Lesson 1.4 Midpoints and Bisectors

Tuesday, September 10, 2024 9:51 PM

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Lesson 1.4 Midpoint...

Lesson 1.4 Midpoints and Bisectors

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

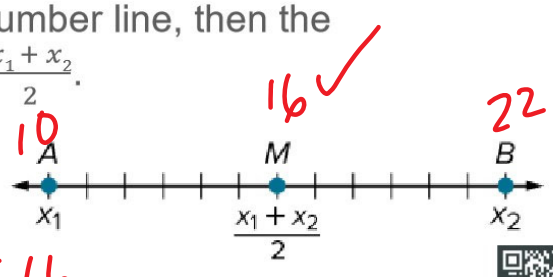
The **midpoint** of a segment is the point halfway between the endpoints of the segment.

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 $M = \frac{x_1 + x_2}{2}$.

$\frac{10 + 22}{2} = \frac{32}{2} = 16$



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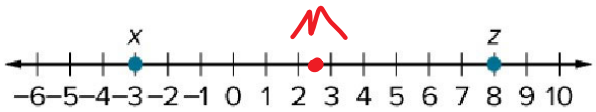
Example 1
Find the Midpoint on a Number Line

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?

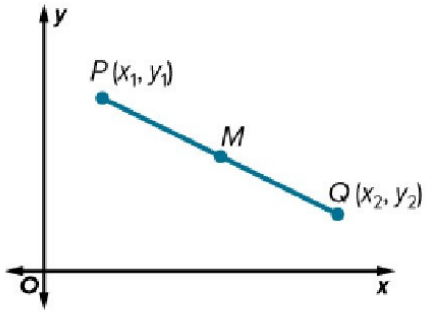
$$\frac{38+62}{2} = \frac{100}{2} = 50$$

Learn
Midpoints on the Coordinate Plane

Key Concept: Midpoint Formula on the Coordinate Plane

If $\overline{PQ}$ has endpoints at $P(x_1, y_1)$

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



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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

$\frac{x_1 + x_2}{2}$

$\frac{-2 + 8}{2}$

$\frac{6}{2} = x = 3$

$\frac{y_1 + y_2}{2}$

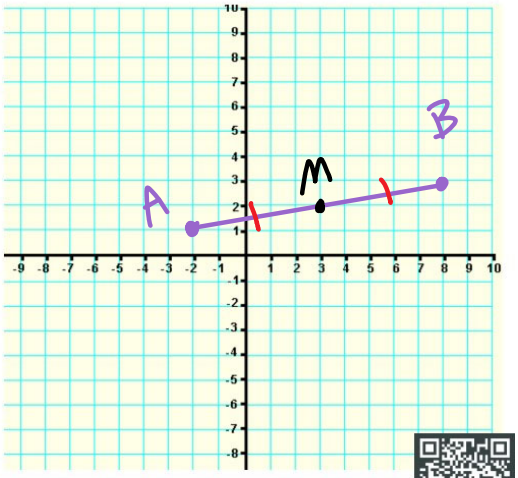
$\frac{1 + 3}{2}$

$\frac{4}{2}$

$y = 2$

$(3, 2)$

M



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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 y x_2 y_2

