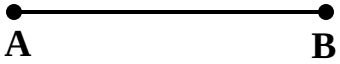
Notes: **SEGMENTS AND MIDPOINTS**

Content Objective: ***I will be able to determine the coordinate(s) of the midpoint of a segment when given the coordinates of its endpoints as represented on one-dimensional (1-D) or two-dimensional (2-D) coordinate systems.***

TERM	DESCRIPTION	EXAMPLE
MIDPOINT	A point on a segment ____equidistant____ from both endpoints. A point is the midpoint of segment if the distances from this point to each endpoint are __equal__.	

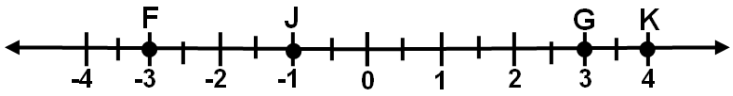
CONSTRUCTION: Construct the midpoint of segment $\overline{AB}$.



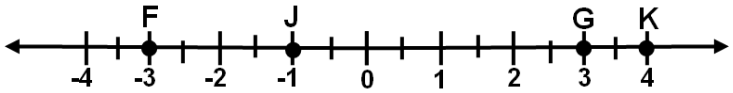
Midpoint Formula for One-Dimensional Coordinate System (number line)

$$M = \frac{|a+b|}{2}$$

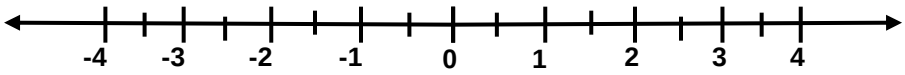
where a and b are the coordinates the of endpoints of the segment



EXAMPLE 1: Find the coordinate of the midpoint of $\overline{FG}$. ____0____

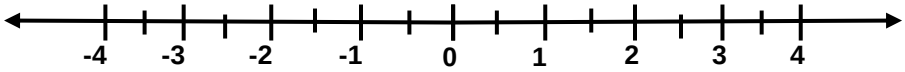


QUICK CHECK: Find the coordinate of the midpoint of $\overline{\mathbf{JK}}$. 1.5



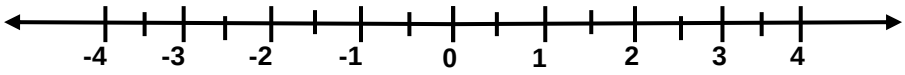
EXAMPLE 2: If the coordinate of the midpoint of $\overline{\mathbf{AB}}$ on a number line is 3, and **A** is at –2, find the coordinate of **B**. 8

QUICK CHECK: If the coordinate of the midpoint of $\overline{\mathbf{CD}}$ on a number line is 1, and **C** is at –3, find the coordinate of **D**. 5



EXAMPLE 3: If the distance of $\overline{\mathbf{AB}}$ is 4 and the coordinate of the midpoint of $\overline{\mathbf{AB}}$ on a number line is -1, find the coordinate of **A** and **B**. -3, 1

QUICK CHECK: If the distance of $\overline{\mathbf{CD}}$ is 7 and the coordinate of the midpoint of $\overline{\mathbf{CD}}$ on a number line is 0, find the coordinate of **A** and **B**. -3.5, 3.5



EXAMPLE 4: If the distance of $\overline{AB}$ is 6 and the coordinate of **A** on a number line is -4, find the coordinate of the midpoint of $\overline{AB}$. **-1 or -7**

QUICK CHECK: If the distance of $\overline{CD}$ is 5 and the coordinate of **A** on a number line is -2, find the midpoint of $\overline{CD}$. **.5 or -4.5**

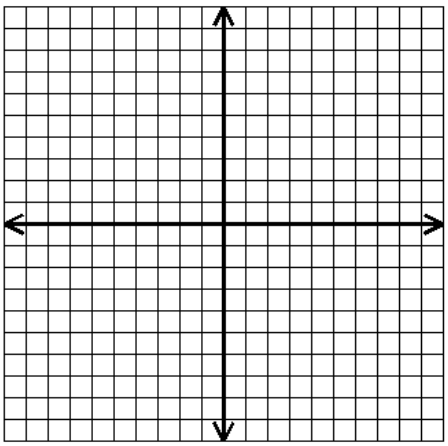
Midpoint Formula for Two-Dimensional Coordinate System (grid)

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

where (x_1, y_1) and (x_2, y_2) are the coordinates the of endpoints of the segment

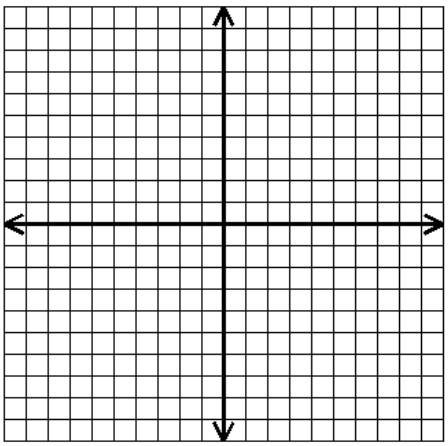
Find the coordinates of the midpoint of each segment formed by the given points.

