Name ____ Date __________

1.3 Using Midpoint and Distance Formulas
For use with Exploration 1.3

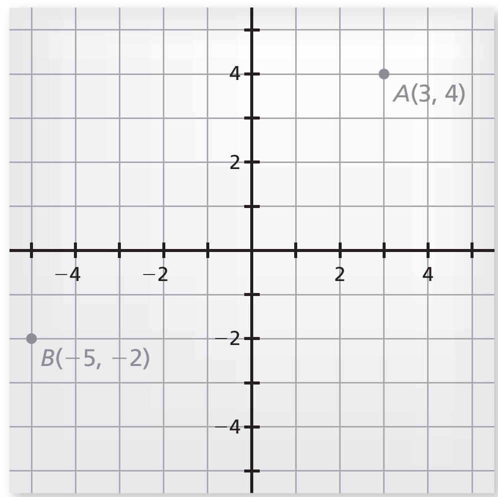
Essential Question How can you find the midpoint and length of a line segment in a coordinate plane?

1 EXPLORATION: Finding the Midpoint of a Line Segment

Go to *BigIdeasMath.com* for an interactive tool to investigate this exploration.

Work with a partner. Use centimeter graph paper.

a. Graph $\overline{AB}$, where the points A and B are as shown.



b. Explain how to *bisect* $\overline{AB}$, that is, to divide $\overline{AB}$ into two congruent line segments. Then bisect $\overline{AB}$ and use the result to find the *midpoint M* of $\overline{AB}$.

c. What are the coordinates of the midpoint M?

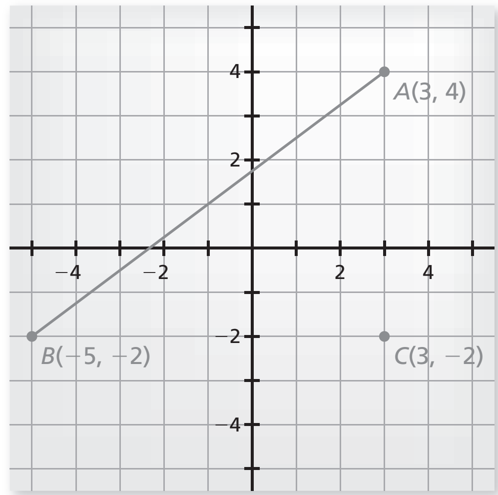
d. Compare the x-coordinates of A, B, and M. Compare the y-coordinates of A, B, and M. How are the coordinates of the midpoint M related to the coordinates of A and B?

2 EXPLORATION: Finding the Length of a Line Segment

Go to *BigIdeasMath.com* for an interactive tool to investigate this exploration.

Work with a partner. Use centimeter graph paper.

a. Add point C to your graph as shown.



b. Use the Pythagorean Theorem to find the length of $\overline{AB}$.

c. Use a centimeter ruler to verify the length you found in part (b).

d. Use the Pythagorean Theorem and point M from Exploration 1 to find the lengths of $\overline{AM}$ and $\overline{MB}$. What can you conclude?

Communicate Your Answer

3. How can you find the midpoint and length of a line segment in a coordinate plane?

4. Find the coordinates of the midpoint M and the length of the line segment whose endpoints are given.

a. $D(-10, -4), E(14, 6)$

b. $F(-4, 8), G(9, 0)$

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1.3 Notetaking with Vocabulary

For use after Lesson 1.3

In your own words, write the meaning of each vocabulary term.

midpoint

segment bisector

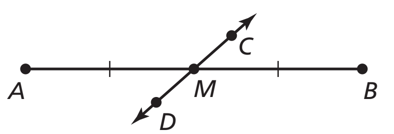
Core Concepts

Midpoints and Segment Bisectors

The **midpoint** of a segment is the point that divides the segment into two congruent segments.

M is the midpoint of $\overline{AB}$.
So, $\overline{AM} \cong \overline{MB}$ and $AM = MB$.

A **segment bisector** is a point, ray, line, line segment, or plane that intersects the segment at its midpoint. A midpoint or a segment bisector *bisects* a segment.



$\overleftrightarrow{CD}$ is a segment bisector of $\overline{AB}$.
So, $\overline{AM} \cong \overline{MB}$ and $AM = MB$.

Notes:

Name____ Date__________

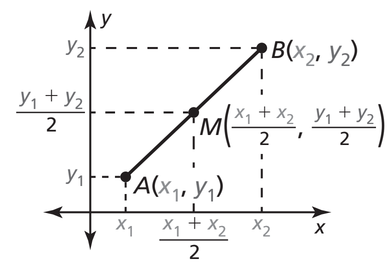
1.3 Notetaking with Vocabulary (continued)

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

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

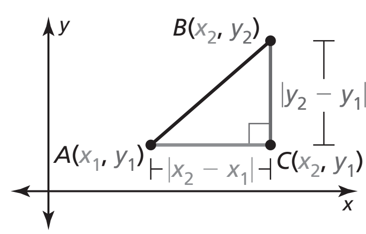


Notes:

The Distance Formula

If $A(x_1, y_1)$ and $B(x_2, y_2)$ are points in a coordinate plane, then the distance between A and B is

$$AB = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}.$$



Notes:

Name ____ Date _________

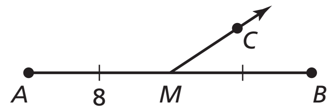
1.3 Notetaking with Vocabulary (continued)

Extra Practice

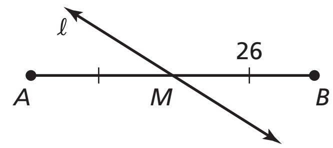
In Exercises 1–3, identify the segment bisector of $\overline{AB}$. Then find AB.

1.

2.

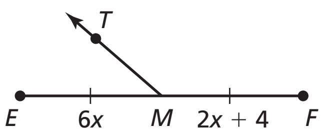


3.

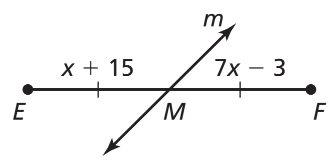


In Exercises 4-6, identify the segment bisector of $\overline{EF}$. Then find EF.

4.



5.



6.

In Exercises 7–9, the endpoints of $\overline{PQ}$ are given. Find the coordinates of the midpoint M.

7. $P(-4, 3)$ and $Q(0, 5)$

8. $P(-2, 7)$ and $Q(10, -3)$

9. $P(3, -15)$ and $Q(9, -3)$

In Exercises 10–12, the midpoint M and one endpoint of $\overline{JK}$ are given. Find the coordinates of the other endpoint.

10. $J(7, 2)$ and $M(1, -2)$

11. $J(5, -2)$ and $M(0, -1)$

12. $J(2, 16)$ and $M\left(-\frac{9}{2}, 7\right)$