Date: 9/3/21

Lesson 1.3 Using Distance and Midpoint Formulas

Learning Intent (Target): *Today I will* be able to describe and determine the midpoint and distance between two points on the coordinate plane.

Success Criteria: *I'll know I'll have it when* I'll be able to use the formulas to solve and prove the distance & midpoint of line segments on the coordinate plane.

Accountable Team Task: *Therefore, I can* prove the distance and midpoint formulas using interactive flip charts, desmos, foldables, and gizmos activities.

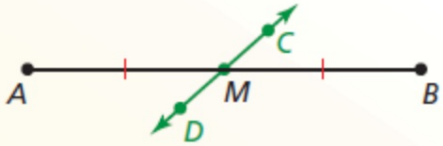
Core Concept

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.



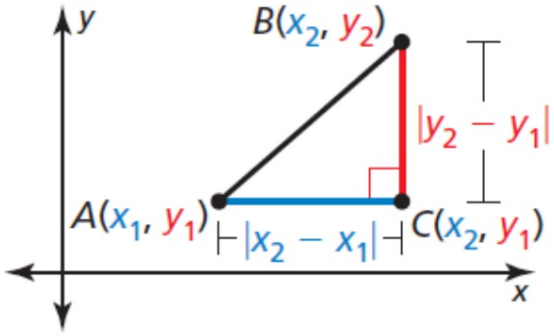
$\overleftrightarrow{CD}$ is a segment bisector of $\overline{AB}$.
So, $\overline{AM} \cong \overline{MB}$ and $AM = MB$.

Core Concept

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

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



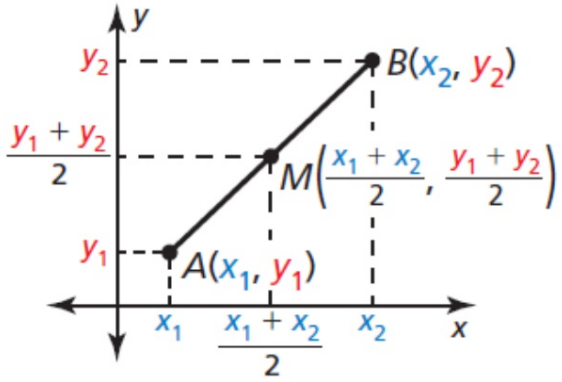
Core Concept

The Midpoint Formula

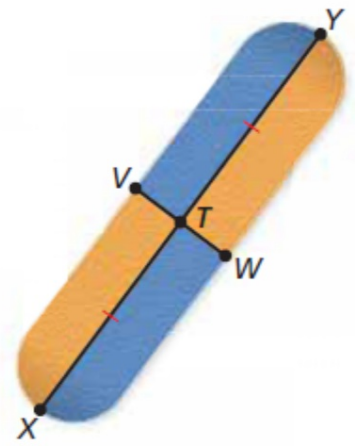
The coordinates of the midpoint of a segment are the averages of the x-coordinates and of the y-coordinates of the endpoints.

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

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



In the skateboard design, $\overline{VW}$ bisects $\overline{XY}$ at point T, and XT =39.9 cm. Find XY.



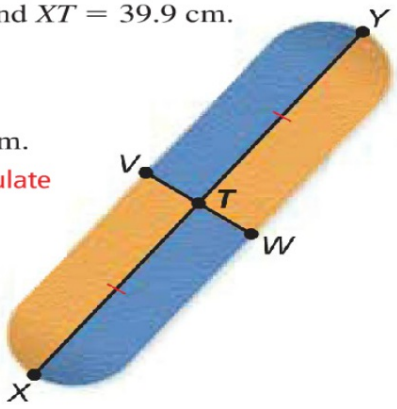
In the skateboard design, $\overline{VW}$ bisects $\overline{XY}$ at point T, and $XT = 39.9$ cm. Find XY.

SOLUTION

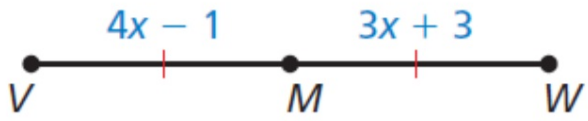
Point T is the midpoint of $\overline{XY}$. So, $XT = TY = 39.9$ cm.

$XY = XT + TY$	Segment Addition Postulate (Postulate 1.2)
$= 39.9 + 39.9$	Substitute.
$= 79.8$	Add.

▶ So, the length of $\overline{XY}$ is 79.8 centimeters.



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



SOLUTION

Step 1 Write and solve an equation. Use the fact that $VM = MW$.

$VM = MW$	Write the equation.
$4x - 1 = 3x + 3$	Substitute.
$x - 1 = 3$	Subtract $3x$ from each side.
$x = 4$	Add 1 to each side.

Step 2 Evaluate the expression for VM when $x = 4$.

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

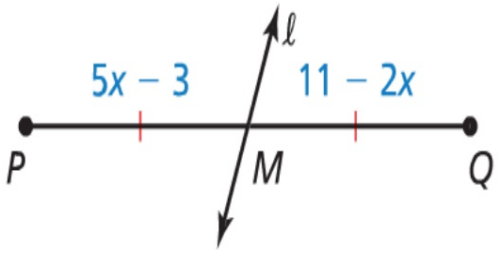
▶ So, the length of $\overline{VM}$ is 15.

Check

Because $VM = MW$, the length of $\overline{MW}$ should be 15.

$MW = 3x + 3 = 3(4) + 3 = 15$ ✓

3. Identify the segment bisector of $\overline{PQ}$. Then find MQ.



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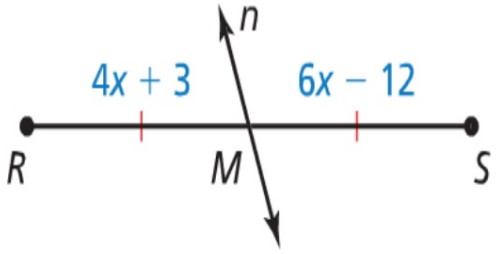
4. Identify the segment bisector of $\overline{RS}$. Then find RS.



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

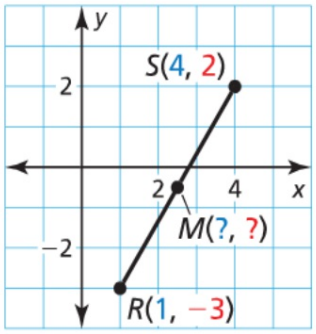
b. The midpoint of $\overline{JK}$ is $M(2, 1)$. One endpoint is $J(1, 4)$. Find the coordinates of endpoint K.

SOLUTION

a. Use the Midpoint Formula.

$$M\left(\frac{1+4}{2}, \frac{-3+2}{2}\right) = M\left(\frac{5}{2}, -\frac{1}{2}\right)$$

▶ The coordinates of the midpoint M are $\left(\frac{5}{2}, -\frac{1}{2}\right)$.



b. Let (x, y) be the coordinates of endpoint K. Use the Midpoint Formula.

Step 1 Find x.

$$\frac{1+x}{2} = 2$$

$$1 + x = 4$$

$$x = 3$$

Step 2 Find y.

$$\frac{4+y}{2} = 1$$

$$4 + y = 2$$

$$y = -2$$

▶ The coordinates of endpoint K are $(3, -2)$.