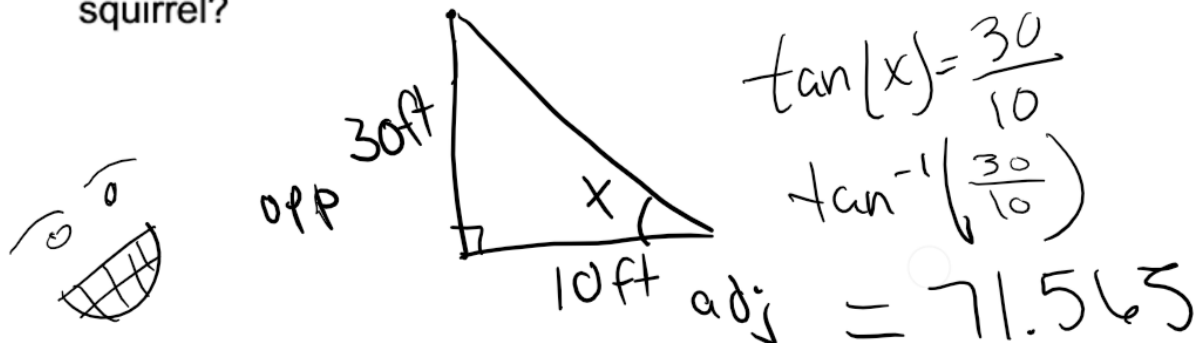


## Warm-Up

SOA-CA H-TOA

A dog is barking at a squirrel on the trunk of a tree. The dog is 10 ft from the tree and the squirrel is 30 ft up the tree. What is the angle of elevation from the dog to the squirrel?



## Goals For Today

Know and apply the Section Formula  
(origin of midpoint formula)

### Section Formula

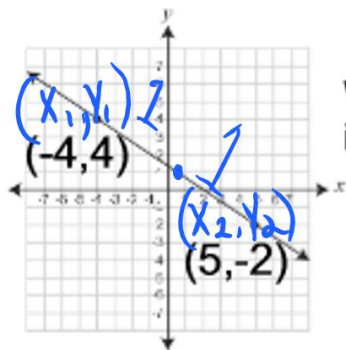
#### Midpoint Formula

Geometry in Coordinate Plane

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

Using this formula find the midpoint of the line shown.

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

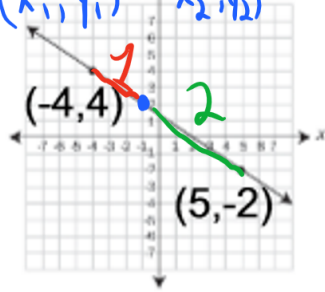


What ratio does midpoint split the line into?

a 1:1 ratio.

What if I didn't want to find a halfway point (1:1),  
but instead a point 1/3 (1:2) of the way from

$(-4, 4)$  to  $(5, -2)$ ?  
 $(x_1, y_1)$   $(x_2, y_2)$



$a:b$   
Section Formula

$$\left( \frac{ax_2 + bx_1}{a+b}, \frac{ay_2 + by_1}{a+b} \right)$$

$a$  and  $b$  come from the ratio.

$(x_1, y_1)$  is the starting point.  
 $(x_2, y_2)$  is the ending point.

$$\left( \frac{5 + (-6)}{1+2}, \frac{-2 + 8}{1+2} \right)$$

$$\left( \frac{-1}{3}, \frac{6}{3} \right)$$

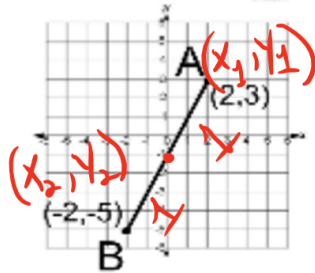
$$(-1, 2)$$

### Section Formula

ratio of  
1:1  
 $a:b$

Geometry in Coordinate Plane

Find the midpoint of the segment AB.

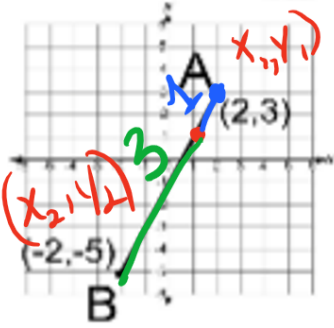


$$\left( \frac{-2 + 2}{1+1}, \frac{-5 + 3}{1+1} \right)$$

$$\left( \frac{0}{2}, \frac{-2}{2} \right)$$

$$(0, -1)$$

Find the coordinates that divide the following segment into a ratio of 1:3 from A to B.



$$a:b = 1:3$$

$$\left( \frac{-2 + 6}{1+3}, \frac{-5 + 9}{1+3} \right)$$

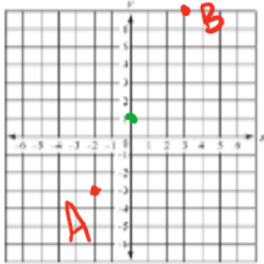
$$\left( \frac{1(-2) + 3(2)}{4}, \frac{1(-5) + 3(3)}{4} \right)$$

$$\left( \frac{4}{4}, \frac{4}{4} \right)$$

$$(1, 1)$$

One other way you could see these problems.

In line segment AB, point A is  $(-2, -3)$ . Coordinate  $(0, 1)$  divides A to B in a ratio of 2:3. What is point B?



$$(x_1, y_1) = (-2, -3)$$

$$a=2 \quad b=3$$

$(x, y)$  is  $(0, 1)$  ← normally what we are finding.

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

Point B  
 $(3, 7)$

$$\therefore \frac{2(x_2) + 3(-2)}{5} = 0.5$$

$$2x_2 - 6 = 0$$

$$2x_2 = 6$$

$$x_2 = 3$$

$$\frac{2(y_2) + 3(-3)}{5} = 1$$

$$\frac{2y_2 - 9}{5} = 1$$

$$2y_2 - 9 = 5$$

$$2y_2 = 14$$

$$y_2 = 7$$

Review:

What is the section formula?

$$(x, y) = \left( \frac{ax_2 + bx_1}{a+b}, \frac{ay_2 + by_1}{a+b} \right)$$

Determine  $x_1$ ,  $x_2$ ,  $y_1$ ,  $y_2$ ,  $a$  and  $b$  in the following problem.

Line segment  $AB$  has endpoints  $(2,6)$  and  $(-1,-3)$ . What coordinate divides  $A$  to  $B$  in the ratio of  $1:2$ ?

$$x_1 = 2 \quad y_1 = 6 \quad x_2 = -1 \quad y_2 = -3$$

$$a = 1 \quad b = 2$$