

1-2 Measuring and Constructing Segments

Warm Up

Simplify.

1. $7 - (-3)$ 10

2. $-1 - (-13)$ 12

3. $|-7 - 1|$ 8

Solve each equation.

4. $2x + 3 = 9x - 11$
2

5. $3x = 4x - 5$
5

1-2 Measuring and Constructing Segments

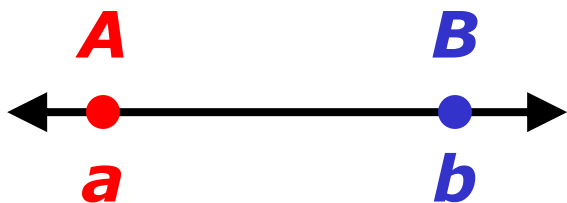
Objectives

Use length and midpoint of a segment.

Construct midpoints and congruent segments.

1-2 Measuring and Constructing Segments

The **distance** (or **length**) between any two points is the absolute value of the difference of the coordinates.

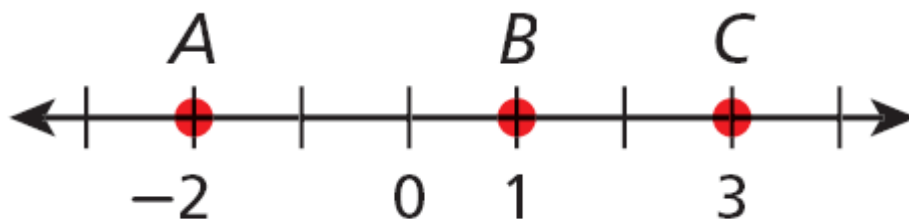


$$AB = |a - b| \text{ or } |b - a|$$

1-2 Measuring and Constructing Segments

Example 1: Finding the Length of a Segment

Find each length.



A. BC

$$\begin{aligned} BC &= |1 - 3| \\ &= |1 - 3| \\ &= 2 \end{aligned}$$

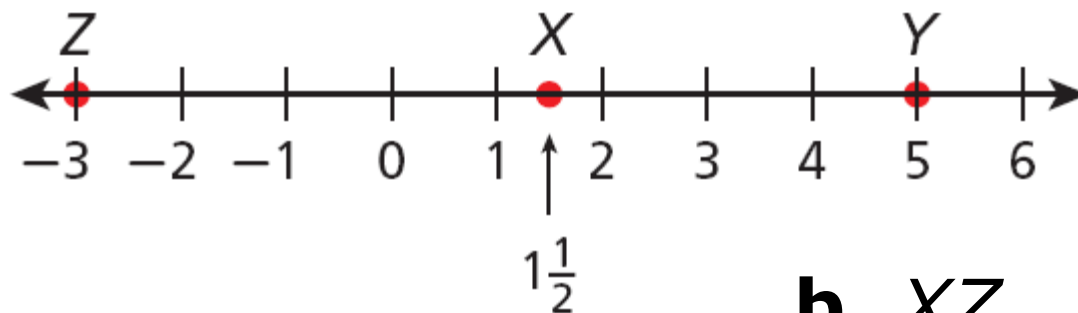
B. AC

$$\begin{aligned} AC &= |-2 - 3| \\ &= |-5| \\ &= 5 \end{aligned}$$

1-2 Measuring and Constructing Segments

Check It Out! Example 1

Find each length.



a. XY

$$\begin{aligned} XY &= \left| 1\frac{1}{2} - 5 \right| \\ &= \left| -3\frac{1}{2} \right| \\ &= 3\frac{1}{2} \end{aligned}$$

