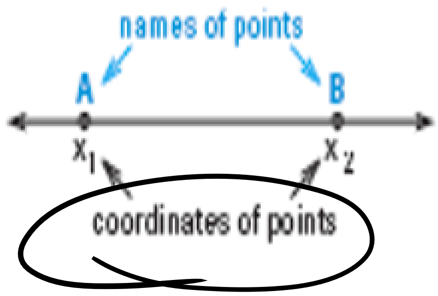
# 1.2 Segments and Congruence

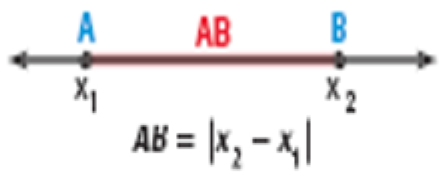
- In geometry, a rule that is accepted without proof is called a ___Axiom___ or a ___postulate___
- A rule that can be proved is called a ___theorem___

**Postulate 1: Ruler Postulate**

The point on the line can be matched one to one with the real numbers. The real number that corresponds to a point is the ___coordinates___ of the point.




The ___distance___ between points A and B, written as AB, is that absolute value of the difference of the coordinates of A and B.

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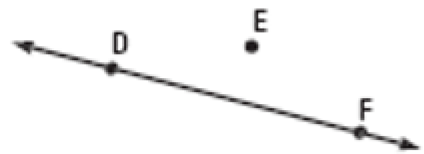
**Example 1:**

Measure the length of $\overline{ST}$ to the nearest tenth of a centimeter.


$\approx 6cm$

### Adding Segment Lengths

- When three points are collinear, you can say one point is between the other two.

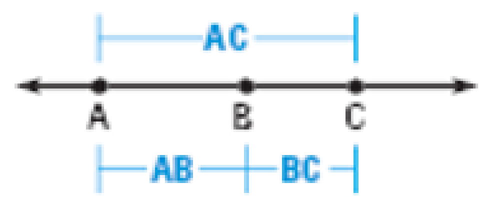

B is between A and C

E is not between D and F

### Postulate 2: Segment Addition Postulate

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

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

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**Example 2:**

Use the diagram to find GH.


$FG + GH = FH$

$21 + GH = 36$

$GH = 15$

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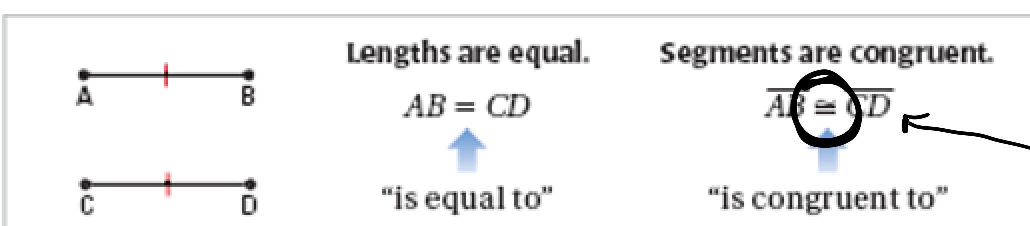
### Congruent Segments

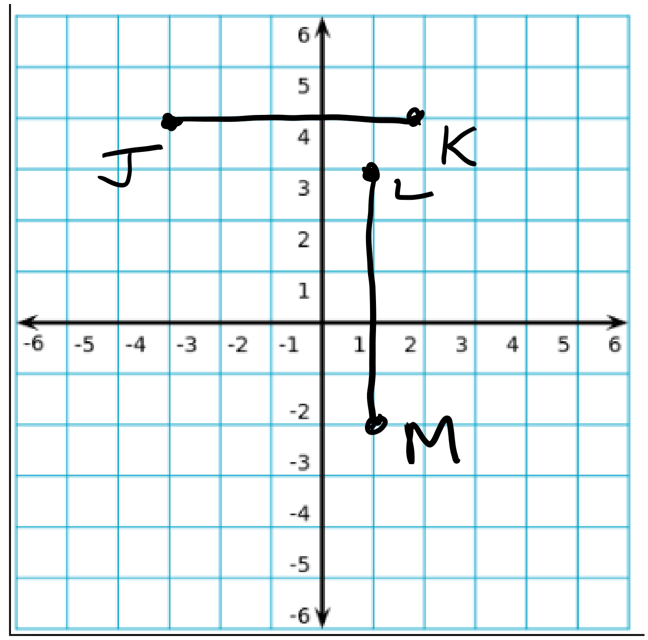
- Line segments that have the same length are called congruent segments.




