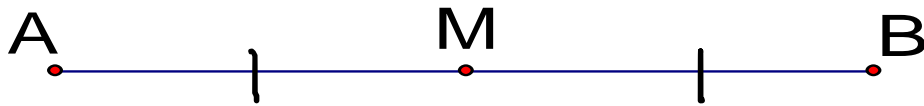


# Warm-up Problems

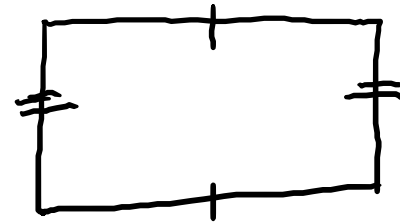
1.  $H$  is between  $E$  and  $F$ . If  $EH = 7x + 4$ ,  $HF = 3x - 6$ , and  $EF = 38$ , find  $x$  and the length of each side.
2. If  $P(-2,5)$  and  $Q(4,7)$ , find  $PQ$ .

# Midpoint

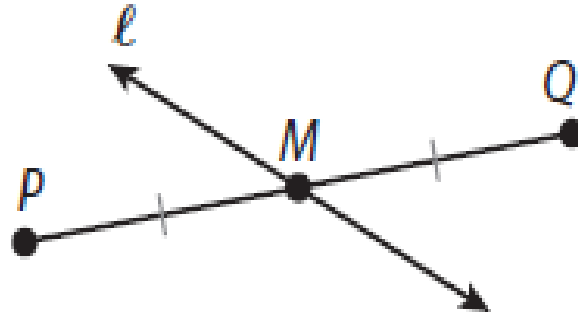
Def. The midpoint of a segment is the point that divides the segment into two equal segments.



$$AM = MB$$



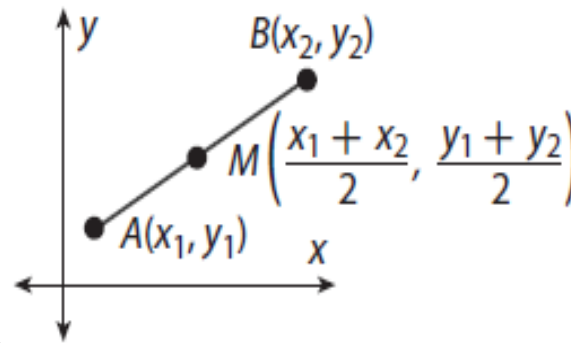
Def. Bisect means to cut something into two equal pieces.



Line  $l$  is called a segment bisector.

## The Midpoint Formula

The midpoint  $M$  of  $\overline{AB}$  with endpoints  $A(x_1, y_1)$  and  $B(x_2, y_2)$  is given by  $M\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$ .



midpoint = average

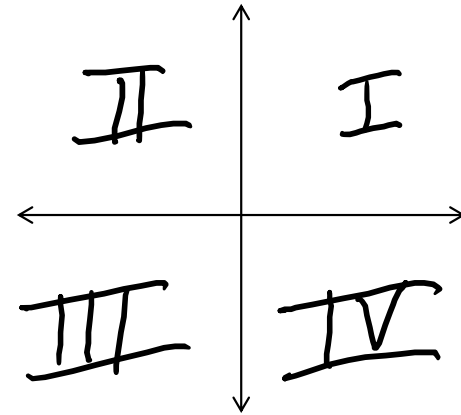
Ex. Find the midpoint of  $\overline{AB}$  if  $A(-2, 3)$  and  $B(5, 1)$ .

$$\frac{-2 + 5}{2} = \frac{3}{2}$$

$$\frac{3 + 1}{2} = \frac{4}{2} = 2$$

$$\left(\frac{3}{2}, 2\right)$$

What are the quadrants?



Ex. If  $\overline{PQ}$  has endpoints  $P(-4, 1)$  and  $Q(2, -3)$ , find the coordinates of the midpoint. What quadrant is it in?

$$\frac{-4+2}{2} = \frac{-2}{2} = -1$$
$$\frac{1+(-3)}{2} = \frac{-2}{2} = -1$$

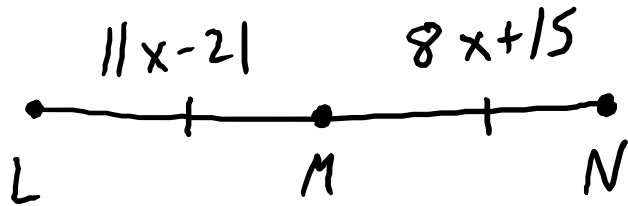
$(-1, -1)$       Q III

Pract. If  $\overline{JK}$  has endpoints  $J(7, 0)$  and  $K(-5, -4)$ , find the coordinates of the midpoint. What quadrant is it in?

$$\frac{7+(-5)}{2} = \frac{2}{2} = 1$$
$$\frac{0+(-4)}{2} = \frac{-4}{2} = -2$$

$(1, -2)$       Q IV

Ex.  $M$  is the midpoint of  $\overline{LN}$ . If  $LM = 11x - 21$  and  $MN = 8x + 15$ , find  $LN$ .



$$LM = 11(12) - 21 = 111$$

$$MN = 8(12) + 15 = 111$$

$$LN = 111 + 111 = \boxed{222}$$

$$\begin{array}{r} 11x - 21 = 8x + 15 \\ -8x \quad \quad -8x \end{array}$$

$$\begin{array}{r} 3x - 21 = 15 \\ +21 \quad +21 \end{array}$$

$$\frac{3x}{3} = \frac{36}{3}$$

$$\boxed{x = 12}$$