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Date: \_\_\_\_\_  
 LESSON 3

**AIM: HOW DO WE WRITE THE EQUATIONS OF LINES IN SLOPE-INTERCEPT FORM?**

*Do Now:* For each of the following equations, rearrange into  $y = mx + b$  form and identify the slope and y-intercept of the line.

(a) $y + 2x = 7$ $-2x - 2x$ $y = -2x + 7$ $m = -2$ $b = 7$	(b) $2x + 3y = 12$ $-2x - 2x$ $3y = -2x + 12$ $y = -\frac{2}{3}x + 4$ $m = -\frac{2}{3}$ $b = 4$	(c) $x - 6y = 7$ $-x - 6y$ $-6y = -x + 7$ $y = \frac{1}{6}x - \frac{7}{6}$ $m = 1/6$ $b = -7/6$
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**Equation of a Line in Slope-Intercept Form**

$y = mx + b$

$m = \text{slope}$   
 $b = \text{y-intercept}$

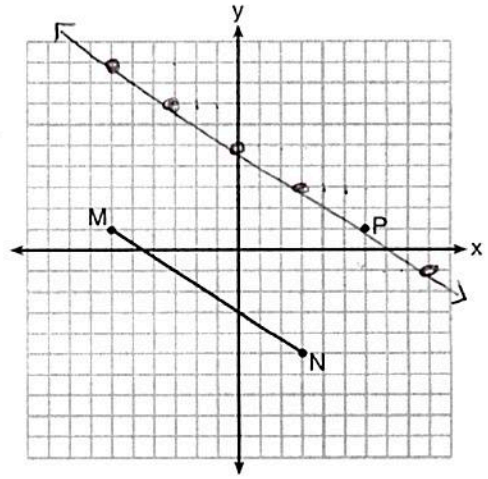
What is the relationship?	What is the relationship?
Line a: $y = \frac{1}{2}x + 4$ Line b: $y = \frac{1}{2}x - 5$	Line c: $y = \frac{2}{3}x + 1$ Line d: $y = -\frac{3}{2}x - 3$
Line a and line b are <u>parallel</u> because <u>the slopes are equal</u>	Line c and line d are <u>perpendicular</u> because <u>the slopes are opposite reciprocals</u>

**Example 1:** What is an equation of a line that is perpendicular to the line whose equation is  $2y + 3x = 1$ ?

- (1)  $y = \frac{2}{3}x + \frac{5}{2}$
- 2)  $y = \frac{3}{2}x + 2$
- 3)  $y = -\frac{2}{3}x + 1$
- 4)  $y = -\frac{3}{2}x + \frac{1}{2}$

$2y + 3x = 1$   
 $-3x - 3x$   
 $2y = -3x + 1$   
 $y = -\frac{3}{2}x + \frac{1}{2}$   
 $m = -\frac{3}{2}$   
 $\perp m = \frac{2}{3}$

**Example 2:** Given  $\overline{MN}$  shown below, with  $M(-6, 1)$  and  $N(3, -5)$ , what is an equation of the line that passes through point  $P(6, 1)$  and is parallel to  $\overline{MN}$ ?



1)  $y = -\frac{2}{3}x + 5$

$$m_{\overline{MN}} = \frac{-5 - 1}{3 - (-6)} = \frac{-6}{9} = -\frac{2}{3}$$

2)  $y = -\frac{2}{3}x - 3$

$$\parallel m = -\frac{2}{3}$$

3)  $y = \frac{3}{2}x + 7$

$$b = 5$$

4)  $y = \frac{3}{2}x - 8$

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

### Point - Slope form of a Linear Equation

ex #1) slope =  $\frac{1}{2} = m$  point =  $(-1, 2)$   
 $y - y_1 = m(x - x_1)$   
 $y - 2 = \frac{1}{2}(x - (-1))$   
 $y - 2 = \frac{1}{2}(x + 1)$

ex #2)  $y - 3 = \frac{4}{5}(x + 2)$  point =  $(-2, 3)$   
FLIP SIGNS!  
 $m = \frac{4}{5}$

