

LESSON
1.3**Study Guide**

For use with pages 15–22

GOAL Find lengths of segments in the coordinate plane.**Vocabulary**

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

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.

The Midpoint Formula: 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

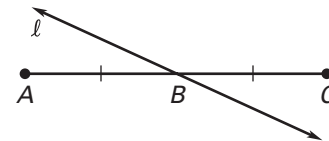
$$\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right).$$

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

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

EXAMPLE 1 Find segment lengths

In the diagram, line ℓ bisects \overline{AC} at point B , and $AB = 8$ in. Find AC .

**Solution**

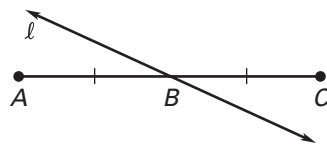
Point B is the midpoint of \overline{AC} . So, $AB = BC = 8$ in.

$$\begin{aligned} AC &= AB + BC && \text{Segment Addition Postulate} \\ &= 8 + 8 && \text{Substitute 8 for } AB \text{ and 8 for } BC. \\ &= 16 \text{ in.} && \text{Add.} \end{aligned}$$

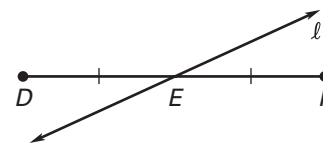
Exercises for Example 1

Line ℓ bisects the segment. Find the indicated length.

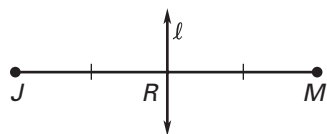
1. Find
- AC
- if
- $AB = 10$
- cm.



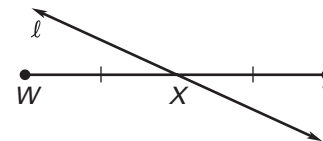
2. Find
- DF
- if
- $EF = 25$
- mm.



3. Find
- JM
- if
- $RM = 37$
- in.



4. Find
- WX
- if
- $WY = 30$
- cm.



LESSON
1.3**Study Guide** *continued*
For use with pages 15–22**EXAMPLE 2** Use the midpoint and distance formulas

- a. The endpoints of \overline{AB} are $A(3, 2)$ and $B(6, 7)$. Find the coordinates of the midpoint M .
- b. What is the length of \overline{AB} ?

Solution

- a. Use the Midpoint Formula.

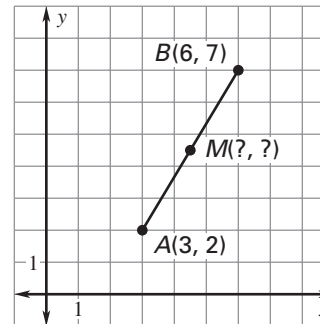
$$M\left(\frac{3+6}{2}, \frac{2+7}{2}\right) = \left(\frac{9}{2}, \frac{9}{2}\right)$$

The coordinates of the midpoint M are $\left(\frac{9}{2}, \frac{9}{2}\right)$.

- b. Use the Distance Formula.

$$\begin{aligned} AB &= \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \\ &= \sqrt{(6 - 3)^2 + (7 - 2)^2} \\ &= \sqrt{3^2 + 5^2} \\ &= \sqrt{9 + 25} \\ &= \sqrt{34} \\ &\approx 5.83 \end{aligned}$$

The length of \overline{AB} is approximately equal to 5.83.



Distance Formula

Substitute.

Subtract.

Evaluate powers.

Add.

Use a calculator to approximate the square root.

Exercises for Example 2

Find the coordinates of the midpoint of the segment with the given endpoints.

5. $A(1, 2)$ and $B(3, 6)$
6. $J(-1, 3)$ and $K(9, 0)$
7. $R(4, -2)$ and $G(12, 8)$
8. $C(-3, -1)$ and $D(9, 5)$
9. $S(5, -2)$ and $T(-3, 4)$
10. $X(7, -4)$ and $Y(-2, -1)$

Find the length of the segment. Round to the nearest tenth of a unit.

