

## Goals For today:

- Refresh skills on finding the slope of a line.
- Determine if two lines are parallel, perpendicular or neither based off their slope.

### Review

### Parallel and Perpendicular Lines

Definition of parallel and perpendicular

What is the definition of parallel?

lines in the same plane that never intersect

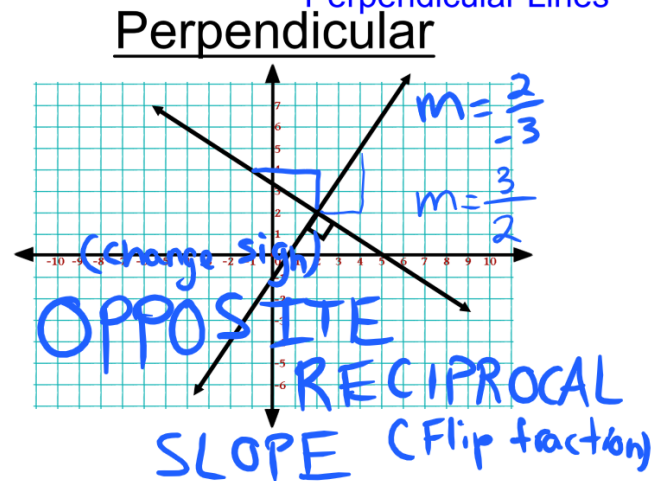
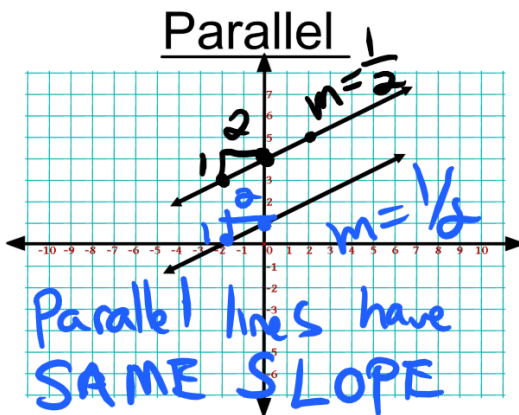
What is the definition of perpendicular?

Intersect at  $90^\circ$

$$y = mx + b \quad \text{slope}$$

Determining Parallel and Perpendicular

### Parallel and Perpendicular Lines



Remember:

$$\text{slope} = \frac{\text{Rise}}{\text{Run}}$$

Identify slope of the following lines and give a parallel and perpendicular slope.

1.  $y = 3x + 5$

$m = 3$  parallel:  $m = 3$   
perp:  $m = -\frac{1}{3}$

2.  $y = \frac{1}{4}(x+8)$

$y = \frac{1}{4}x + 2$   
 $m = \frac{1}{4}$  parallel:  $m = \frac{1}{4}$   
perp:  $m = -\frac{4}{1}$

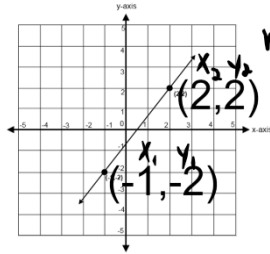
3.  $y + 2 = 6(x-2)$

$y + 2 = 6x - 12$   
 $y = 6x - 14$   
 $m = \frac{6}{1}$  parallel:  $m = \frac{6}{1}$   
perp:  $m = -\frac{1}{6}$

4.  $\frac{3y}{3} = \frac{9x + 15}{3}$

$y = 3x + 5$   
 $m = \frac{3}{1}$  parallel:  $m = \frac{3}{1}$   
perp:  $m = -\frac{1}{3}$

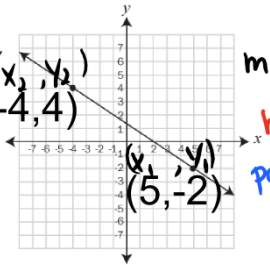
5.



$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{2 - (-2)}{2 - (-1)} = \frac{4}{3}$

$m = \frac{4}{3}$   
parallel:  $m = \frac{4}{3}$   
perp:  $m = -\frac{3}{4}$

6.



$m = \frac{4 - (-2)}{-4 - 5} = \frac{6}{-9}$

$m = -\frac{6}{9} = -\frac{2}{3}$   
parallel:  $m = -\frac{2}{3}$   
perp:  $m = \frac{3}{2}$

Parallel, Perpendicular, Same, or Neither

Parallel, Perpendicular, Same, or Neither

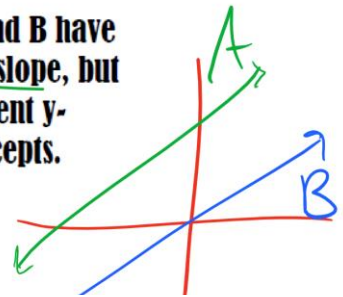
Line A has a slope of 4.

Line B has a slope of  $-\frac{1}{4}$ .

