9.1 Apply the Distance and Midpoint Formulas

TEKS *a.4, a.5, 2A.2.A; G.7.C*

Before You found the slope of a line passing through two points.

Now You will find the length and midpoint of a line segment.

Why? So you can find real-world distances, as in Exs. 48–51.

Key Vocabulary
- distance formula
- midpoint formula

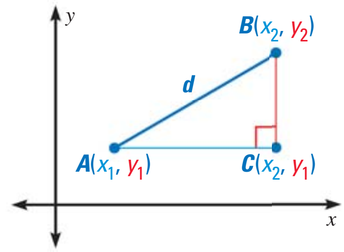
To find the distance d between $A(x_1, y_1)$ and $B(x_2, y_2)$, apply the Pythagorean theorem to right triangle ABC.

$$(AB)^2 = (AC)^2 + (BC)^2$$

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

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

The final equation is the **distance formula**.



KEY CONCEPT *For Your Notebook*

The Distance Formula

The distance d between (x_1, y_1) and (x_2, y_2) is $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$.

TAKS

EXAMPLE 1 TAKS Practice: Multiple Choice

What is the distance between (−2, 6) and (3, −1)?

Ⓐ $2\sqrt{3}$ Ⓑ $\sqrt{26}$ Ⓒ $\sqrt{74}$ Ⓓ 12

Solution

Let $(x_1, y_1) = (-2, 6)$ and $(x_2, y_2) = (3, -1)$.

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} = \sqrt{(3 - (-2))^2 + (-1 - 6)^2} = \sqrt{25 + 49} = \sqrt{74}$$

▶ The correct answer is C. Ⓐ Ⓑ Ⓒ Ⓓ

EXAMPLE 2 Classify a triangle using the distance formula

Classify $\triangle ABC$ as *scalene*, *isosceles*, or *equilateral*.

$$AB = \sqrt{(7 - 4)^2 + (3 - 6)^2} = \sqrt{18} = 3\sqrt{2}$$

$$BC = \sqrt{(2 - 7)^2 + (1 - 3)^2} = \sqrt{29}$$

$$AC = \sqrt{(2 - 4)^2 + (1 - 6)^2} = \sqrt{29}$$

▶ Because $BC = AC$, $\triangle ABC$ is isosceles.