$\cong$

**Example 3:**

Plot **J**(-3, 4), **K**(2, 4), **L**(1, 3) and **M**(1, -2) on the coordinate plane given. Then determine whether $\overline{JK}$ and $\overline{LM}$ are congruent.




$|-3-2|=5$

$|3-(-2)|=5$

$\overline{JK}$ and $\overline{LM}$ are congruent. $\overline{JK} \cong \overline{LM}$

**Example 4:**

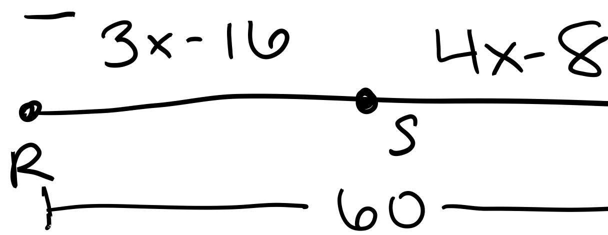
Point *S* is between *R* and *T* on $\overline{RT}$. Use the given information to write an equation in terms of x. Solve the equation, then find *RS* and *ST*.

$RS = 3x - 16$

$ST = 4x - 8$

$RT = 60$

$RS + ST = RT$




$RS = 3(12) - 16 = 20$ ✓

$ST = 4(12) - 8 = 40$ ✓

$3x - 16 + 4x - 8 = 60$

$7x - 24 = 60$ ✓

$x = 12$ ✓

**Example 5:**

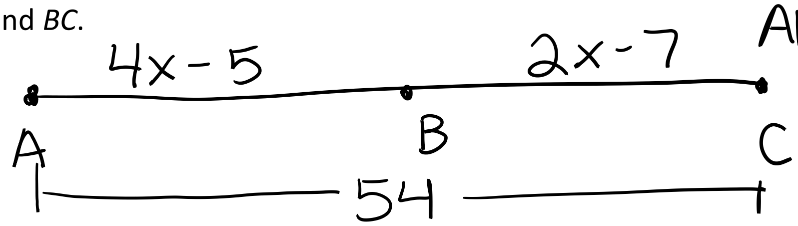
Point *B* is between *A* and *C* on $\overline{AC}$. Use the given information to write an equation in terms of x. Solve the equation, then find *AB* and *BC*.

$AB = 4x - 5$

$BC = 2x - 7$

$AC = 54$

$AB + BC = AC$




$AB = 4(11) - 5 = 39$ ✓

$BC = 2(11) - 7 = 15$ ✓

$4x - 5 + 2x - 7 = 54$

$6x - 12 = 54$ ✓

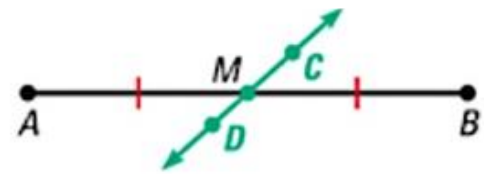
$x = 11$ ✓

# 1.3 Use Midpoint and Distance Formulas

**Vocabulary**

- **Midpoint:** the point on a **segment** that divides the segment into two Congruent segments.
- **Segment bisector**: a point, ray, line, line segment, or plane that Intersects the segment at its Midpoint.


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




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

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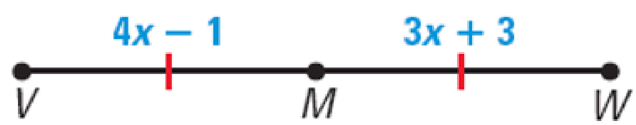
**Example 1:**

Point $M$ is the midpoint of $\overline{VW}$.
Find the length of $\overline{VM}$.