Opposite Reciprocal slope  
Perpendicular

Lines A and B have the same slope, but different y-intercepts.

parallel



Parallel, Perpendicular, Same, or Neither

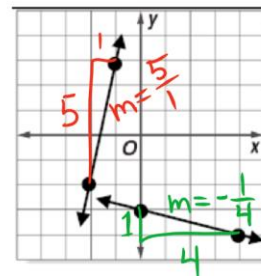
Parallel, Perpendicular, Same, or Neither

$m = 3$  Line A:  $3x = y - 12$   
 $3x = y - 12$

Line B:  $y + \frac{1}{3}x = 0$   
 $3x + 12 = 4$   
 $4 + \frac{1}{3}x = 0$   
 $-\frac{1}{3}x = -\frac{1}{3}x$   
 $y = -\frac{1}{3}x$

Opp. recip. slopes  
Perpendicular

$m = -\frac{1}{3}$



Neither

Slopes are not the same or opp. recip.

Parallel, Perpendicular, Same, or Neither

Line A passes through (3, 5) and (-1, 8). Line B passes through (2, -2) and (-3, 6).

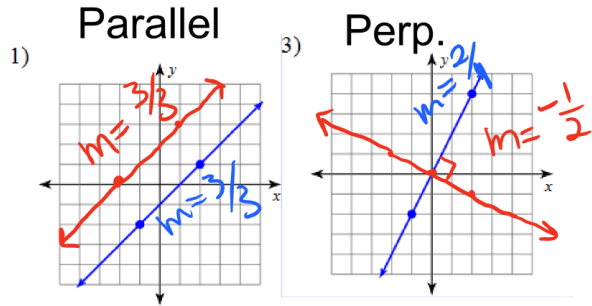
$m = \frac{8-5}{-1-3} = -\frac{3}{4}$

$m = \frac{6-(-2)}{-3-2} = \frac{8}{-5}$

Neither slopes are not the same or opposite reciprocals.

# Practice Set 1

## 1, 3, 5, 9



Perp.  
 5)  $y = \frac{7}{5}x + 2$   $m = \frac{7}{5}$   
 $m = -\frac{5}{7}$   
 $y = -\frac{5}{7}x + 9$

**Parallel**  
 9)  $(-8, -2), (-7, 5)$   
 $m = \frac{5 - (-2)}{-7 - (-8)} = \frac{7}{1}$   
 $m = \frac{7}{1}$   
 $y = 7x + 3$

NEW Problem type. Parallel and Perpendicular Lines

Ex. Write an equation that is perpendicular to  $y = \frac{5}{6}x + 2$ , that passes through point  $(5, -1)$ .

original line  
 $y = \frac{5}{6}x + 2$   
 $m = \frac{5}{6}$

New line: Perp  $(x, y)$   
 $m = -\frac{6}{5}$  (opp. recip.)  
 $y = -\frac{6}{5}x + b$   
 point line passes through  $(5, -1)$   
 $-1 = -\frac{6}{5}(5) + b$   
 $-1 = -6 + b$   
 $+6 \quad +6$   
 $5 = b$   
 $y = -\frac{6}{5}x + 5$

Ex. Write the equation of a line that goes through  $(2, 4)$  and is parallel to  $y = \frac{1}{4}x + 11$

original  
 $m = \frac{1}{4}$

Parallel line  
 $m = \frac{1}{4}$   
 $y = \frac{1}{4}x + b$   
 only care about the slope of original line.  
 $4 = \frac{1}{4}(2) + b$   
 $4 = 0.5 + b$   
 $-0.5 \quad -0.5$   
 $3.5 = b$   
 $y = \frac{1}{4}x + 3.5$

You try!

Parallel and Perpendicular Lines

Write an equation that is parallel to  $y = \frac{2}{3}x - 8$ , that passes through point (6, 5).

Original line

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

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

Same slope →

New line: Parallel

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

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

Sub. in (6,5)

$$5 = \frac{2}{3}(6) + b$$

$$5 = 4 + b$$

$$b = 1$$

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

Practice problems

3, 5, 9, and 11

Parallel

Perpendicular

3)  $x + y = 2$ , through point (2,1)

$$y = -x + 2$$

$$m = -1$$

New line Parallel

$$m = -1$$

$$y = -x + b$$

$$1 = -(2) + b$$

$$1 = -2 + b$$

$$3 = b$$

$$y = -x + 3$$

5)  $y = 2x + 1$ , through point (4,6)

$$m = 2$$

New line Perp.

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

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

$$6 = -\frac{1}{2}(4) + b$$

$$6 = -2 + b$$

$$8 = b$$

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

9) Write an equation for a line parallel to a line with the points.

$(-14, -16), (2, -20)$

$$m = \frac{-20 - (-16)}{2 - (-14)} = \frac{-4}{16} = -\frac{1}{4}$$

New line Parallel

$$m = -\frac{1}{4}$$

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

11. Write the equation for a line parallel to line  $y - 4x = 7$  that goes through point (2,1).

original

$$y - 4x = 7$$

$$y = 4x + 7$$

$$m = 4$$

New line parallel

$$y = 4x + b$$

$$1 = 4(2) + b$$

$$1 = 8 + b$$

$$-7 = b$$

$$y = 4x - 7$$

## Recap of what we learned so far.

1. How do the slopes of perpendicular lines relate?

opp. reciprocals

2. If the slope of two lines is the same and the y-intercept is different, what type of lines are they?

parallel lines

