# MIDPOINT, MEDIAN, & RIGHT BISECTOR

## LEARNING GOALS

Students will:

- Learn how to find the midpoint of a line segment.
- Learn how to find the median of a triangle.
- Learn how to find a right bisector.

## MIDPOINT

The…

| | | |
|---|---|---|
| Slope | A measure of the steepness of a line | Formula<br>$\text{slope} = \frac{\text{rise}}{\text{run}}$ |

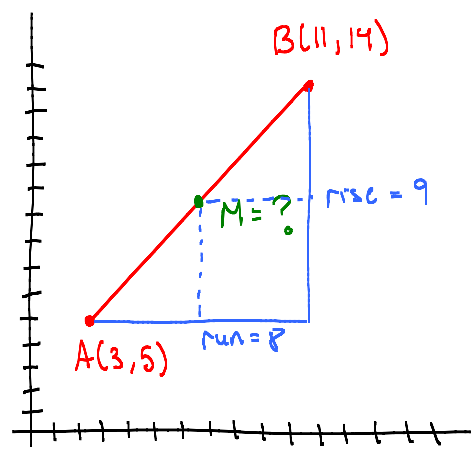
Can be used to find the…

| | | |
|---|---|---|
| Midpoint | A point that divides a line segment into two equal line segments | Formula<br>$\left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$ |

How might you use the calculation of a midpoint in your lives?

## EXAMPLE 1: FIND A MIDPOINT

There are two hospitals located at coordinates A (3, 5) and B (11, 14). The city wants to build a new ambulance station halfway between the two hospitals. Determine the coordinates of this location.




Method 1: Calculate the slope

$\text{rise} = y_2 - y_1 = 14 - 5 = 9$

$\text{run} = x_2 - x_1 = 11 - 3 = 8$

Therefore,

$$M = (x, y) = \left(x_1 + \frac{\text{run}}{2}, y_1 + \frac{\text{rise}}{2}\right)$$
$$= \left(3 + \frac{8}{2}, 5 + \frac{9}{2}\right)$$
$$= (3 + 4, 5 + 4.5)$$
$$= (7, 9.5)$$

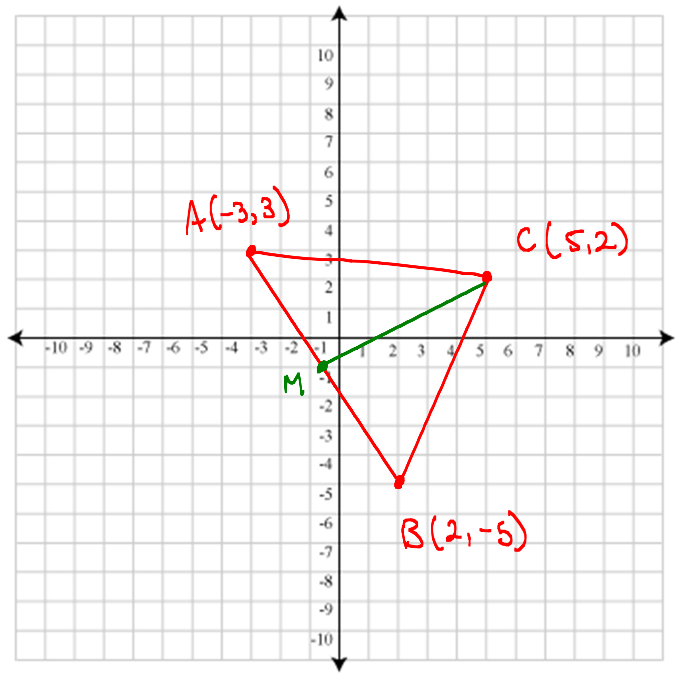
Method 2: Use the Midpoint formula.

$$M = (x, y) = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$$
$$= \left(\frac{3 + 11}{2}, \frac{5 + 14}{2}\right)$$
$$= \left(\frac{14}{2}, \frac{19}{2}\right)$$
$$= (7, 9.5)$$

| | |
|---|---|
| ~~Midpoint~~ Median | A line segment joining a vertex of a triangle to the midpoint of the opposite side. |
| Vertex | A point that represents the intersection of sides. |

EXAMPLE 2: MEDIAN OF A TRIANGLE

Determine an equation for the median from vertex C for the triangle with vertices C(5, 2), A(-3, 3), and B(2, -5).




