1-2 Measuring and Constructing Segments

Essential Learnings #1

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

Vocabulary

coordinate
distance
length
construction
between
congruent segments
midpoint
bisect
segment bisector

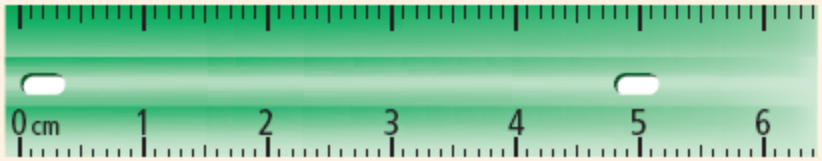
1-2 Measuring and Constructing Segments

A ruler can be used to measure the distance between two points. A point corresponds to one and only one number on a ruler. The number is called a **coordinate**. The following postulate summarizes this concept.

1-2 Measuring and Constructing Segments

Postulate 1-2-1 **Ruler Postulate**

The points on a line can be put into a one-to-one correspondence with the real numbers.



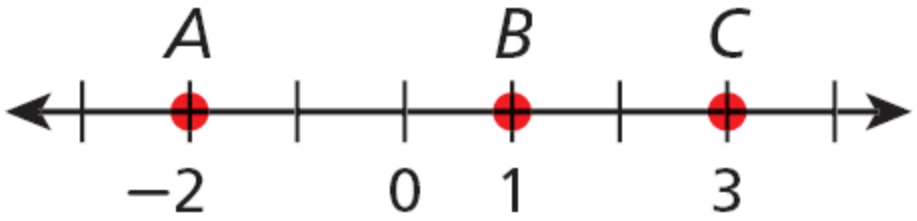
1-2 Measuring and Constructing Segments

The **distance** between any two points is the absolute value of the difference of the coordinates. If the coordinates of points A and B are a and b, then the distance between A and B is $|a - b|$ or $|b - a|$. The distance between A and B is also called the **length** of $\overline{AB}$, or AB.

$AB = |a - b|$ or $|b - a|$

Example 1: Finding the Length of a Segment

Find each length.



A. BC

$BC = |1 - 3|$

$= |1 - 3|$

$= 2$

B. AC

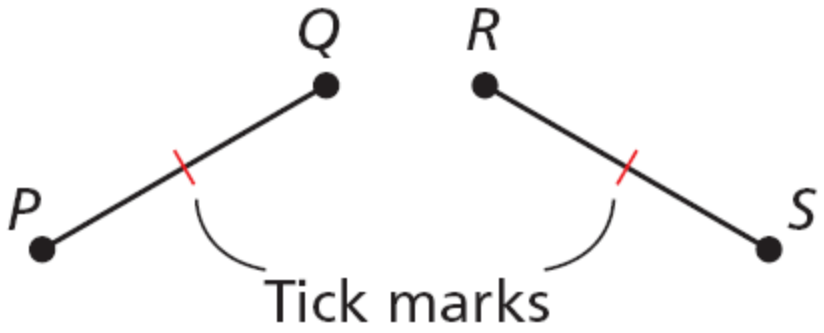
$AC = |-2 - 3|$

$= |- 5|$

$= 5$

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

You can make a sketch or measure and draw a segment. These may not be exact. A **construction** is a way of creating a figure that is more precise. One way to make a geometric construction is to use a compass and straightedge.

Example 2 Continued

Sketch, draw, and construct a segment congruent to $\overline{MN}$.

