GUIDED PRACTICE for Examples 1 and 2

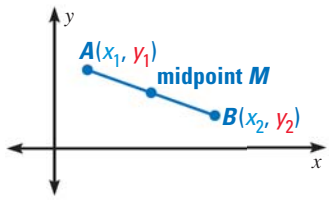
1. What is the distance between $(3, -3)$ and $(-1, 5)$?
2. The vertices of a triangle are $R(-1, 3)$, $S(5, 2)$, and $T(3, 6)$. Classify $\triangle RST$ as *scalene*, *isosceles*, or *equilateral*.

KEY CONCEPT *For Your Notebook*

The Midpoint Formula

A line segment's *midpoint* is equidistant from the segment's endpoints. The **midpoint formula**, shown below, gives the midpoint of the line segment joining $A(x_1, y_1)$ and $B(x_2, y_2)$.

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



In words, each coordinate of M is the mean of the corresponding coordinates of A and B.

EXAMPLE 3 Find the midpoint of a line segment

Find the midpoint of the line segment joining $(-5, 1)$ and $(-1, 6)$.

Solution

Let $(x_1, y_1) = (-5, 1)$ and $(x_2, y_2) = (-1, 6)$.

$$\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right) = \left(\frac{-5 + (-1)}{2}, \frac{1 + 6}{2}\right) = \left(-3, \frac{7}{2}\right)$$

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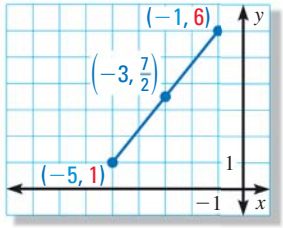


EXAMPLE 4 Find a perpendicular bisector

REVIEW EQUATIONS
For help with writing equations of perpendicular lines, see p. 98.

Write an equation for the perpendicular bisector of the line segment joining $A(-3, 4)$ and $B(5, 6)$.

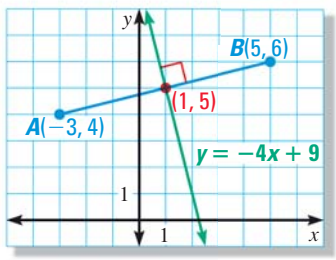
Solution

STEP 1 **Find** the midpoint of the line segment.

$$\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right) = \left(\frac{-3 + 5}{2}, \frac{4 + 6}{2}\right) = (1, 5)$$

STEP 2 **Calculate** the slope of $\overline{AB}$.

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{6 - 4}{5 - (-3)} = \frac{2}{8} = \frac{1}{4}$$



STEP 3 **Find** the slope of the perpendicular bisector: $-\frac{1}{m} = -\frac{1}{1/4} = -4$.

STEP 4 **Use** point-slope form: $y - 5 = -4(x - 1)$, or $y = -4x + 9$.

▸ An equation for the perpendicular bisector of $\overline{AB}$ is $y = -4x + 9$.