point  
 $y - \boxed{y_1} = \boxed{m}(x - \boxed{x_1})$   
 $\downarrow$  SLOPE

**Example 3:** Which equation represents a line parallel to the line whose equation is  $-2x + 3y = -4$ ?

~~1)  $y - 3 = -\frac{3}{2}(x - 1)$~~

2)  $y - 3 = \frac{2}{3}(x - 1)$

~~3)  $y = \frac{3}{2}x - 4$~~

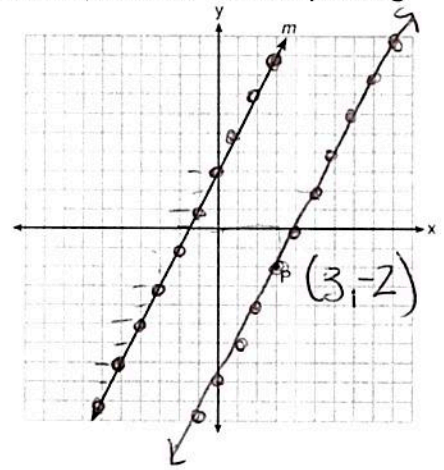
~~4)  $y = -\frac{2}{3}x + 1$~~

$$\begin{array}{r} -2x + 3y = -4 \\ +2x \quad +2x \\ \hline 3y = 2x - 4 \\ \frac{3y}{3} = \frac{2x}{3} - \frac{4}{3} \\ y = \frac{2}{3}x - \frac{4}{3} \end{array}$$

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

$$\parallel m = \frac{2}{3}$$

**Example 4:** Line  $m$  and point  $P$  are shown in the graph below. Which equation represents the line passing through  $P$  and parallel to line  $m$ ?



1)  $y - 3 = 2(x + 2)$  point =  $(-2, 3)$   $m = \frac{2}{1}$

2)  $y + 2 = 2(x - 3)$  point =  $(3, -2)$   $\parallel m = \frac{2}{1} = 2$

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

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

**Example 5:** Write an equation of a line that is perpendicular to the line  $y = \frac{2}{3}x + 5$  and that passes through the point  $(0, 4)$ .

$x_1, y_1$

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

$\perp m = -\frac{3}{2}$

$y - y_1 = m(x - x_1)$

$y - 4 = -\frac{3}{2}(x - 0)$

$y - 4 = -\frac{3}{2}x$  OR  $y = -\frac{3}{2}x + 4$

**Example 6:** Find an equation of the line passing through the point  $(5, 4)$  and parallel to the line whose equation is  $2x + y = 3$ .

$-2x \quad -2x$

$y = -2x + 3$

$m = -2$

$\parallel m = -2$

$y - y_1 = m(x - x_1)$

$y - 4 = -2(x - 5)$

OR

$y - 4 = -2x + 10$   
 $+4 \qquad +4$

$y = -2x + 14$



**Example 7:** Two lines are represented by the equations  $x + 2y = 4$  and  $4y - 2x = 12$ . Determine whether these lines are parallel, perpendicular, or neither. Explain your answer.

$$\begin{array}{r} x + 2y = 4 \\ -x \quad -x \\ \hline 2y = -x + 4 \\ \frac{2y}{2} = \frac{-x}{2} + \frac{4}{2} \\ y = -\frac{1}{2}x + 2 \end{array}$$

$$\begin{array}{r} 4y - 2x = 12 \\ +2x \quad +2x \\ \hline 4y = 2x + 12 \\ \frac{4y}{4} = \frac{2x}{4} + \frac{12}{4} \\ y = \frac{1}{2}x + 3 \end{array}$$

NEITHER! Slopes are neither equal or opp. reciprocal slopes

**Practice NYTS (Now You Try Some!)**

1. Write an equation of the line that passes through the point  $(6, -5)$  and is parallel to the line whose equation is  $2x - 3y = 11$ .

$$\begin{array}{r} -2x \quad -2x \\ -3y = -2x + 11 \\ -3 \quad -3 \\ \hline y = \frac{2}{3}x - \frac{11}{3} \\ m = 2/3 \\ \parallel m = 2/3 \end{array}$$

$$\begin{array}{l} x_1, y_1 \\ y - y_1 = m(x - x_1) \\ y - (-5) = \frac{2}{3}(x - 6) \\ \boxed{y + 5 = \frac{2}{3}(x - 6)} \end{array}$$

$$\begin{array}{l} \text{OR} \\ y + 5 = \frac{2}{3}x - 4 \\ -5 \quad -5 \\ \boxed{y = \frac{2}{3}x - 9} \end{array}$$

2. What is an equation of the line that passes through the point  $(6, 8)$  and is perpendicular to a line with equation  $y = \frac{3}{2}x + 5$ ?

$$\begin{array}{l} m = \frac{3}{2} \\ \perp m = -\frac{2}{3} \end{array}$$

$$\begin{array}{l} y - y_1 = m(x - x_1) \\ \boxed{y - 8 = -\frac{2}{3}(x - 6)} \end{array}$$

$$\begin{array}{l} \text{OR} \\ y - 8 = -\frac{2}{3}x + 4 \\ +8 \quad +8 \\ \boxed{y = -\frac{2}{3}x + 12} \end{array}$$

3. Which equation represents a line that is parallel to the line whose equation is  $y = \frac{3}{2}x - 3$  and passes through the point  $(1, 2)$ ?