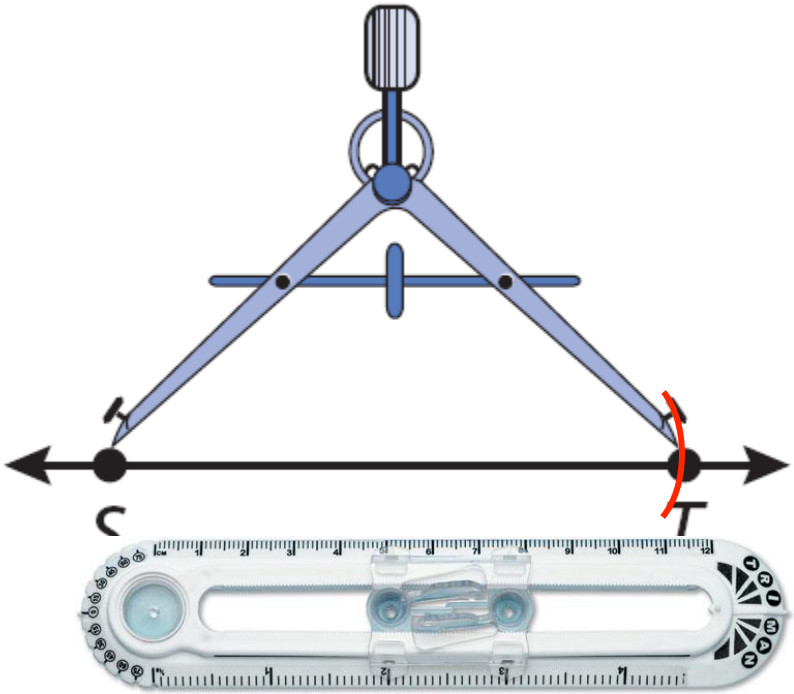
Step 1 Estimate and sketch. Estimate the length of $\overline{MN}$ and sketch $\overline{PQ}$ approximately the same length.

Step 2 Measure and draw. Use a ruler to measure MN. MN appears to be 3.5 in. Use a ruler to draw XY to have length 3.5 in.

Example 2 Continued

Sketch, draw, and construct a segment congruent to $\overline{MN}$.

Step 3 Construct and compare. Use a compass and straightedge to construct $\overline{ST}$ congruent to $\overline{MN}$.

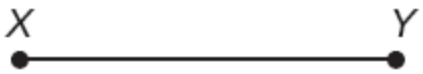


A ruler shows that $\overline{PQ}$ and $\overline{XY}$ are approximately the same length as $\overline{MN}$, but $\overline{ST}$ is precisely the same length.

Check It Out! Example 2 Continued

Sketch, draw, and construct a segment congruent to $\overline{JK}$.

Step 1 Estimate and sketch. Estimate the length of MN and sketch PQ approximately the same length.

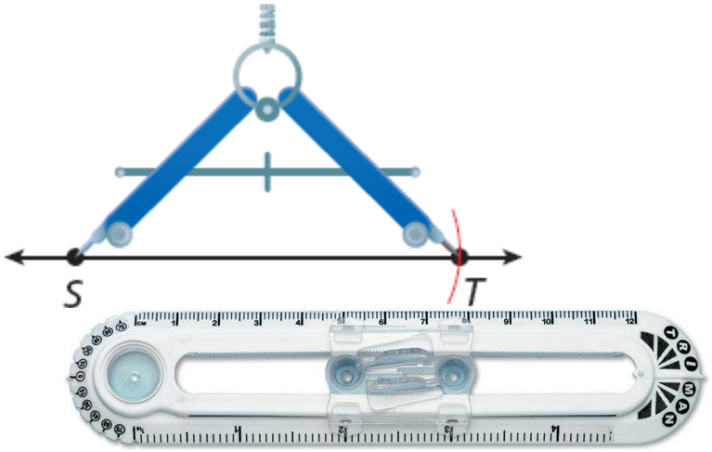


Step 2 Measure and draw. Use a ruler to measure JK. JK appears to be 1.7 in. Use a ruler to draw XY to have length 1.7 in.

Check It Out! Example 2 Continued

Sketch, draw, and construct a segment congruent to $\overline{JK}$.

Step 3 Construct and compare. Use a compass and straightedge to construct $\overline{ST}$ congruent to $\overline{JK}$.



A ruler shows that $\overline{PQ}$ and $\overline{XY}$ are approximately the same length as $\overline{JK}$, but $\overline{ST}$ is precisely the same length.

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 $AB + BC = AC$.

Example 3A: Using the Segment Addition Postulate

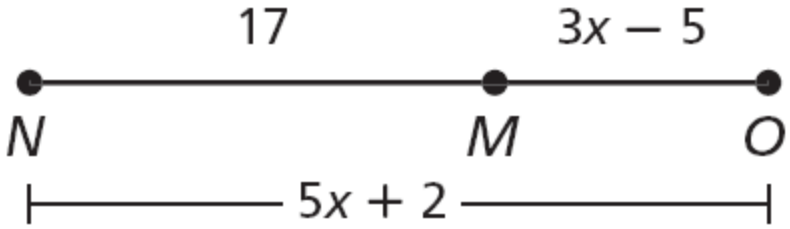
G is between F and H, $FG = 6$, and $FH = 11$. Find GH.

