11.5 Apply the Distance and Midpoint Formulas

TEKS A.4.A, A.10.A; 2A.9.D, 2A.9.F

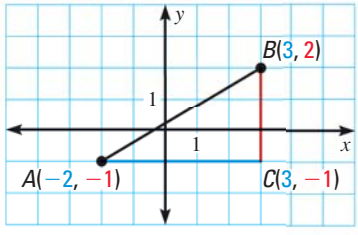
Before You used the Pythagorean theorem and its converse.

Now You will use the distance and midpoint formulas.

Why? So you can calculate distances traveled, as in Ex. 47.

Key Vocabulary
- **distance formula**
- **midpoint**
- **midpoint formula**

To find the distance between the points $A(-2, -1)$ and $B(3, 2)$, draw a right triangle, as shown. The lengths of the legs of the right triangle are as follows.



$$AC = |3 - (-2)| = 5$$

$$BC = |-1 - 2| = 3$$

You can use the Pythagorean theorem to find AB, the length of the hypotenuse of the right triangle.

$(AB)^2 = (AC)^2 + (BC)^2$ **Pythagorean theorem**

$AB = \sqrt{(AC)^2 + (BC)^2}$ **Take positive square root of each side.**

$AB = \sqrt{5^2 + 3^2} = \sqrt{34}$ **Substitute 5 for *AC* and 3 for *BC* and simplify.**

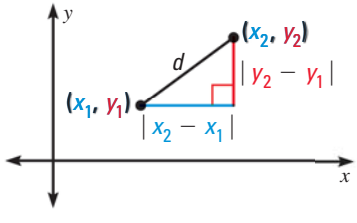
This example suggests that you can find the distance between two points in a coordinate plane using the following formula, called the **distance formula**.

KEY CONCEPT *For Your Notebook*

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 (−1, 3) and (5, 2).

Let $(x_1, y_1) = (-1, 3)$ and $(x_2, y_2) = (5, 2)$.

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

$= \sqrt{(5 - (-1))^2 + (2 - 3)^2}$ **Substitute.**

$= \sqrt{6^2 + (-1)^2} = \sqrt{37}$ **Simplify.**

▶ The distance between the points is $\sqrt{37}$ units.