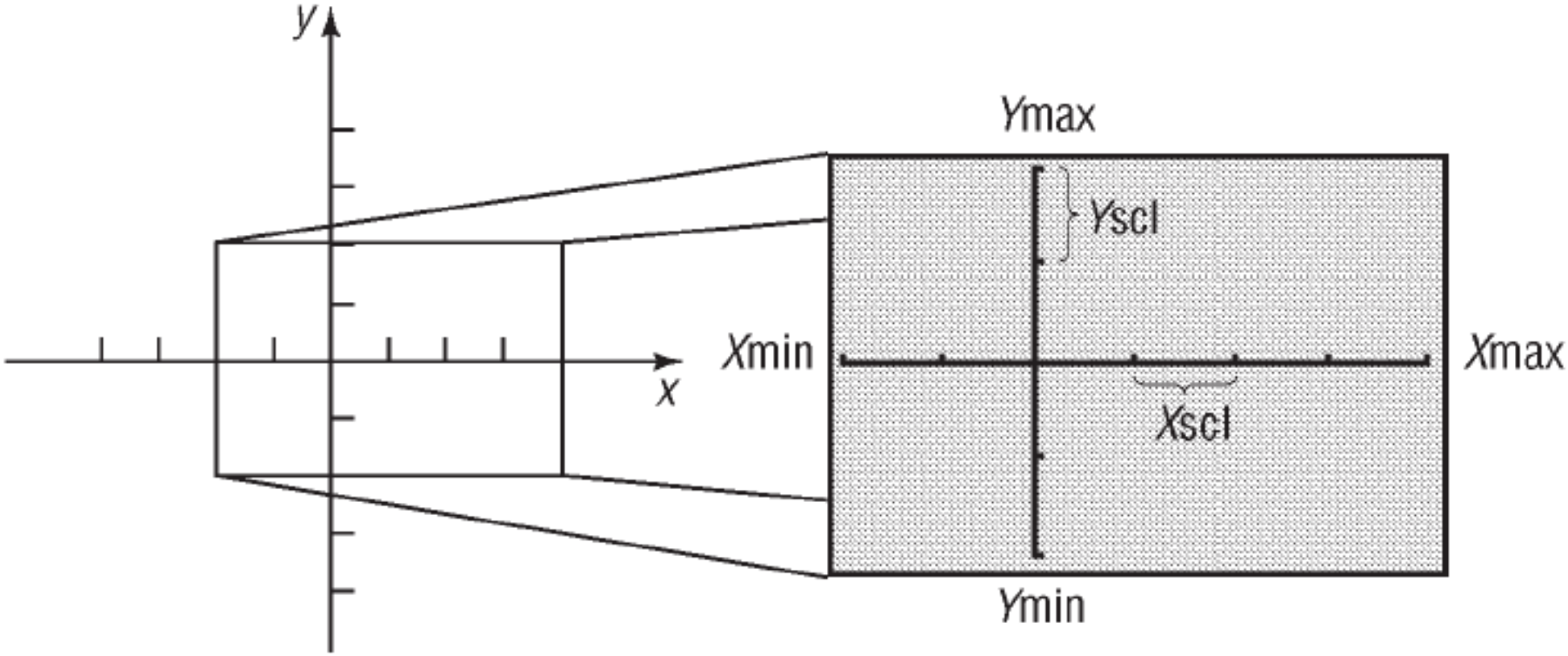
Let's plot the point (0,7)