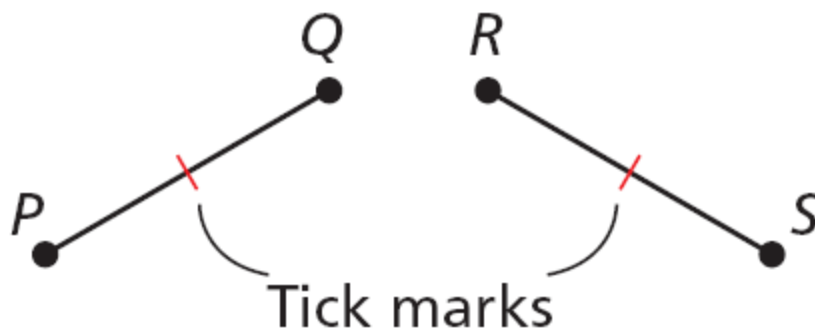
b. XZ

$$\begin{aligned} XZ &= \left| 1\frac{1}{2} - (-3) \right| \\ &= \left| 4\frac{1}{2} \right| \\ &= 4\frac{1}{2} \end{aligned}$$

1-2 Measuring and Constructing Segments

Congruent segments are segments that have the same length.

In the diagram, $PQ = RS$, so you can write $\overline{PQ} \cong \overline{RS}$. This is read as "segment PQ is congruent to segment RS ." **Tick marks** are used in a figure to show congruent segments.



1-2 Measuring and Constructing Segments

In order for you to say that a point B is **between** two points A and C , all three points must lie on the same line, and $AB + BC = AC$.

Postulate 1-2-2 Segment Addition Postulate

If B is between A and C ,
then $AB + BC = AC$.



1-2 Measuring and Constructing Segments

Example 3A: Using the Segment Addition Postulate

**G is between F and H , $FG = 6$, and $FH = 11$.
Find GH .**

$$FH = FG + GH$$

$$11 = 6 + GH$$

$$\begin{array}{r} -6 \quad -6 \\ \hline \end{array}$$

$$5 = GH$$

Seg. Add. Postulate

Substitute 6 for FG and 11 for FH .

Subtract 6 from both sides.

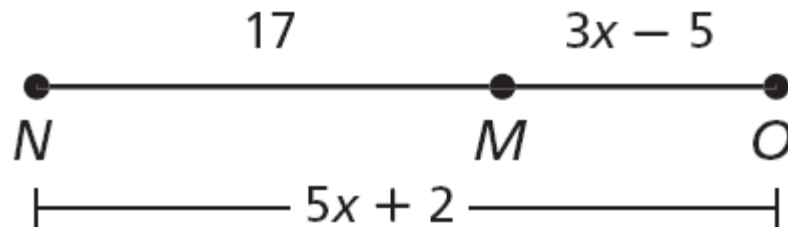
Simplify.

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Example 3B: Using the Segment Addition Postulate

M is between N and O .

Find NO .



$$NM + MO = NO$$

$$17 + (3x - 5) = 5x + 2$$

$$3x + 12 = 5x + 2$$

$$\underline{\quad - 2 \quad} \quad \underline{\quad - 2 \quad}$$

$$3x + 10 = 5x$$

$$\underline{-3x} \quad \underline{-3x}$$

$$\frac{10}{2} = \frac{2x}{2}$$

$$5 = x$$

Seg. Add. Postulate

Substitute the given values

Simplify.

Subtract 2 from both sides.

Simplify.

Subtract $3x$ from both sides.

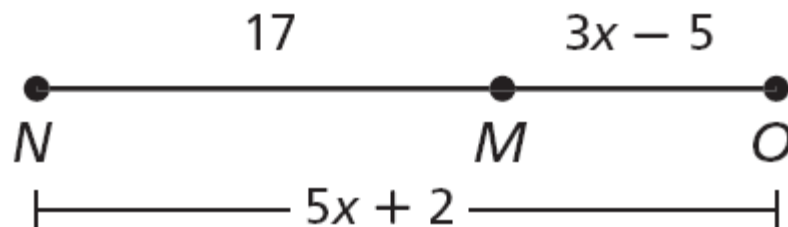
Divide both sides by 2.

