

### 9.3 Notes: Midpoint Formula & Partitioning a Segment

Warm-Up

lines  $\parallel$

lines  $\perp$

neither  $\parallel$  or  $\perp$

1.  $y = \frac{1}{3} - 17$      $y = x + 10$   
 $y = \frac{1}{3} + 2$      $y = x - 2$

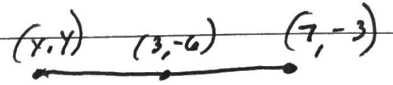
2.  $y = -2x$   
 $y = \frac{1}{2}x - 6$

3.  $y = 13x - 12$   
 $y = 43x + 21$

Coincidental:  $y = 2x + 1$   
 $y = 2x + 1$

Midpoint Formula

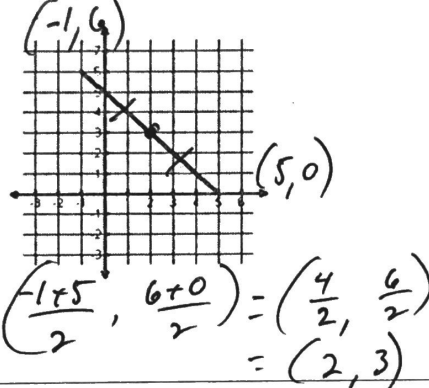
$$\left( \frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$$



Example One:

$(3, 7)$  and  $(-2, 4)$   
 $\left( \frac{3 + (-2)}{2}, \frac{7 + 4}{2} \right)$   
 $\left( \frac{1}{2}, \frac{11}{2} \right)$

Example Two:



Example Three:

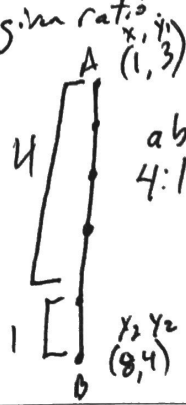
Midpoint  $(3, -6)$   
 endpoint  $(7, -3)$   
 $(3, -6) = \left( \frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$   
 $(3, -6) = \left( \frac{7 + x_2}{2}, \frac{-3 + y_2}{2} \right)$   
 $3 = \frac{7 + x}{2}$      $-6 = \frac{-3 + y}{2}$   
 $6 = 7 + x$      $-12 = -3 + y$   
 $-1 = x$      $(-1, -9)$      $-9 = y$

Partitioning a Segment Formula

$$\left( \frac{a}{a+b} (x_2 - x_1) + x_1, \frac{a}{a+b} (y_2 - y_1) + y_1 \right)$$

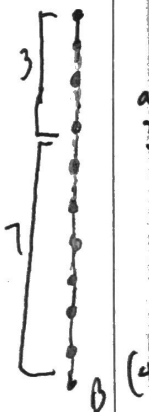
Example One: Find the coordinates of point P along the directed line segment AB so that AP to PB is the given ratio.

$A(1, 3), B(8, 4); 4$  to  $1$   
 $\left( \frac{4}{5}(8-1) + 1, \frac{4}{5}(4-3) + 3 \right)$   
 $\left( \frac{4}{5} \cdot 7 + 1, \frac{4}{5} \cdot 1 + 3 \right)$   
 $\left( 5.6 + 1, \frac{4}{5} + 3 \right)$



Example Two:  $A(-2, 1) B(4, 5); 3$  to  $7$

$\left( \frac{3}{10}(4+2) - 2, \frac{3}{10}(5-1) + 1 \right)$   
 $\left( \frac{3}{10} \cdot 6 - 2, \frac{3}{10} \cdot 4 + 1 \right)$   
 $(1.8 - 2, 1.2 + 1)$   
 $(-0.2, 2.2)$



$(6.6, 3.8)$