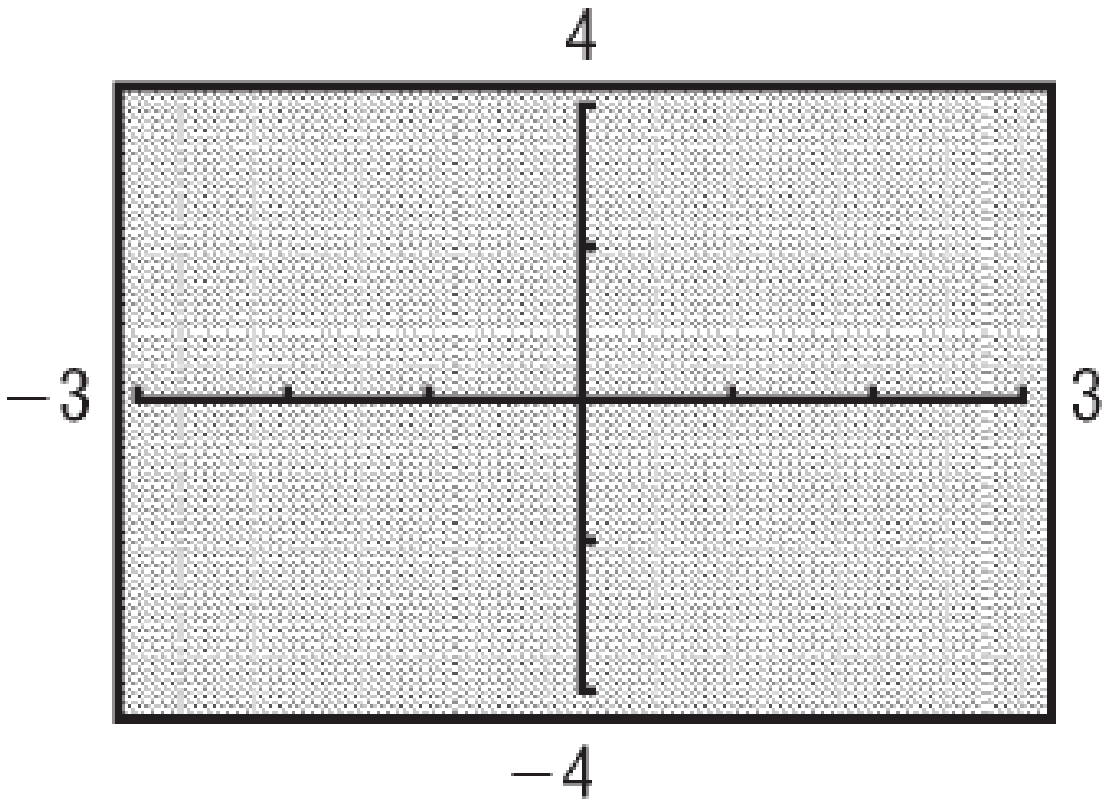

Quadrant II
x < 0, y > 0
Quadrant I
x > 0, y > 0
Quadrant III
x < 0, y < 0
Quadrant IV
x > 0, y < 0

$y = 2x$



*X*min:	the smallest value of x shown on the viewing window
*X*max:	the largest value of x shown on the viewing window
*X*scl:	the number of units per tick mark on the x-axis
*Y*min:	the smallest value of y shown on the viewing window
*Y*max:	the largest value of y shown on the viewing window
*Y*scl:	the number of units per tick mark on the y-axis

