Lesson 1.4 Midpoints and Bisectors

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Lesson 1.4 Midpoints

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Workbook pages 31-40

MA.912.GR.3.3

Use coordinate geometry to solve mathematical and real-world geometric problems involving lines, circles, triangles and quadrilaterals.

MA.912.GR.5.2

Construct the bisector of a segment or an angle, including the perpendicular bisector of a line segment.

Content Objective

Students will find midpoints and bisect line segments.

Learn

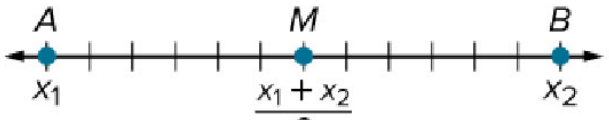
Midpoints on a Number Line

The **midpoint** of a segment is the point halfway between the endpoints of the segme

A point is **equidistant** from other points if it is the same distance from them.

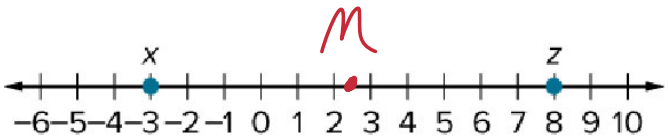
Key Concept: Midpoint on a Number Line

If $\overline{AB}$ has endpoints at x_1 and x_2 on a number line, then the midpoint M of $\overline{AB}$ has coordinate $M = \frac{x_1 + x_2}{2}$.



Example 1
Find the Midpoint on a Number Line

Find the coordinate of the midpoint of $\overline{XZ}$.



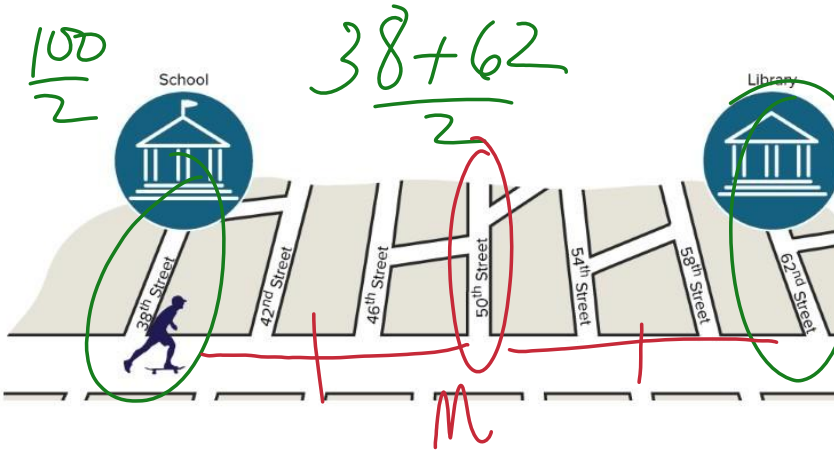
$\frac{-3+8}{2} = \frac{5}{2} = 2.5$

Example 2
Midpoints in the Real World

Check

DISTANCE Kenneth travels from his school on 38th Street to the library on 62nd Street. He stops halfway there to take a break. Where does Kenneth stop to rest?

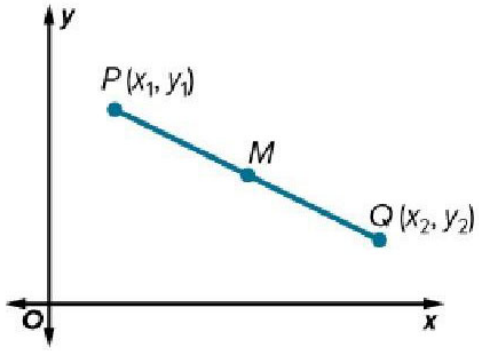
50



Learn
Midpoints on the Coordinate Plane

Key Concept: Midpoint Formula on the Coordinate Plane

If $\overline{PQ}$ has endpoints at $P(x_1, y_1)$ and $Q(x_2, y_2)$ on the coordinate plane, then the midpoint M of $\overline{PQ}$ has coordinates $M\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$.



