

# Geometry and Algebra

## Objectives

1. State and apply the distance formula.
2. State and apply the general equation of a circle.
3. State and apply the slope formula.
4. Determine whether two lines are parallel, perpendicular, or neither.
5. Understand the basic properties of vectors.
6. State and apply the midpoint formula.

## 13-1 The Distance Formula

Some of the terms you have used in your study of graphs are reviewed below.

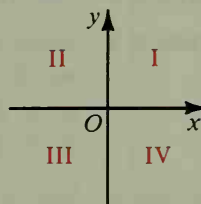
**Origin:** Point  $O$

**Axes:**  $x$ -axis and  $y$ -axis

**Quadrants:** Regions I, II, III, and IV

**Coordinate plane:** The plane of the  $x$ -axis and the  $y$ -axis

The arrowhead on each axis shows the positive direction.



You can easily find the distance between two points that lie on a horizontal line or on a vertical line.

The distance between  $A$  and  $B$  is 4.

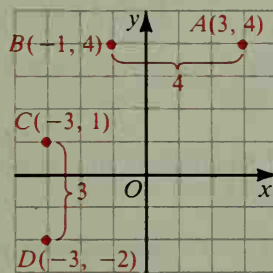
Using the  $x$ -coordinates of  $A$  and  $B$ :

$$|3 - (-1)| = 4, \text{ or } |(-1) - 3| = 4$$

The distance between  $C$  and  $D$  is 3.

Using the  $y$ -coordinates of  $C$  and  $D$ :

$$|1 - (-2)| = 3, \text{ or } |(-2) - 1| = 3$$



When two points do not lie on a horizontal or vertical line, you can find the distance between the points by using the Pythagorean Theorem.

**Example 1** Find the distance between points  $A(4, -2)$  and  $B(1, 2)$ .

**Solution** Draw the horizontal and vertical segments shown. The coordinates of  $T$  are  $(1, -2)$ . Then  $AT = 3$ ,  $BT = 4$ ,  $(AB)^2 = 3^2 + 4^2 = 25$ , and  $AB = 5$ .