$4x - 1 = 3x + 3$

$x = 4$

$VM = 4(4) - 1 = 15$

$MW = 3(4) + 3 = 15$

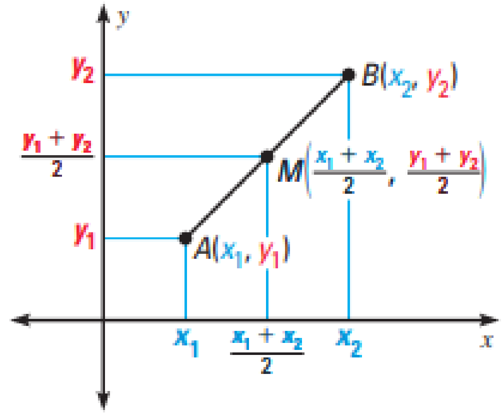
$VM = 15$

$VW = 30$

**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

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

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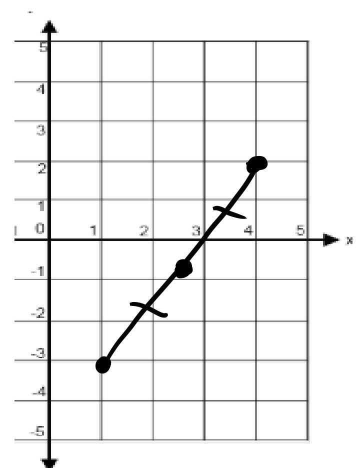
**Example 2a:**

The endpoints of $\overline{RS}$ are $R(1, -3)$ and $S(4, 2)$.
Find the coordinates of the midpoint *M.*

$$\left(\frac{1+4}{2}, \frac{-3+2}{2}\right)$$

$$\left(\frac{5}{2}, -\frac{1}{2}\right)$$



**Example 2b:**

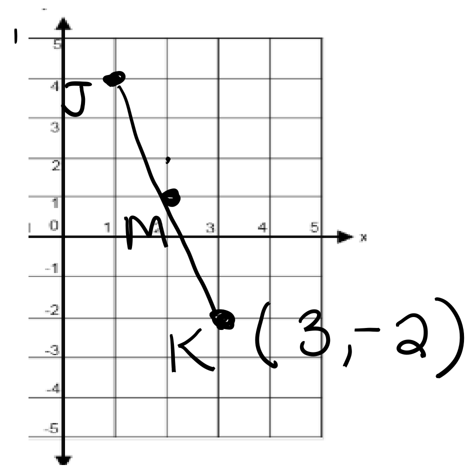
The midpoint of $\overline{JK}$ is $M(2, 1)$. One endpoint is $J(1, 4)$.
Find the coordinates of endpoint *K.*

$$\left(\frac{1+x_2}{2}, \frac{4+y_2}{2}\right)$$

$$\cancel{2}\left(\frac{1+x_2}{\cancel{2}}\right) = 2(2) \qquad \cancel{2}\left(\frac{4+y_2}{\cancel{2}}\right) = 1(2)$$

$$1+x_2 = 4 \qquad 4+y_2 = 2$$

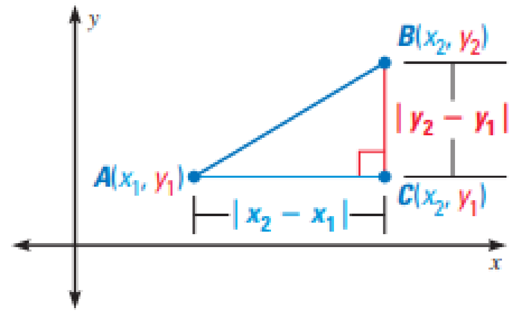
$$x_2 = 3 \qquad y_2 = -2$$



**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

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

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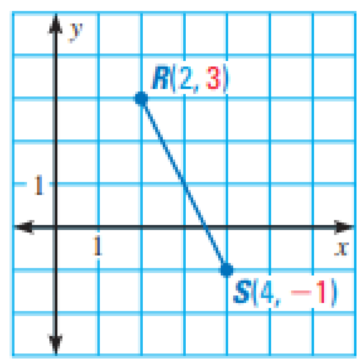
**Example 3:**

What is the approximate length of $\overline{RS}$ with endpoints $R(2, 3)$ and $S(4, -1)$?




**A** 1.4 units **B** 4.0 units $\boxed{\textbf{C}\ 4.5\text{ units}}$ **D** 6 units

$$RS = \sqrt{(4-2)^2 + (-1-3)^2}$$

$$= \sqrt{(2)^2 + (-4)^2}$$

$$= \sqrt{4 + 16}$$

$$= \sqrt{20} \approx 4.47$$