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Example 3B Continued

M is between N and O .

Find NO .



$$NO = 5x + 2$$

$$= 5(5) + 2$$

$$= 27$$

Substitute 5 for x .

Simplify.

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Check It Out! Example 3a

Y is between X and Z, $XZ = 3$, and $XY = 1\frac{1}{3}$.

Find YZ.

$$XZ = XY + YZ$$

Seg. Add. Postulate

$$3 = 1\frac{1}{3} + YZ$$

Substitute the given values.

$$\begin{array}{r} -1\frac{1}{3} \quad -1\frac{1}{3} \\ \hline \end{array}$$

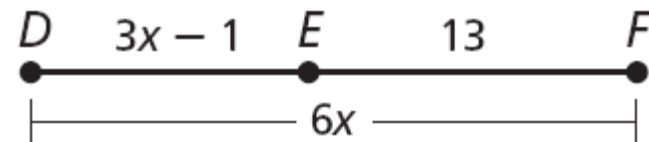
Subtract $1\frac{1}{3}$ from both sides.

$$1\frac{2}{3} = YZ$$

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Check It Out! Example 3b

E is between D and F . Find DF .



$$DE + EF = DF$$

$$(3x - 1) + 13 = 6x$$

$$3x + 12 = 6x$$

$$\underline{- 3x} \quad \underline{- 3x}$$

$$12 = 3x$$

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

$$4 = x$$

Seg. Add. Postulate

Substitute the given values

Subtract $3x$ from both sides.

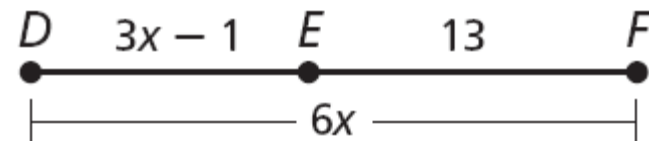
Simplify.

Divide both sides by 3.

1-2 Measuring and Constructing Segments

Check It Out! Example 3b Continued

E is between D and F . Find DF .



$$DF = 6x$$

$$= 6(4)$$

$$= 24$$

Substitute 4 for x .

Simplify.

1-2 Measuring and Constructing Segments

The **midpoint** is a point in the exact middle of a segment

Bisect – to cut the segment into two congruent segments.

If M is the midpoint of AB , then $AM = MB$.

So if $AB = 6$, then $AM = 3$ and $MB = 3$.

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Example 4: Recreation Application

The map shows the route for a race. You are at X , 6000 ft from the first checkpoint C . The second checkpoint D is located at the midpoint between C and the end of the race Y . The total race is 3 miles. How far apart are the 2 checkpoints?



$$\begin{aligned} XY &= 3(5280 \text{ ft}) && \text{Convert race distance to feet.} \\ &= 15,840 \text{ ft} \end{aligned}$$

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Example 4 Continued



$$XC + CY = XY$$

Seg. Add. Post.

$$6000 + CY = 15,840$$

Substitute 6000 for XC and 15,840 for XY.

$$\begin{array}{r} - 6000 \\ \hline \end{array}$$

$$\begin{array}{r} - 6000 \\ \hline \end{array}$$

Subtract 6000 from both sides.

$$CY = 9840$$

Simplify.

$$CD = \frac{1}{2}(9840)$$

D is the mdpt. of \overline{CY} , so $CD = \frac{1}{2}CY$.

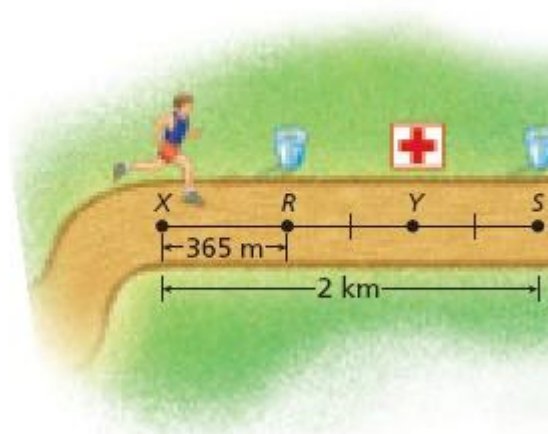
$$= 4920 \text{ ft}$$

The checkpoints are 4920 ft apart.