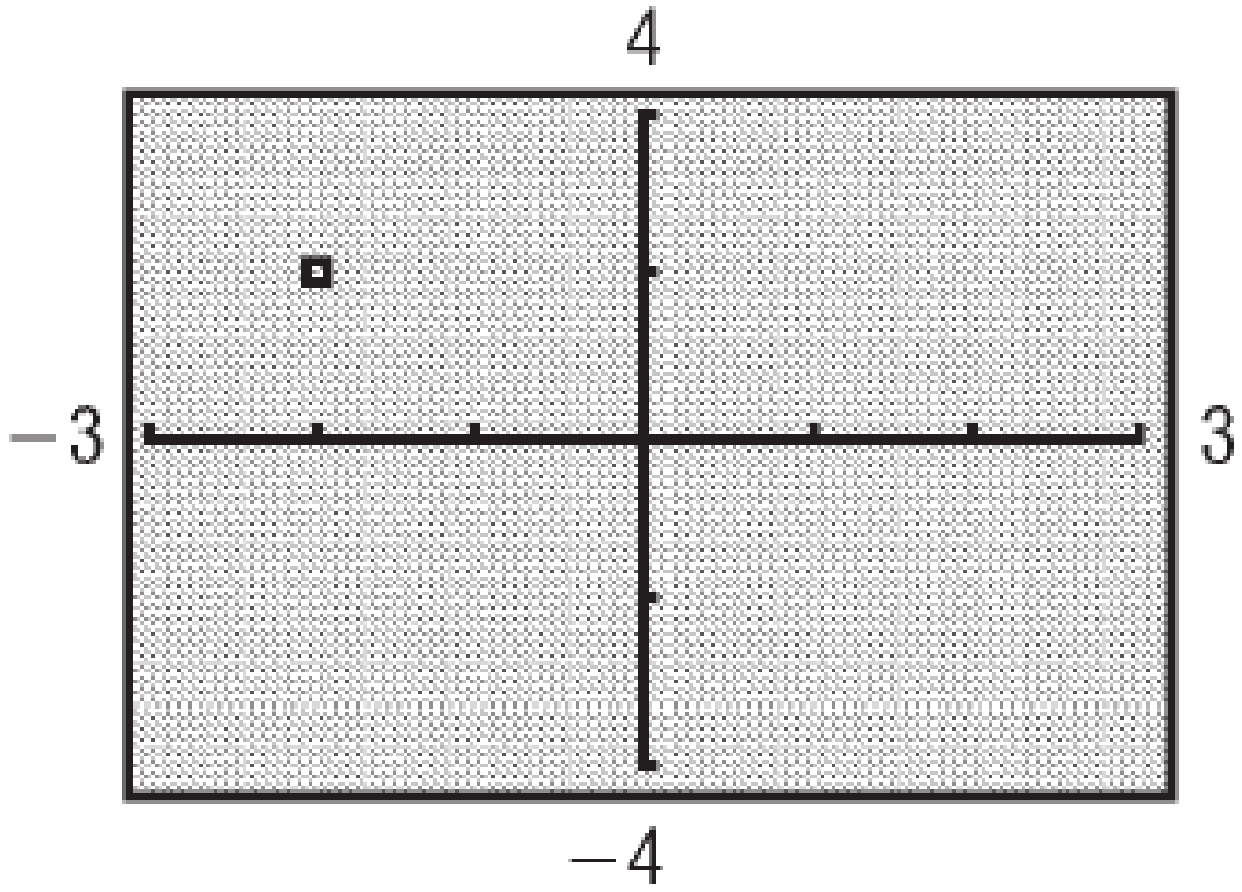




$$X\min = -3 \qquad Y\min = -4$$

$$X\max = 3 \qquad Y\max = 4$$

$$X\text{scl} = 1 \qquad Y\text{scl} = 2$$

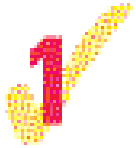


$$X\min = -3 \qquad Y\min = -4$$

$$X\max = 3 \qquad Y\max = 4$$

$$X\text{scl} = 1 \qquad Y\text{scl} = 2$$

OBJECTIVE 1

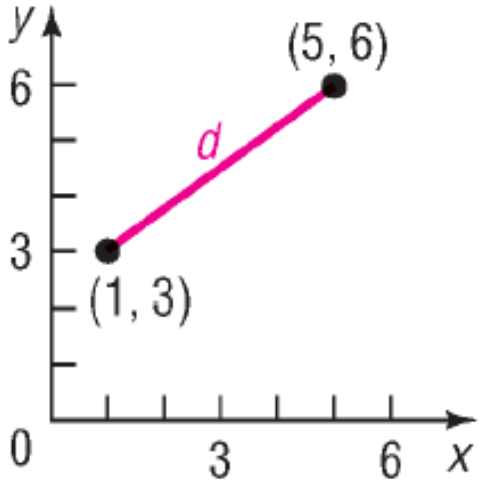


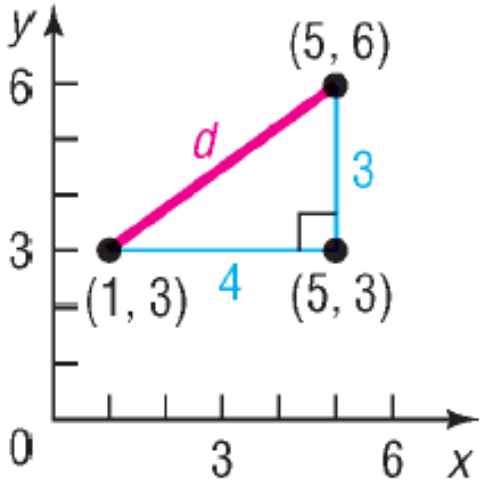
Use the Distance Formula

EXAMPLE

Finding the Distance between Two Points

Find the distance d between the points $(1, 3)$ and $(5, 6)$.