Example 3
Find the Midpoint on the Coordinate Plane

Find the coordinates of *M*, the midpoint of $\overline{AB}$, for *A*(−2, 1) and *B*(8, 3).

x_1, y_1 x_2, y_2

$\frac{-2 + 8}{2}, \frac{1 + 3}{2}$

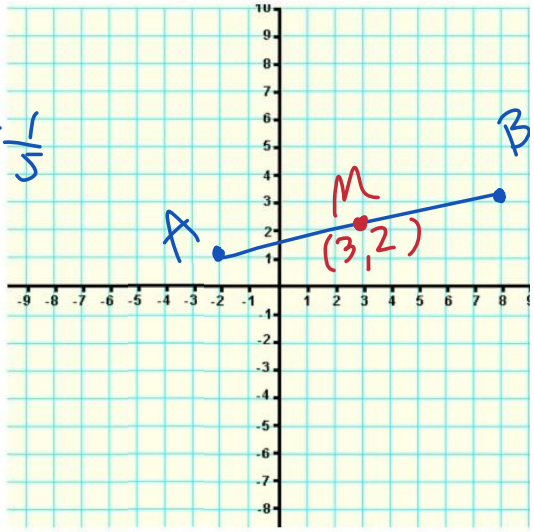
$\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}$

$\frac{6}{2}, \frac{4}{2}$

Midpoint (3, 2)

Slope

$\frac{\text{Rise}}{\text{Run}}$ $\frac{2}{10} \div \frac{2}{2} = \frac{1}{5}$



Example 3
Find the Midpoint on the Coordinate Plane

Check

Find the coordinates of *B*, the midpoint of $\overline{AC}$, for *A*(−3, −2) and *C*(5, 10).

x_1, y_1 x_2, y_2

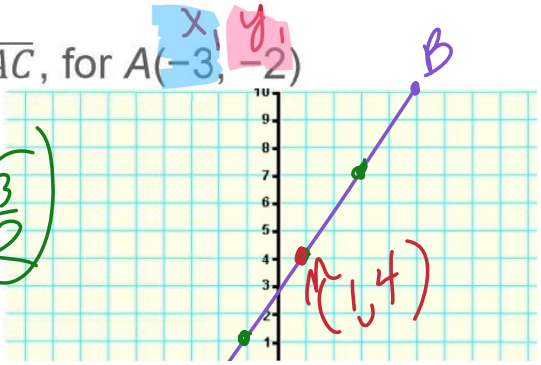
$\frac{-3 + 5}{2}, \frac{-2 + 10}{2}$

$\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}$

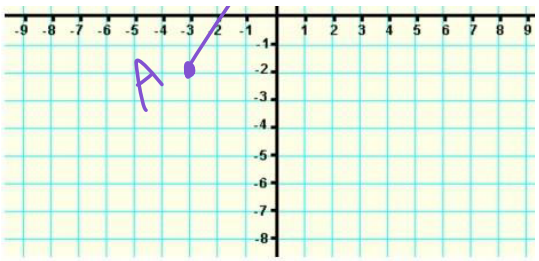
$\frac{2}{2}, \frac{8}{2}$

Slope

$\frac{\text{Rise}}{\text{Run}}$ $\frac{12}{8} \div \frac{4}{4} = \frac{3}{2}$



Midpoint (1, 4)



Example 4
Find Missing Coordinates

Find the coordinates of *A* if $P\left(3, \frac{1}{2}\right)$ is the midpoint of $\overline{AB}$ and *B* has coordinates (8, 3). *Use the midpoint Formula & Graph to prove using the slope!

? x_1, y_1

$\frac{x_1 + x_2}{2} = 3$ $\quad \frac{y + 3}{2} = 0.5$

$x + 8 = 6$ $\quad y + 3 = 1$

$x = -2$ $\quad y = -2$

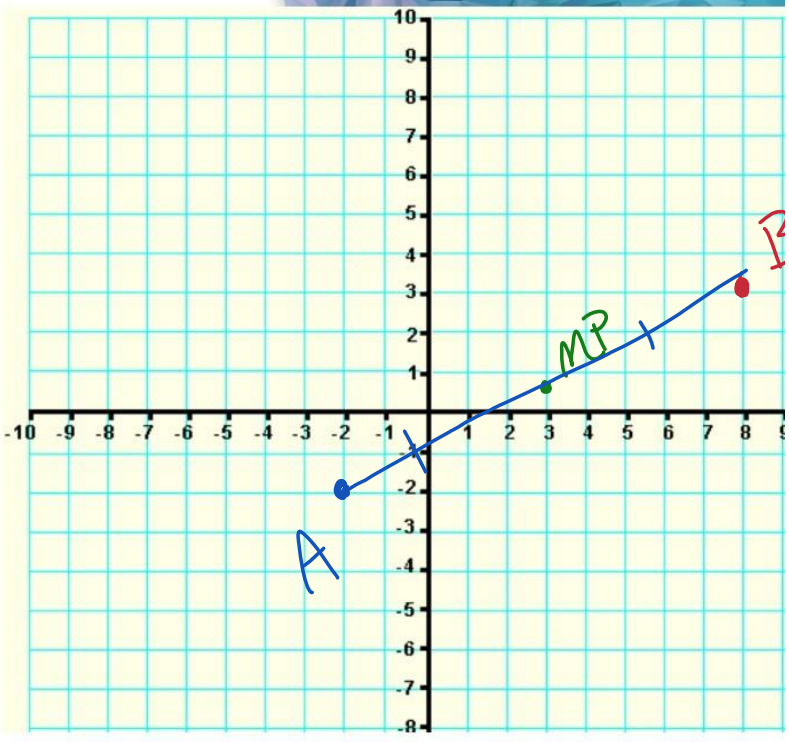
Midpt P (3, 1/2)

