

### 1.3 – Midpoint & Segment Bisector

**Objective:** I can find the coordinates of the midpoint of a segment.

**MIDPOINT** of a segment: The point that bisects, or divides, a segment into 2 congruent ( $\cong$ ) segments.

A point is the midpoint of segment if it is between the two endpoints, and the distances from this point to each endpoint are equal.

\*Tick marks indicate  $\cong$  segments!  
 $\overline{PM} \cong \overline{MQ}$      $PM = MQ$

Midpoint on a number line:

$$\text{Midpoint} = \frac{a+b}{2}$$

(Where  $a$  &  $b$  are coordinates of endpoints.)

**EXAMPLE 1:** Find the coordinate of the midpoint of  $\overline{RS}$ .



$$M = \frac{-2+10}{2} = \frac{8}{2} = 4$$

**EXAMPLE 2:** B is the midpoint of  $\overline{AC}$ .  $AB = z + 2$  and  $BC = 2z - 6$ . Find "z".

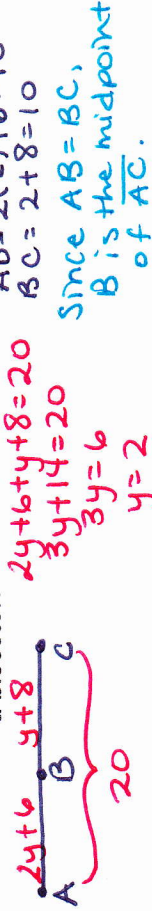


$$z+2 = 2z-6$$

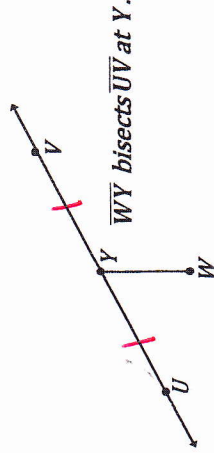
$$8 = z$$

**SEGMENT BISECTOR:** A ray, segment, or line that intersects a segment at its midpoint.

**EXAMPLE 1:** B is between A and C.  $AB = 2y + 6$ ,  $BC = y + 8$ , and  $AC = 20$ . Find the value of "y" and determine if B is a bisector.



Use the figure below to answer EXAMPLES 2 – 5.



**EXAMPLE 2:** If  $UY = 5$ , then find  $YV$  and  $UV$ .

$$YV = 5$$

$$UV = 10$$

**EXAMPLE 3:** If  $UY = 4x - 3$  and  $YV = x$ , find  $UY$  and  $UV$ .

$$4x - 3 = x$$

$$-3 = -3x$$

$$1 = x$$

$$UY = 1$$

$$UV = 2$$

**EXAMPLE 4:** If  $UV = 18$  and  $UY = 9$ , find  $YV$ .

$$YV = 9$$

**EXAMPLE 5:** If  $UV = x + 6$  and  $UY = x - 1$ , find  $YV$ .

$$2(x-1) = x+6$$

$$2x-2 = x+6$$

$$x = 8$$

$$YV = 8-1 = 7$$

Midpoint on a coordinate plane:

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

Endpoints

$$(x_1, y_1)$$

$$(x_2, y_2)$$

EXAMPLE 1: Find the midpoint between  $(-11, 3)$  and  $(8, -7)$ .

$$x_1 \ y_1 \quad x_2 \ y_2$$

$$M(x,y) = \left( \frac{-11+8}{2}, \frac{3-7}{2} \right) = \left( \frac{-3}{2}, \frac{-4}{2} \right) = \left( \frac{-3}{2}, -2 \right)$$

EXAMPLE 2: Find the coordinates of the midpoint of  $\overline{VW}$ , if

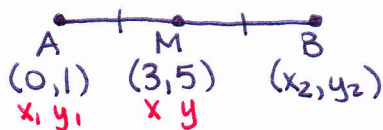
$V(3, -6)$  and  $W(7, 2)$ .

$$x_1 \ y_1 \quad x_2 \ y_2$$

$$M(x,y) = \left( \frac{3+7}{2}, \frac{-6+2}{2} \right) = \left( \frac{10}{2}, \frac{-4}{2} \right) = (5, -2)$$

EXAMPLE 3:  $M$  is the midpoint of  $\overline{AB}$  with  $A(0, 1)$  and  $M(3, 5)$ .

Find the coordinates of  $B$ .



$$(3, 5) = \left( \frac{0+x_2}{2}, \frac{1+y_2}{2} \right)$$

$$3 = \frac{x_2}{2}$$

$$6 = x_2$$

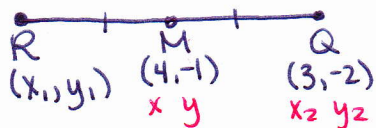
$$5 = \frac{1+y_2}{2}$$

$$10 = 1+y_2$$

$$9 = y_2$$

$$B(6, 9)$$

EXAMPLE 4: The midpoint of  $\overline{RQ}$  is  $M(4, -1)$ . What are the coordinates of  $R$  if  $Q$  is at  $(3, -2)$ ?



$$(4, -1) = \left( \frac{x_1+3}{2}, \frac{y_1-2}{2} \right)$$

$$4 = \frac{x_1+3}{2}$$

$$8 = x_1+3$$

$$5 = x_1$$

$$-1 = \frac{y_1-2}{2}$$

$$-2 = y_1-2$$

$$0 = y_1$$

$$R(5, 0)$$