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

$$\parallel m = \frac{3}{2}$$

1)  $y - 1 = \frac{3}{2}(x - 2)$

~~2)  $y - 2 = -\frac{2}{3}(x - 1)$~~

3)  $y - 2 = \frac{3}{2}(x - 1)$

~~4)  $y - 1 = -\frac{2}{3}(x - 2)$~~

4. What is an equation of the line that passes through the point  $(2, 4)$  and is perpendicular to the line whose equation is  $y = 2x + 3$ ?

$x, y_1$

$$y - 4 = -\frac{1}{2}(x - 2)$$

$$y - 4 = -\frac{1}{2}x + 1$$

$$+4 \qquad +4$$

$$y = -\frac{1}{2}x + 5$$

1)  $y = -\frac{1}{2}x + 5$

2)  $y = -\frac{1}{2}x + 4$

~~3)  $y = 2x - 6$~~

~~4)  $y = 2x$~~

$$y = 2x + 1$$

$$m = 2$$

$$\perp m = -\frac{1}{2}$$

5. What is an equation of the line that passes through the point  $(-2, 3)$  and is parallel to the line whose equation is  $y = \frac{3}{2}x - 4$ ?

$x, y_1$

$$y - 3 = \frac{3}{2}(x - (-2))$$

$$y - 3 = \frac{3}{2}(x + 2)$$

$$y - 3 = \frac{3}{2}x + 3$$

$$+3 \qquad +3$$


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$$y = \frac{3}{2}x + 6$$

~~1)  $y = \frac{-2}{3}x$~~

~~2)  $y = \frac{-2}{3}x + \frac{5}{3}$~~

3)  $y = \frac{3}{2}x$

4)  $y = \frac{3}{2}x + 6$

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

$$\parallel m = \frac{3}{2}$$

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 LESSON 3 HOMEWORK

1. On the grid below, the line,  $s$ , is graphed as well as the point  $(2, 4)$ . Write the equation of a line parallel to line  $s$  that passes through the point  $(2, 4)$ .

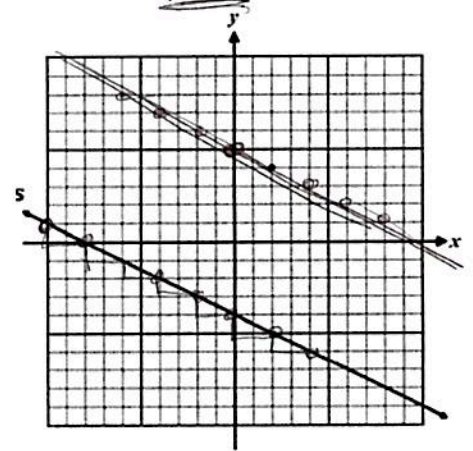
$$m = -\frac{1}{2} \quad x_1, y_1$$

$$y - 4 = -\frac{1}{2}(x - 2)$$

$$y - 4 = -\frac{1}{2}x + 1$$

$$+4 \qquad +4$$

$$y = -\frac{1}{2}x + 5$$



2. What is the slope of a line perpendicular to the line whose equation is  $3x - 7y + 14 = 0$ ?

- 1)  $\frac{3}{7}$
- 2)  $-\frac{7}{3}$
- 3) 3
- 4)  $-\frac{1}{3}$

$$m = 3/7$$

$$\perp m = -7/3$$

$$3x - 7y + 14 = 0$$

$$+7y \quad +7y$$

$$\frac{3x + 14}{7} = \frac{7y}{7}$$

$$y = \frac{3}{7}x + 2$$

3. Find an equation of the line passing through the point  $(6, 5)$  and perpendicular to the line whose equation is  $2y + 3x = 6$ .

$$-3x - 3x$$

$$\frac{2y}{2} = \frac{3x + 6}{2}$$

$$y = \frac{3}{2}x + 3$$

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

$$\perp m = -\frac{2}{3}$$

$x_1, y_1$

$$y - 5 = -\frac{2}{3}(x - 6)$$

$$\text{OR}$$

$$y - 5 = -\frac{2}{3}x + 4$$

$$+5 \qquad +5$$

$$y = -\frac{2}{3}x + 9$$

4. What is the equation of a line passing through the point  $(6, 1)$  and parallel to the line whose equation is  $3x = 2y + 4$ ?

$$y - 1 = \frac{3}{2}(x - 6)$$

$$\text{OR}$$

$$y - 1 = \frac{3}{2}x - 9$$

$$+1 \qquad +1$$

$$y = \frac{3}{2}x - 8$$

$x_1, y_1$

$$-4 \quad -4$$

$$\frac{3x}{2} = \frac{2y + 4}{2}$$

$$y = \frac{3}{2}x - 2$$

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

$$\parallel m = \frac{3}{2}$$