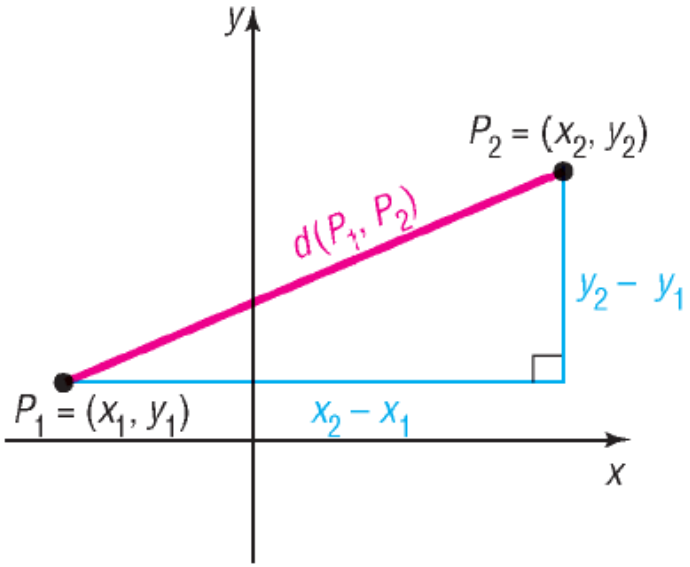
$$d^2 = 4^2 + 3^2 = 16 + 9 = 25 \qquad d = \sqrt{25} = 5$$

