

Apply the Distance & Midpoint Formula

Notes p. 208



Distance formula

Midpoint

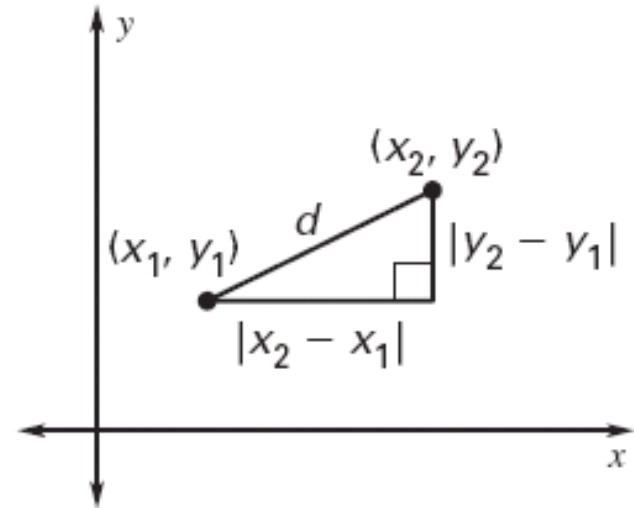
Midpoint formula



THE DISTANCE FORMULA

The distance d between any two points (x_1, y_1) and (x_2, y_2) is

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



Example 1**Find the distance between two points**

Find the distance between $(4, -3)$ and $(-7, 2)$.

Let $(x_1, y_1) = (4, -3)$ and $(x_2, y_2) = (-7, 2)$.

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

**Distance
formula**

$$= \sqrt{(\quad - \quad)^2 + (\quad - \quad)^2}$$

Substitute.

$$= \sqrt{(\quad)^2 + (\quad)^2} = \underline{\quad}$$

Simplify.

The distance between the points is units.



Example 2 Find a missing coordinate

The distance between $(5, a)$ and $(9, 6)$ is $4\sqrt{2}$ units.
Find the possible values of a .

Solution

Use the distance formula with $d = 4\sqrt{2}$. Let $(x_1, y_1) = (5, a)$ and $(x_2, y_2) = (9, 6)$.

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

Distance
formula

$$4\sqrt{2} = \sqrt{(\underline{\quad} - \underline{\quad})^2 + (\underline{\quad} - \underline{\quad})^2}$$

Substitute.

$$4\sqrt{2} = \sqrt{\underline{\hspace{2cm}}}$$

Multiply.

$$4\sqrt{2} = \sqrt{\underline{\hspace{2cm}}}$$

Simplify.

$$\underline{\hspace{2cm}} = \underline{\hspace{2cm}}$$

Square each
side.



$$0 = \underline{\hspace{2cm}}$$

$$0 = \underline{\hspace{2cm}}$$

$$\underline{\hspace{2cm}} = 0 \quad \text{or} \quad \underline{\hspace{2cm}} = 0$$

$$a = \underline{\hspace{1cm}} \quad \text{or} \quad a = \underline{\hspace{1cm}}$$

The value of a is $\underline{\hspace{1cm}}$ or $\underline{\hspace{1cm}}$.

**Write in
standard form.**

Factor.

**Zero-product
property**

Solve for a .



**1. Find the distance
between $(2, -3)$
and $(5, 1)$.**

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



2. The distance between $(-1, 2)$ and $(3, b)$ is $\sqrt{41}$ units. Find the possible values of b .

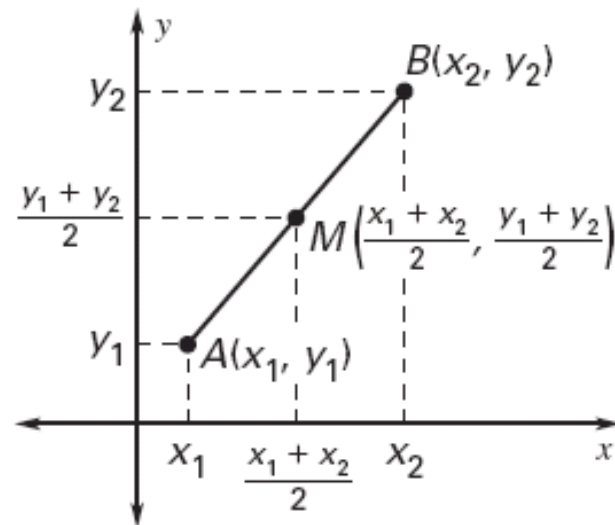
$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$



THE MIDPOINT FORMULA

The midpoint M of the line segment with endpoints $A(x_1, y_1)$ and $B(x_2, y_2)$ is

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



Example 3**Find a midpoint of a line segment**

Find the midpoint of the line segment with endpoints $(-3, 7)$ and $(-1, 11)$.

Solution

Let $(x_1, y_1) = (-3, 7)$ and $(x_2, y_2) = (-1, 11)$.

$$\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right) = \left(\frac{\boxed{} + \boxed{}}{\boxed{}}, \frac{\boxed{} + \boxed{}}{\boxed{}} \right)$$
$$= (\underline{}, \underline{})$$

The midpoint of the line segment is $(\underline{}, \underline{})$.



3. $(1, -2), (5, -4)$

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

4. $(5, 12), (13, 8)$

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

Assignment: p. 195 2 – 20 even