EXAMPLE 5: (-9, 3) and (8, -7)



Midpoint: **$(-\frac{1}{2}, -2)$**

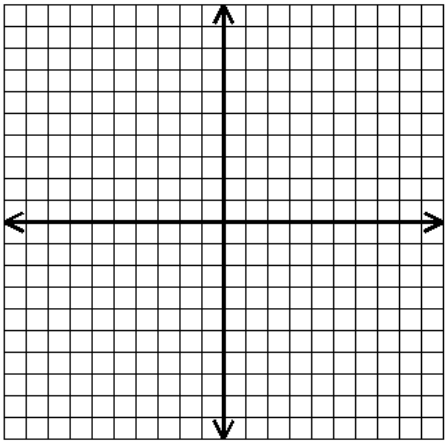
QUICK CHECK: (3, -6) and (7, 2)



Midpoint: **(5, -2)**

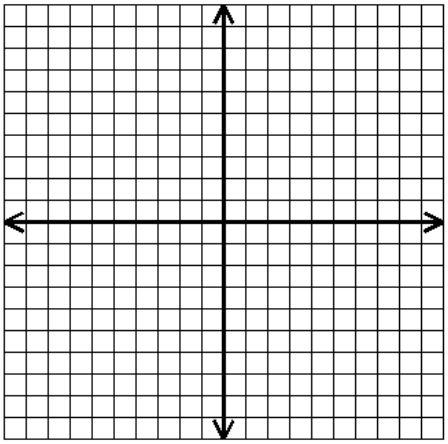
Find the coordinates of the missing endpoint of each segment.

EXAMPLE 6: **M** is the midpoint of $\overline{AB}$ with **A**(0,1) and **M**(3,5). Find the coordinates of **B**.



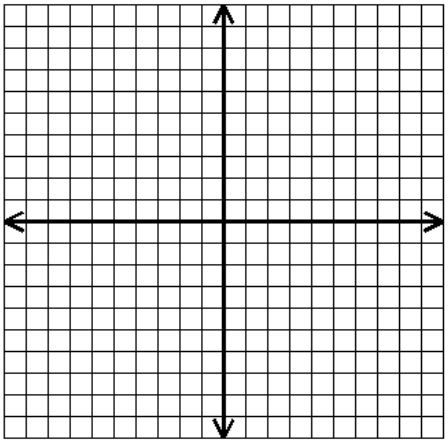
Endpoint B: **(6, 9)**

QUICK CHECK: The midpoint of $\overline{CD}$ is **M** (-1, 4). What are the coordinates of **C** if **D** is at (3, -2)?



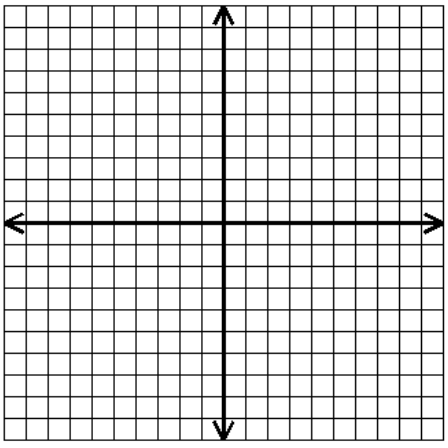
Endpoint C: **(-5, 10)**

EXAMPLE 7: Given line $y = \frac{3}{2}x + 4$, **M** is the midpoint of $\overline{AB}$, the distance of $\overline{AB}$ is $\sqrt{13}$, and **A**(-4,-2). Find the coordinates of **M** and **B**.



Midpoint M: $M_1=(-3, -.5), M_2=(-5, -3.5)$
Endpoint B: $B_1=(-2,1), B_2=(-6,-5)$

QUICK CHECK: Given line $y = -\frac{12}{5}x + 3$, **M** is the midpoint of $\overline{CD}$, the distance of $\overline{CD}$ is 13, and **C**(5, -9). Find the coordinates of **M** and **D.**



Midpoint M: $M_1=(2.5,-3), M_2=(7.5,-15)$

Endpoint D: $B_1=(0,3), B_2=(10,-21)$