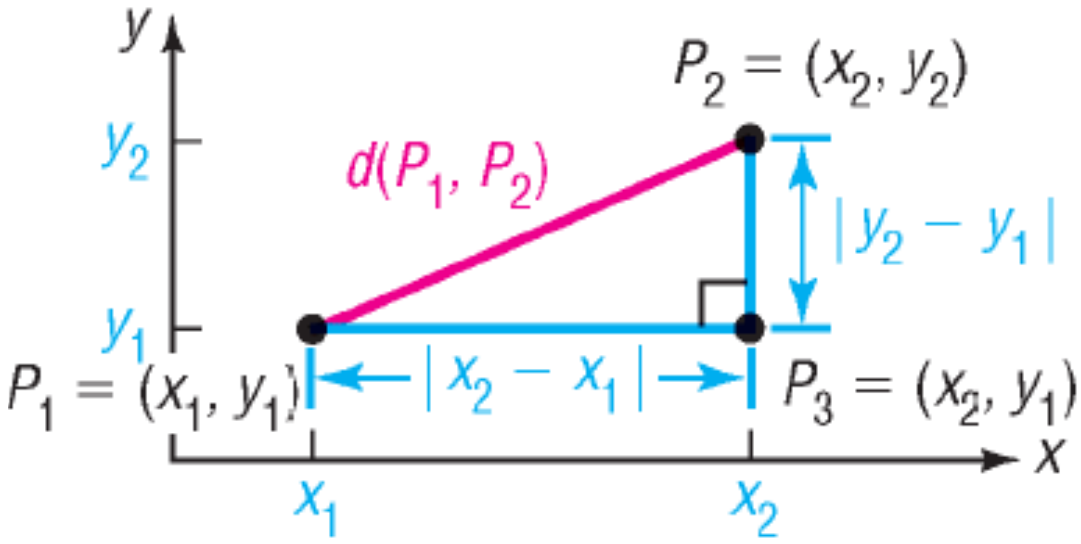
Distance Formula

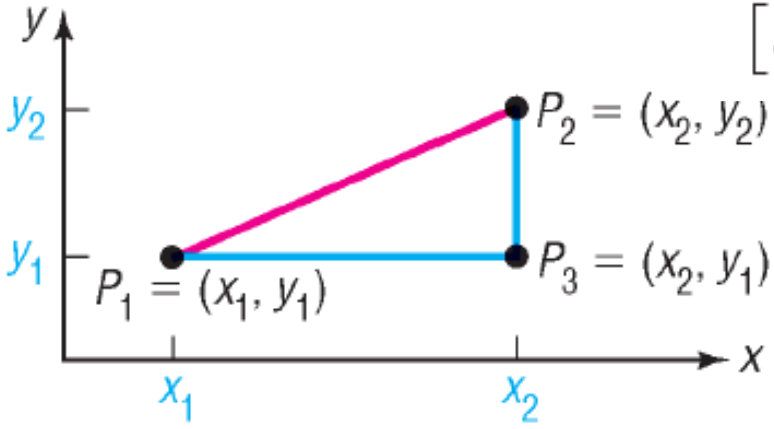
The distance between two points $P_1 = (x_1, y_1)$ and $P_2 = (x_2, y_2)$, denoted by $d(P_1, P_2)$, is

