Name ______________________________ Date ______________

Using Midpoints

The **midpoint** of a segment is the point that divides the segment into two congruent segments. In the figure, M is the midpoint of $\overline{AB}$. So, $\overline{AM} \cong \overline{MB}$ and $AM = MB$.

Example 1 **Point M is the midpoint of $\overline{PQ}$. Find the length of $\overline{PQ}$.**

First write and solve an equation. Use the fact that $PM = MQ$.

$PM = MQ$ — Write the equation.

$3x + 10 = 8x + 25$ — Substitute.

$-3 = x$ — Solve for x.

Then evaluate the expression for PM when $x = -3$ to obtain $PM = 1$. By the Segment Addition Postulate and the definition of midpoint, $PQ = PM + MQ = 1 + 1 = 2$.

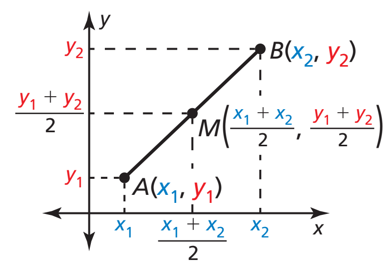
▶ So, the length of $\overline{PQ}$ is 2.

The Midpoint Formula

The coordinates of the midpoint of a segment are the averages of the x-coordinates and of the y-coordinates of the endpoints.

If $A(x_1, y_1)$ and $B(x_2, y_2)$ are points in a coordinate plane, then the midpoint M of $\overline{AB}$ has coordinates

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



Example 2 **The endpoints of $\overline{AB}$ are $A(-4, 7)$ and $B(10, -8)$. Find the coordinates of the midpoint M.**

Use the Midpoint Formula.

$$M\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right) = M\left(\frac{-4 + 10}{2}, \frac{7 + (-8)}{2}\right) = M\left(3, -\frac{1}{2}\right)$$

▶ The coordinates of the midpoint M are $\left(3, -\frac{1}{2}\right)$.

Practice

Check your answers at BigIdeasMath.com.

1. Point M bisects $\overline{JK}$ such that $JM = 4x - 5$ and $MK = 3x + 2$. Find the length of $\overline{JK}$. $JK = 46$

2. Point M bisects $\overline{EF}$ such that $EM = 7x + 11$ and $MF = 8x$. Find the length of $\overline{EF}$. $EF = 176$

The endpoints of $\overline{RS}$ are given. Find the coordinates of the midpoint M.

3. $R(-6, 3)$, $S(-4, 1)$
   $(-5, 2)$

4. $R(0, -2)$, $S(6, -8)$
   $(3, -5)$

5. $R(13, 2)$, $S(7, 6)$
   $(10, 4)$

6. $R(-2, 9)$, $S(4, 0)$
   $\left(1, \frac{9}{2}\right)$

Copyright © Big Ideas Learning, LLC