A ?, y_1 (−2)

x_1, −2

(−2,)

Example 4
Find Missing Coordinates

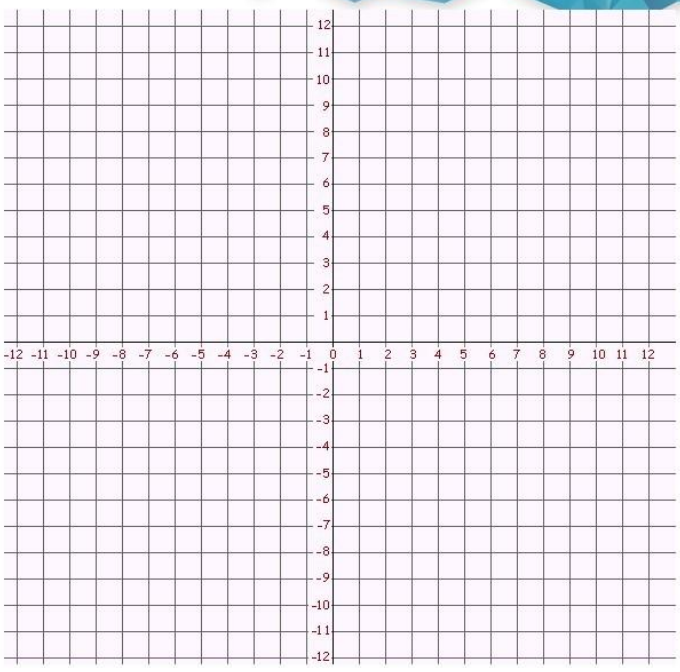


Example 4
Find Missing Coordinates

Check

Find the coordinates of Q if $R(6, -1)$ is the midpoint of $\overline{QS}$ and S has coordinates $(12, 4)$. Use the midpoint formula and graph to prove.

Example 4
Find Missing Coordinates



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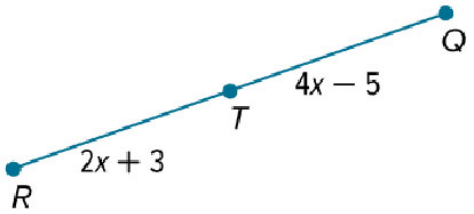
Learn
Bisectors

Because the midpoint separates a segment into two congruent segments, we can say that the midpoint **bisects**

the segment. Any segment, line, plane, or point that bisects a segment is called a **segment bisector**.

Example 5
Find Missing Measures

Find the measure of $\overline{RT}$ if T is the midpoint of $\overline{RQ}$.



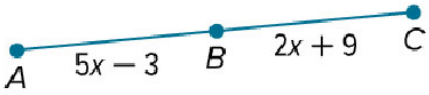
Example 5
Find Missing Measures

Check

Find the measure of $\overline{RS}$ if S is the midpoint of $\overline{RT}$.

Example 6
Find the Total Length

Find the measure of $\overline{AC}$ if *B* is the midpoint of $\overline{AC}$.



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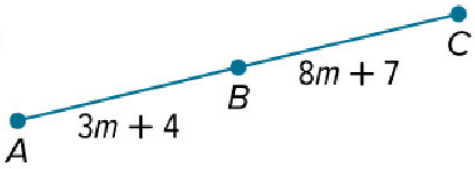
Example 6
Find the Total Length

Check

Find the measure of $\overline{AC}$ if *B* is the midpoint of $\overline{AC}$. Round your answer to the nearest tenth, if necessary.



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