$$d(P_1, P_2) = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

Proof of the Distance Formula





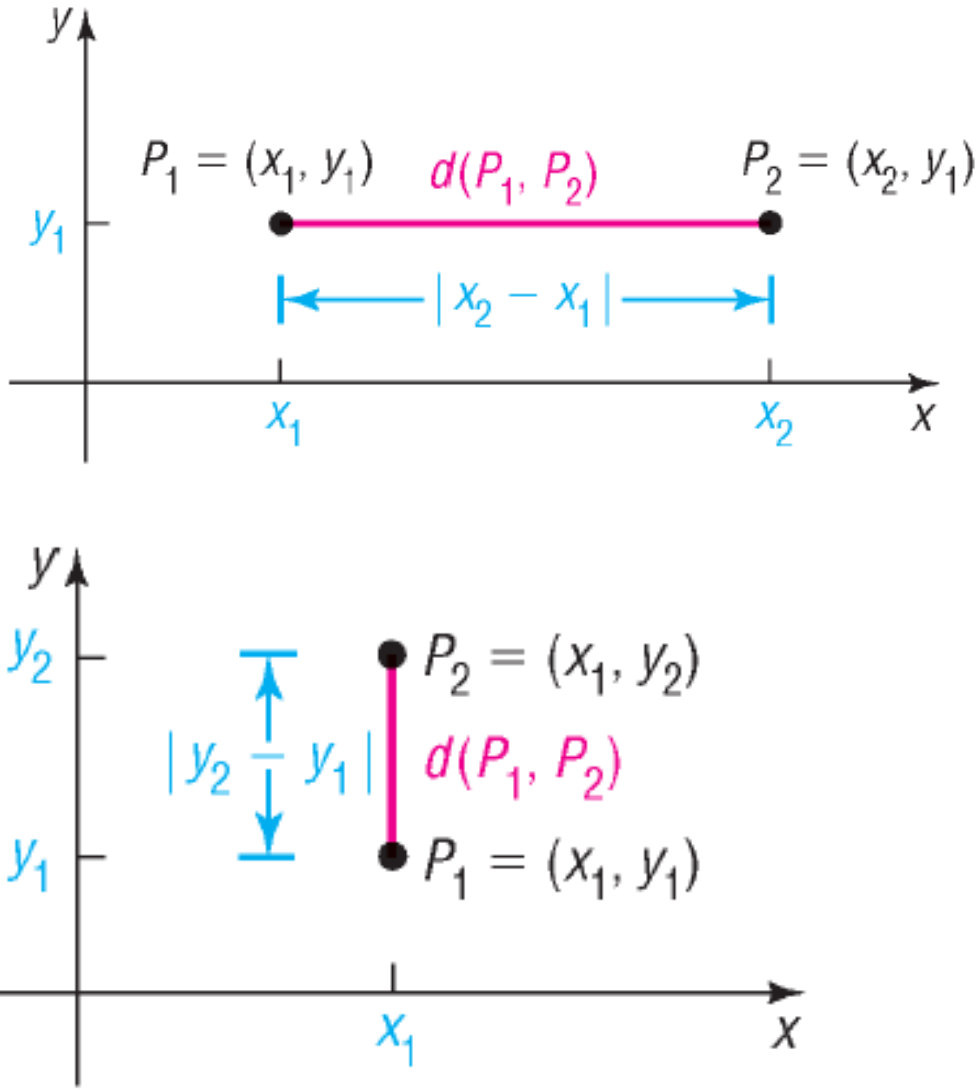


$$[d(P_1, P_2)]^2 = |x_2 - x_1|^2 + |y_2 - y_1|^2$$

$$= (x_2 - x_1)^2 + (y_2 - y_1)^2$$

$$d(P_1, P_2) = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

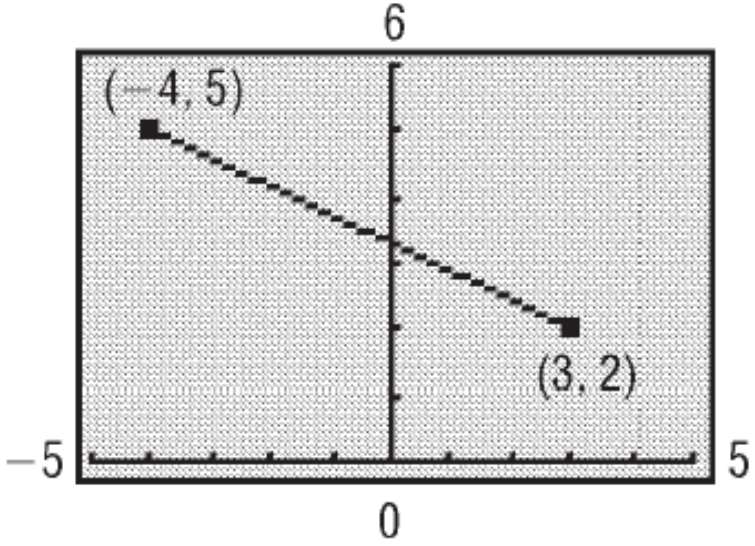
Horizontal or Vertical Segments



EXAMPLE

Finding the Length of a Line Segment

Find the length of the line segment from (-4 , 5) to (3, 2)



$$d = \sqrt{58} \approx 7.62$$

$$d(P_1, P_2) = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

EXAMPLE

Using Algebra to Solve Geometry Problems

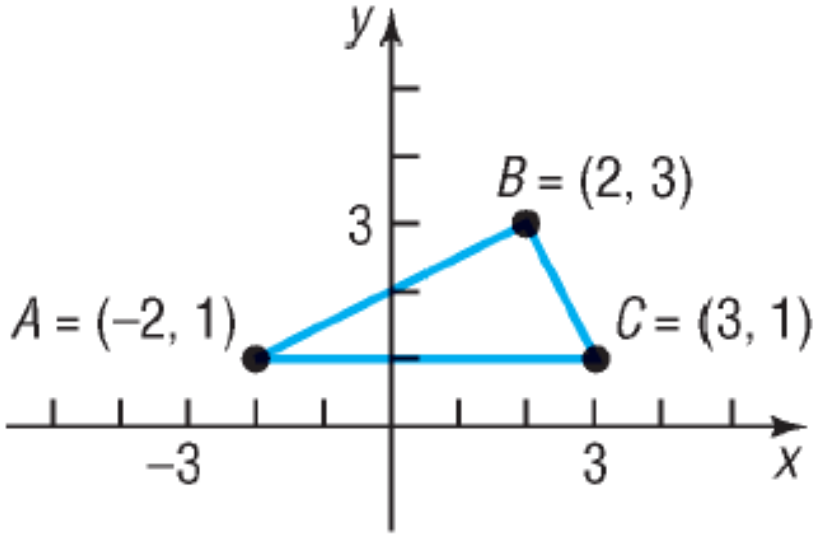
Consider the three points $A = (-2, 1)$, $B = (2, 3)$, and $C = (3, 1)$.

(a) Plot each point and form the triangle ABC.

(b) Find the length of each side of the triangle.

