

5.6 - PARALLEL LINES:

Two lines are parallel if they have the SAME slope.

Are these 2 lines parallel?  $y = \frac{-3x}{2} + 2$

and  $3x + 2y = 8$

Parallel

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

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

Convert the standard form equation to slope intercept. Compare the slopes.

$$3x + 2y = 8$$

$$-3x \quad -3x$$

$$2y = -3x + 8$$

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

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

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

Are these lines parallel?

$$y = 2x - 6$$

$$m = 2$$

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

$$m = 2$$

Yes

Are these parallel?

$$y = 3x + 4$$

$$m = 3$$

$$m = \frac{3}{4}$$

Not parallel

$$-3x + \frac{1}{4}y = 12$$

convert to  
slope intercept  
form

$$y = mx + b$$

$$\begin{array}{r} +3x + 4y = 12 \\ +3x \end{array}$$

$$\frac{4}{4}y = \frac{3x}{4} + \frac{12}{4}$$

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

Are these parallel?

$$y - 4 = \frac{3}{2}(x - 7) \quad m = \frac{3}{2}$$

$$-\frac{3}{2}x + y = 6 \quad y = mx + b$$

$$y = \frac{3}{2}x + 6 \quad m = \frac{3}{2} \text{ parallel}$$

5-6 Given an equation of a line. Write the equation of a new line parallel to the first line.

Example: Write the equation of a line that contains  $(2, -6)$  and is parallel to  $y = 3x + 9$ . The question asks you to write a new equation that has  $(2, -6)$ .

1) Take the slope from the first equation. It becomes the slope of the new equation.  $m = 3$ . That's all you need from the first equation. Ignore it for everything else.

new line  
 $m = 3$   $(2, -6)$   
 $y + 6 = 3(x - 2)$

2) Write the new equation in point slope form by using the slope from Step 1 and the given point:

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

$y + 6 = 3(x - 2)$  Stop here for point slope form. Point slope does not distribute the 3. You only distribute if they ask for slope intercept form.

Convert to slope intercept form:

$$y + 6 = 3(x - 2)$$

$$y + 6 = 3x - 6 \quad \text{Distributive property}$$

$$y + 6 - 6 = 3x - 6 - 6$$

$$y = 3x - 12$$

*Get y by itself:  
 $y = mx + b$*

Are these lines  
parallel?

$$2x - 4y = 3$$

$$y = \frac{1}{2}x + 8$$

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Write the equation of a new line that contains  $(4, -5)$  and is parallel to  $y = \frac{1}{2}x + 8$ .

ⓐ Write in point slope form

ⓑ Convert it to slope intercept form.

Are these lines  
parallel?

$$2x - 4y = 3$$

yes

$$y = \frac{1}{2}x + 8$$

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

$$\cancel{2}x - 4y = 3 \quad -2x$$

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

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

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

Write the equation of a new line that contains  $(4, -5)$  and is parallel to  $y = \frac{1}{2}x + 8$ .

ⓐ Write in point slope form  
 ⓑ Convert it to slope intercept form.

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$$m = \frac{1}{2}x$$

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

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

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

$3(x + 2)$

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

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

$$y = \frac{1}{2}x - 7$$

$$\frac{-4}{2} = -2$$

$$\frac{-4 \div 2}{2 \div 2} = \frac{-2}{1}$$

Green workbook #11

$$y = 4x + 2 \quad m = 4$$

What is the slope  
of a line parallel to  
 $y = 4x + 2$   $m = 4$

new line  $m = 4$

Green workbook #5)

$$6x + 2y = 4$$

$$-6x \qquad -6x$$

$$y = mx + b$$

$$2y = -6x + 4$$

$$y = -\frac{6}{2}x + \frac{4}{2} \quad m = -3$$

Write the equation of a new line that contains  $(3, -2)$  and is parallel to  $y = 2x - 4$

- ① Convert to point slope form.  
② Convert it to slope intercept form.

New line  $m = 2$   $(3, -2)$

$$y + 2 = 2(x - 3)$$

$$y + 2 = 2(x - 3)$$

$$y + 2 = 2x - 6$$

$\quad -2 \qquad \qquad -2$

$$y = 2x - 8$$

Write an equation in slope intercept form of the line that passes through the given point and is parallel to the graph of the given equation:

$$(-1, 3); \quad y = 2x - 8$$

new  $m = 2$

$(-1, 3)$

step 1  
pull slope  
from given line

$$\begin{array}{cc} \text{slope} & \text{point} \\ m=2 & (-1, 3) \end{array}$$

$$y - 3 = 2(x + 1)$$

step 2  
Write in  
point slope  
form

$$\begin{array}{l} y - 3 = 2x + 2 \\ + 3 \quad \quad \quad + 3 \\ \hline y = 2x + 5 \end{array}$$

step 3  
convert to  
slope intercept  
form.

Black workbook #1

$$(-1, 3)$$

$$y = 2x - 8$$

$$m = 2$$

New  $m = 2$   $(-1, 3)$

$$y - 3 = 2(x + 1)$$

Point Slope  
Form

$$y - 3 = 2x + 2$$

$$+ 3 \quad + 3$$

$$y = 2x + 5$$

slope  
intercept  
form

$$(2, 6) \quad y = -3x + 5$$

$$m = -3; \quad (x_1, y_1)$$

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

$$\begin{array}{r} y - 6 \\ + 6 \end{array} = \begin{array}{r} -3x + 6 \\ + 6 \end{array}$$

$$y = -3x + 12$$

5.6 - PERPENDICULAR LINES:

Two lines are perpendicular if their slopes are **NEGATIVE RECIPROCAL**S.

Negative reciprocal – Flip the value of the given slope and reverse the sign.

If you multiply the two slopes it = -1.

Slope = 2. The negative reciprocal is -1/2

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2

$$\frac{4}{1} \quad -\frac{1}{4}$$

m = 3 The negative reciprocal is -3/4

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4

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3

Are these lines perpendicular

@  $y = 4x - 1$   $m = 4$

$y = -\frac{1}{4}x + 3$   $m = -\frac{1}{4}$

Perpendicular

Write the negative reciprocal to find the slope of the line perpendicular to the given line

$$y = 3x - 2 \quad m = 3$$

Perpendicular: Flip 3 and change the sign =  $\left(-\frac{1}{3}\right)$

Example: Write the equation of a line that contains (4, 2) and is perpendicular to :

$$m = -\frac{1}{3} \quad Y = -\frac{1}{3}X + 2$$

Perpendicular =  $\frac{3}{1}$

1) Write the negative reciprocal for the slope from the first equation. It becomes the slope of the new equation.

$$(4, 2) \quad m = \frac{3}{1}$$

That's all you need from the first equation. Ignore everything else.

2) Write the new equation by using the slope from Step 1 and the given point:

$y - 2 = 3(x - 4)$  Stop here for point slope form. Point slope does not distribute the 3. You only distribute if they ask for slope intercept form.

Convert it to slope intercept form:

Write the equation of a new line that contains  $(4, -5)$  and is perpendicular to  $y = \frac{1}{2}x + 8$ .

Ⓐ Write in point slope form

Ⓑ Convert it to slope intercept form.

Old  ~~$y = \frac{1}{2}x + 8$~~   ~~$m = \frac{1}{2}$~~

New  $(4, -5)$

perpendicular

$$y + 5 = -\frac{2}{1}(x - 4) \quad \text{point slope form}$$

$$y + 5 = -2x + 8$$

$$y = -2x + 3$$