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Check It Out! Example 4

You are 1182.5 m from the first-aid station. What is the distance to a drink station located at the midpoint between your current location and the first-aid station?



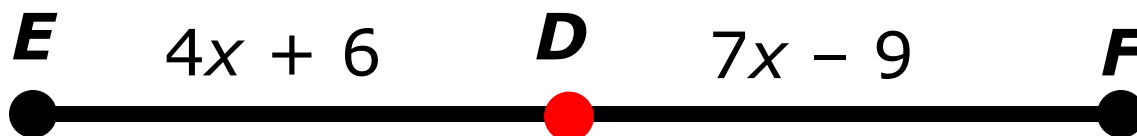
The distance XY is 1182.5 m. The midpoint would be

$$\frac{1182.5}{2} = 591.25 \text{ m.}$$

1-2 Measuring and Constructing Segments

Example 5: Using Midpoints to Find Lengths

D is the midpoint of \overline{EF} , $ED = 4x + 6$, and $DF = 7x - 9$. Find ED , DF , and EF .



Step 1 Solve for x .

$$ED = DF$$

D is the mdpt. of \overline{EF} .

$$4x + 6 = 7x - 9$$

Substitute $4x + 6$ for ED and $7x - 9$ for DF .

$$\begin{array}{r} -4x \\ \hline \end{array}$$

$$\begin{array}{r} -4x \\ \hline \end{array}$$

Subtract $4x$ from both sides.

$$6 = 3x - 9$$

Simplify.

$$\begin{array}{r} +9 \\ \hline \end{array}$$

$$\begin{array}{r} +9 \\ \hline \end{array}$$

Add 9 to both sides.

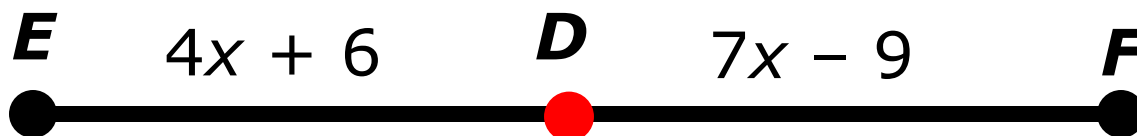
$$15 = 3x$$

Simplify.

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Example 5 Continued

D is the midpoint of \overline{EF} , $ED = 4x + 6$, and $DF = 7x - 9$. Find ED , DF , and EF .



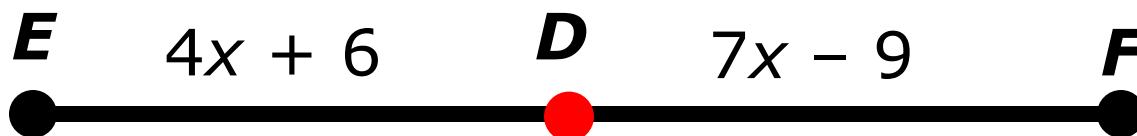
$$\frac{15}{3} = \frac{3x}{3} \quad \text{Divide both sides by 3.}$$

$$x = 5 \quad \text{Simplify.}$$

1-2 Measuring and Constructing Segments

Example 5 Continued

D is the midpoint of \overline{EF} , $ED = 4x + 6$, and $DF = 7x - 9$. Find ED , DF , and EF .