$\frac{x_1 + x_2}{2}$

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

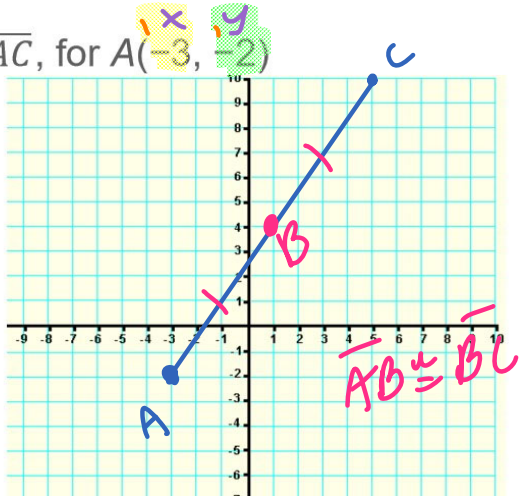
$\frac{2}{2} = x = 1$

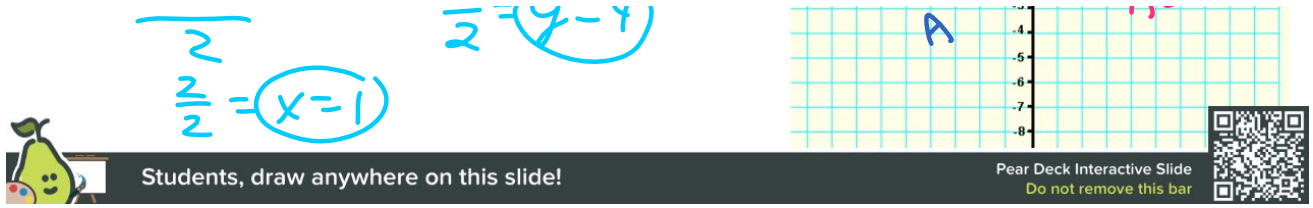
$\frac{y_1 + y_2}{2}$

$\frac{-2 + 10}{2}$

$\frac{8}{2} = y = 4$

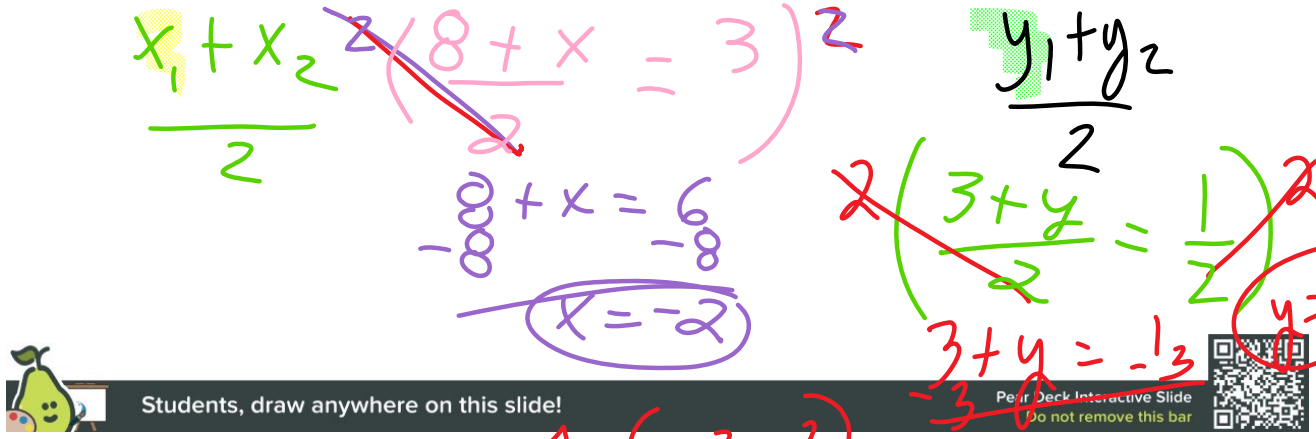
$(1, 4)$



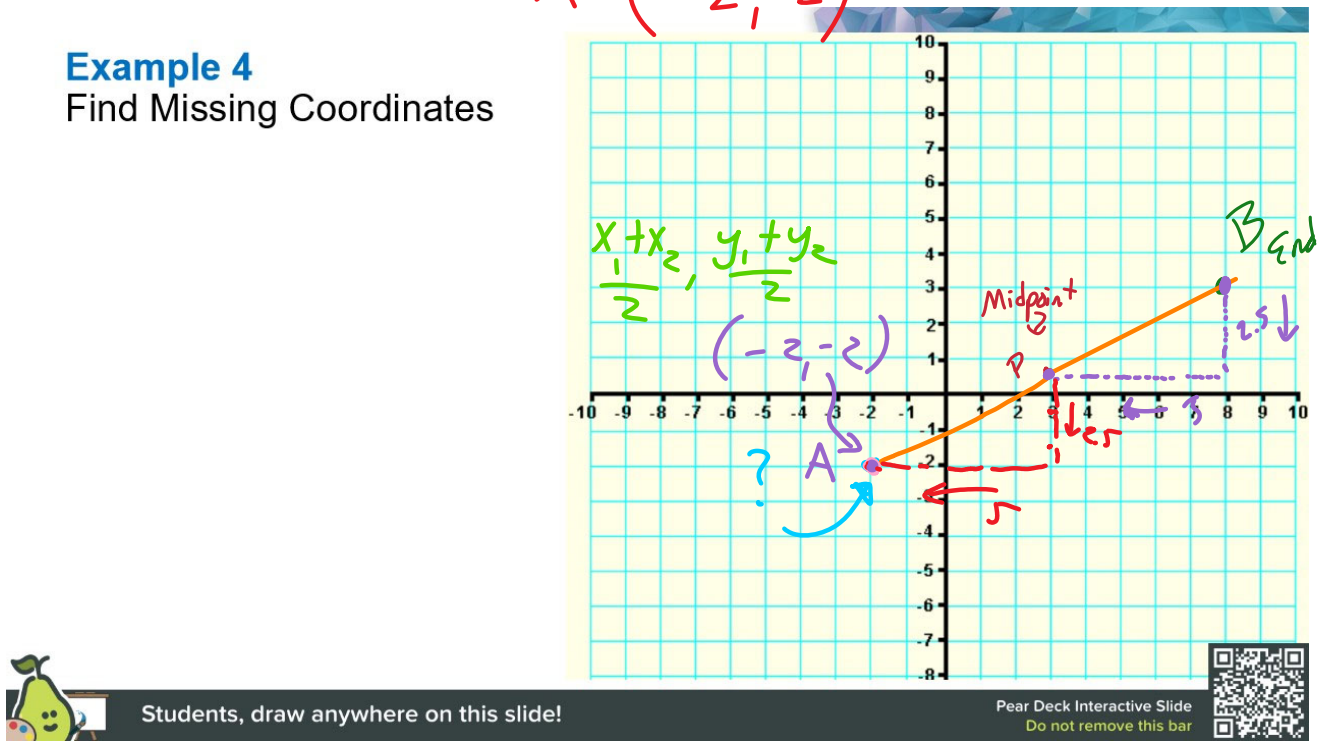


Example 4
Find Missing Coordinates

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!



Example 4
Find Missing Coordinates



Example 4
Find Missing Coordinates

Check

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.

endpoint x_1, y_1

$\frac{x_1+x_2}{2}$

$\frac{12+x}{2} = 6$

$12 + x = 12$

$-12 \quad -12$

$x = 0$

$\frac{y_1+y_2}{2}$

$\frac{4+y}{2} = -1$

$4 + y = -2$

$-4 \quad -4$

$y = -6$

$0, -6$

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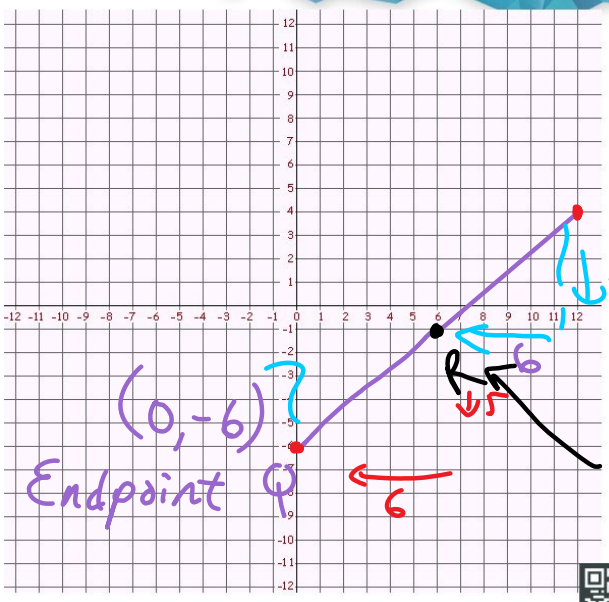
Example 4

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**.

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Example 5
Find Missing Measures

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

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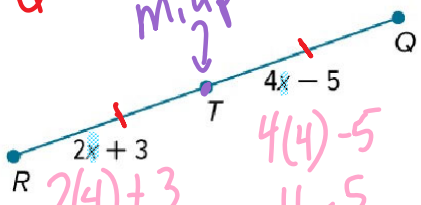
$\overline{RT} \cong \overline{TQ}$

midpoint