1) Find the coordinates of the midpoint between A + B.

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

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

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

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

2) Now find the slope of the line segment CM.

$$m = \frac{\text{rise}}{\text{run}}$$

$$= \frac{y_2 - y_1}{x_2 - x_1}$$

$$= \frac{2-(-1)}{5-(-\frac{1}{2})}$$

$$= \frac{3}{\frac{11}{2}}$$

$$= 3 \times \frac{2}{11}$$

$$= \frac{6}{11}$$

3) Use the point C (or M) to find the y-intercept using the equation of a line.

$$y = \frac{6}{11}x + b$$

$$2 = \frac{6}{11}(5) + b$$

$$2 = \frac{30}{11} + b$$

$$2 - \frac{30}{11} = b$$

$$\frac{22}{11} - \frac{30}{11} = b$$

$$b = -\frac{8}{11}$$

$$\boxed{y = \frac{6}{11}x - \frac{8}{11}}$$

| | |
|---|---|
| Right Bisector | The line that passes through the midpoint of a line segment and intersects it at a 90° angle. |
| Equidistant | Equally Distant. |

## EXAMPLE 3: EQUATION OF A RIGHT BISECTOR

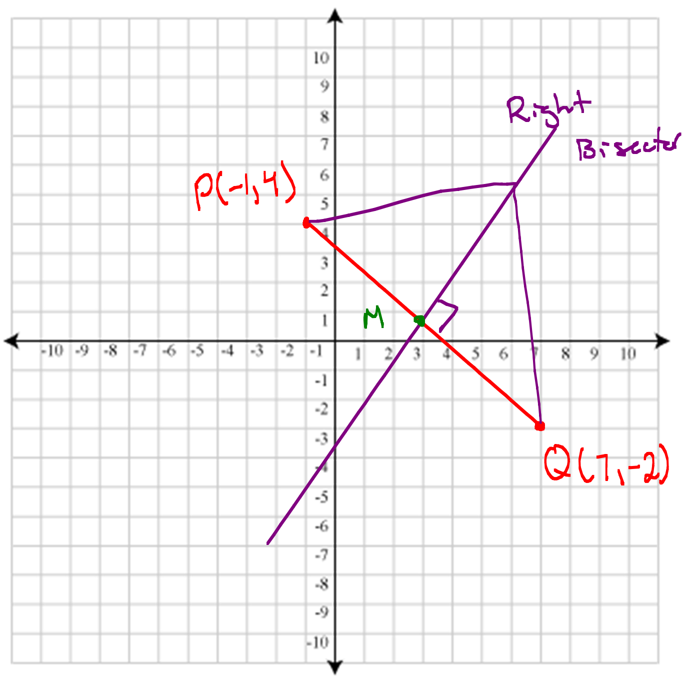
Two schools are located at points P(-1, 4) and Q (7, -2) on a town map. The school board is planning a new sports complex to be used by both schools. The board wants to find a location **equidistant** from the two schools. Use an equation to represent the possible locations for the athletic complex.

A point can be equidistant from the schools anywhere along the right bisector.

1) Find the slope of the line PQ
   - Perpendicular lines have slopes that are the negative reciprocals of each other.

2) The right bisector passes through the midpoint of PQ
   - Provides a point along the line required to find the y-intercept.

3) Find the y-intercept using the slope and the midpoint.




## HOMEFUN ☺

Pg 66 – 67 #1 – 4 (a,b), 5, 13-17, 19.