Step 2 Find ED , DF , and EF .

$$\begin{aligned} ED &= 4x + 6 \\ &= 4(5) + 6 \\ &= 26 \end{aligned}$$

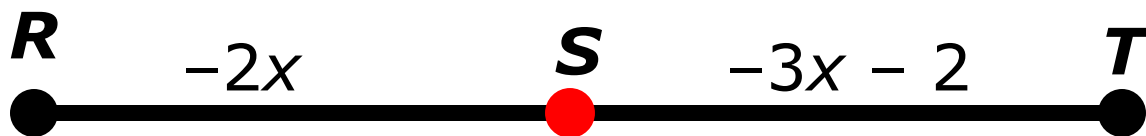
$$\begin{aligned} DF &= 7x - 9 \\ &= 7(5) - 9 \\ &= 26 \end{aligned}$$

$$\begin{aligned} EF &= ED + DF \\ &= 26 + 26 \\ &= 52 \end{aligned}$$

1-2 Measuring and Constructing Segments

Check It Out! Example 5

S is the midpoint of RT , $RS = -2x$, and $ST = -3x - 2$. Find RS , ST , and RT .



Step 1 Solve for x .

$$RS = ST \quad S \text{ is the mdpt. of } \overline{RT}.$$

$$-2x = -3x - 2 \quad \text{Substitute } -2x \text{ for } RS \text{ and } -3x - 2 \text{ for } ST.$$

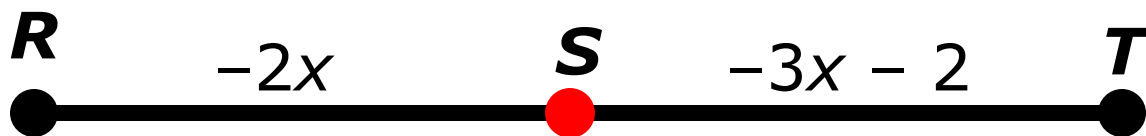
$$\underline{+3x} \quad \underline{+3x} \quad \text{Add } 3x \text{ to both sides.}$$

$$x = -2 \quad \text{Simplify.}$$

1-2 Measuring and Constructing Segments

Check It Out! Example 5 Continued

S is the midpoint of RT , $RS = -2x$, and $ST = -3x - 2$. Find RS , ST , and RT .



Step 2 Find RS , ST , and RT .

$$\begin{aligned}RS &= -2x \\ &= -2(-2) \\ &= 4\end{aligned}$$

$$\begin{aligned}ST &= -3x - 2 \\ &= -3(-2) - 2 \\ &= 4\end{aligned}$$

$$\begin{aligned}RT &= RS + ST \\ &= 4 + 4 \\ &= 8\end{aligned}$$

1-2 Measuring and Constructing Segments

Lesson Quiz: Part I

1. M is between N and O . $MO = 15$, and $MN = 7.6$. Find NO .

22.6

2. S is the midpoint of \overline{TV} , $TS = 4x - 7$, and $SV = 5x - 15$. Find TS , SV , and TV .

25, 25, 50

3. Sketch, draw, and construct a segment congruent to \overline{CD} .



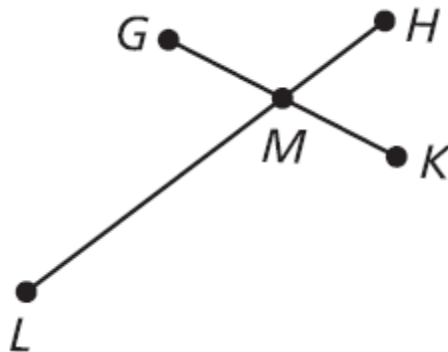
Check students' constructions

1-2 Measuring and Constructing Segments

Lesson Quiz: Part II

4. \overline{LH} bisects \overline{GK} at M . $GM = 2x + 6$, and $GK = 24$. Find x .

3



5. Tell whether the statement below is sometimes, always, or never true. Support your answer with a sketch.

If M is the midpoint of KL , then M , K , and L are collinear. **Always**