$2x+3 = 4x-5$

$+5 \quad +5$

$2x+8 = 4x$

$-2x \quad -2x$

$8 = 2x$

$\frac{8}{2} = \frac{2x}{2}$

$4 = x$

$2(4)+3$

$8+3$

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$4(4)-5$

$16-5$

11

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Example 5
Find Missing Measures

Check

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

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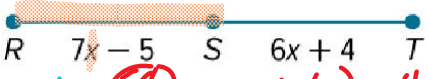

$7(9)-5$

58

$6(9)+4$

58 ✓

$7x-5 = 6x+4$

$-7x \quad -7x$

$-5 = -1x+4$

$-4 \quad -4$

$-9 = -1x$

$\frac{-9}{-1} = \frac{-1x}{-1}$

$x = 9$

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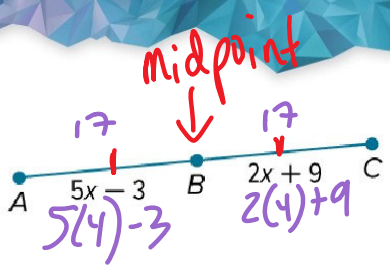
Example 6
Find the Total Length

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



$5x-3=2x+9$

$-2x \quad -2x$

$3x-3=9$

$+3 \quad +3$

$\frac{3x}{3}=\frac{12}{3}$

$x=4$

$+17 \quad +17$

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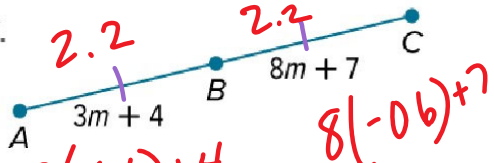
Example 6
Find the Total Length

Check

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



$3m+4=8m+7$

$-4 \quad -4$

$3m=8m+3$

$-8m \quad -8m$

$-5m=3$

$\frac{-5m}{-5}=\frac{3}{-5}$

$m=-0.6$

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