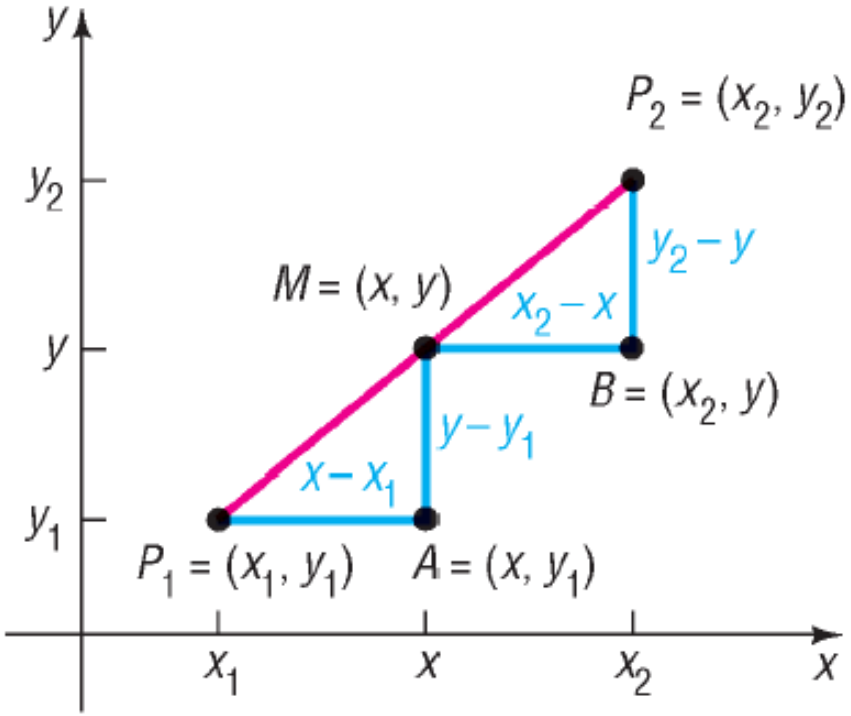
(c) Verify that the triangle is a right triangle.

(d) Find the area of the triangle.



OBJECTIVE 2

Use the Midpoint Formula



$$x - x_1 = x_2 - x$$
$$2x = x_1 + x_2$$
$$x = \frac{x_1 + x_2}{2}$$

$$y - y_1 = y_2 - y$$
$$2y = y_1 + y_2$$
$$y = \frac{y_1 + y_2}{2}$$

Midpoint Formula

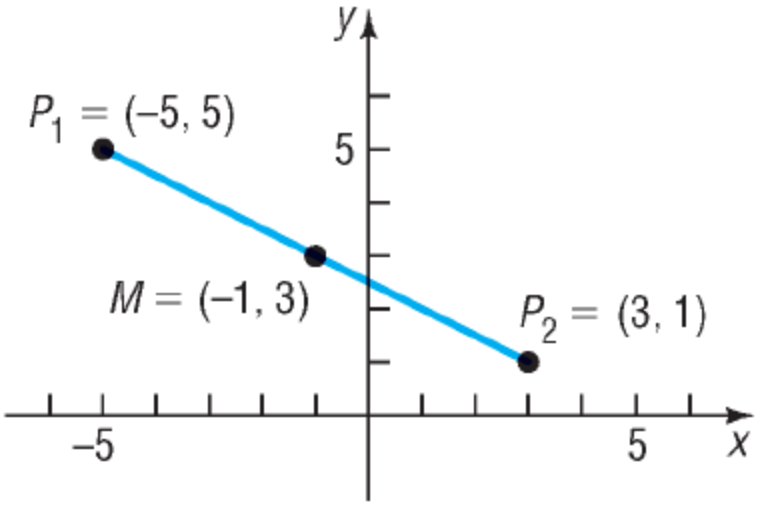
The midpoint $M = (x, y)$ of the line segment from $P_1 = (x_1, y_1)$ to $P_2 = (x_2, y_2)$ is

$$M = (x, y) = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$$

EXAMPLE

Finding the Midpoint of a Line Segment

Find the midpoint of a line segment from $P_1 = (-5, 5)$ to $P_2 = (3, 1)$. Plot the points P_1 and P_2 and their midpoint. Check your answer.



$$M = (x, y) = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$$