$FH = FG + GH$	*Seg. Add. Postulate*
$11 = 6 + GH$	*Substitute 6 for FG and 11 for FH.*
$-6 \quad -6$	*Subtract 6 from both sides.*
$5 = GH$	*Simplify.*

Example 3B: Using the Segment Addition Postulate

***M* is between *N* and *O*.**

Find *NO*.

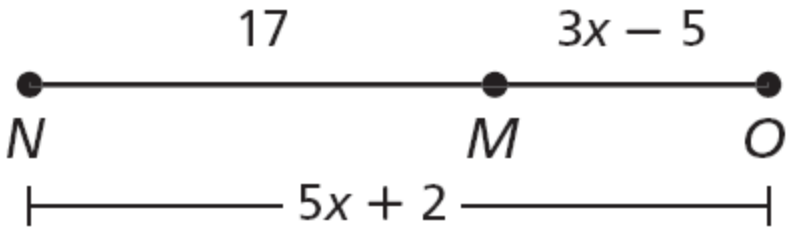


$NM + MO = NO$	*Seg. Add. Postulate*
$17 + (3x - 5) = 5x + 2$	*Substitute the given values*
$3x + 12 = 5x + 2$	*Simplify.*
$-2 \quad -2$	*Subtract 2 from both sides.*
$3x + 10 = 5x$	*Simplify.*
$-3x \quad -3x$	*Subtract 3x from both sides.*
$\frac{10}{2} = \frac{2x}{2}$	*Divide both sides by 2.*
$5 = x$	

Example 3B Continued

***M* is between *N* and *O*.**

Find *NO*.



$NO = 5x + 2$

$= 5(5) + 2$ *Substitute 5 for x.*

$= 27$ *Simplify.*

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*

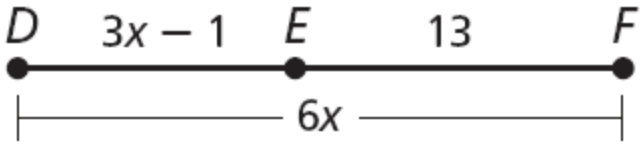
$3 = 1\frac{1}{3} + YZ$ *Substitute the given values.*

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

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

Check It Out! Example 3b

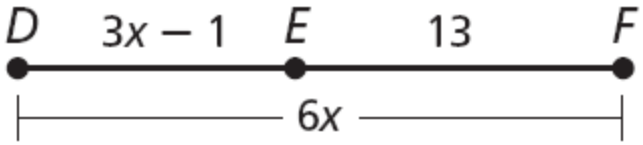
***E* is between *D* and *F*. Find *DF*.**



$DE + EF = DF$	*Seg. Add. Postulate*
$(3x - 1) + 13 = 6x$	*Substitute the given values*
$3x + 12 = 6x$	
$-3x \quad -3x$	*Subtract 3x from both sides.*
$12 = 3x$	*Simplify.*
$\frac{12}{3} = \frac{3x}{3}$	*Divide both sides by 3.*
$4 = x$	

Check It Out! Example 3b Continued

***E* is between *D* and *F*. Find *DF*.**



$DF = 6x$

$= 6(4)$ *Substitute 4 for x.*

$= 24$ *Simplify.*

1-2 Measuring and Constructing Segments

The **midpoint** M of $\overline{AB}$ is the point that **bisects**, or divides, the segment into two congruent segments. If M is the midpoint of $\overline{AB}$, then $AM = MB$.

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

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?

$XY = 3(5280 \text{ ft})$ *Convert race distance to feet.*

$= 15{,}840 \text{ ft}$

Example 4 Continued

$XC + CY = XY$ *Seg. Add. Post.*

$6000 + CY = 15{,}840$ *Substitute 6000 for XC and 15,840 for XY.*

$-6000 \qquad -6000$ *Subtract 6000 from both sides.*

$CY = 9840$ *Simplify.*

$CD = \frac{1}{2}(9840)$ *D is the mdpt. of $\overline{CY}$, so $CD = \frac{1}{2}CY$.*

$= 4920$ ft

The checkpoints are 4920 ft apart.