

9-6

The Distance and Midpoint Formulas

(Pages 466–470)

Sometimes it is necessary to study line segments on the coordinate plane. A **line segment**, or a part of a line, contains two endpoints. The coordinates of these endpoints can help us find the length and the **midpoint**, or the point that is halfway between the two endpoints, of the line segment. We can calculate the length of a line segment by using the **Distance Formula**, and we can calculate the midpoint of a line segment by using the **Midpoint Formula**.

The Distance Formula	To calculate the distance d of a line segment with endpoints (x_1, y_1) and (x_2, y_2) use the formula $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$.
The Midpoint Formula	To calculate the midpoint of a line segment with endpoints (x_1, y_1) and (x_2, y_2) use the formula $\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$.

Examples

- a. Find the distance between (2, 3) and (6, 8).

Let $x_1 = 2$, $x_2 = 6$, $y_1 = 3$, and $y_2 = 8$.

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

$$d = \sqrt{(6 - 2)^2 + (8 - 3)^2}$$

$$d = \sqrt{4^2 + 5^2}$$

$$d = \sqrt{16 + 25}$$

$$d = \sqrt{41} \text{ or } 6.4 \text{ units}$$

- b. Find the midpoint of (5, 1) and (−1, 5).
Let $x_1 = 5$, $x_2 = -1$, $y_1 = 1$, and $y_2 = 5$.

$$\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right) \quad \text{Midpoint Formula}$$

$$\left(\frac{5 + (-1)}{2}, \frac{1 + 5}{2}\right) \quad \text{Substitute.}$$

$$\left(\frac{4}{2}, \frac{6}{2}\right) \quad \text{Add.}$$

(2, 3) is the midpoint

Practice

Find the distance between each pair of points. Round answers to the nearest hundredth.

1. (4, 6), (1, 5)

2. (15, 4), (10, 10)

3. (−7, −2), (11, 3)

Find the midpoint of the given points.

4. (7, −5), (9, −1)

5. (−8, 4), (3, −4)

6. (−1.8, 1.9), (1.1, 2.8)

7. **Standardized Test Practice** What is the midpoint of the line segment with endpoints (5, −1) and (−9, 7)?

A (2, −3)

B (−2, 3)

C (3, −2)

D (−3, 2)