

## Algebra 1 Notes: 01/16 – 01/20

### Parallel and Perpendicular Lines

#### Parallel Lines

The slopes of parallel lines are always equal.

- Example:
  - The equations  $y = 4x + 1$  and  $y = 4x + 3$  are parallel, because they both have a slope of 4.

#### Perpendicular Lines

The slopes of perpendicular lines are always opposite reciprocals of each other.

- Example:
  - The equations  $y = \frac{2}{3}x + 2$  and  $y = -\frac{3}{2}x + 5$  are perpendicular because their slopes are opposite reciprocals of each other.
  - The term opposite reciprocal simply means to flip the slope and change the sign.
    - For example, if  $m = \frac{4}{5}$ , then a slope perpendicular to that would be  $m = -\frac{5}{4}$ .

Two slopes that are perpendicular will always have a product of -1.

- Example:
  - $\frac{4}{5} \cdot -\frac{5}{4} = -\frac{20}{20} = -1.$

## Writing Equations of Parallel and Perpendicular Lines

There are 3 steps to writing equations of parallel and perpendicular lines.

1. Determine the slope of the new line.
2. Pick which equation to use:
  - a. Slope-intercept:  $y = mx + b$
  - b. Point-Slope:  $y - y_1 = m(x - x_1)$
3. Substitute values.

Ex 1 – Write the equation of a line perpendicular to  $y = -\frac{1}{3}x - 5$  through the point  $(-1, 4)$ . Write the final answer in slope-intercept form.

- Step 1: Determine the slope of the new line.
  - Since it must be perpendicular to the given line, the slope of our new line must be  $m = 3$ .
- Step 2: Pick equation.
  - Since we have the point  $(-1, 4)$ , we should use the point-slope equation of a line:  $y - y_1 = m(x - x_1)$ .
- Step 3: Substitute values.
  - Since  $m = 3$  and  $(x_1, y_1) = (-1, 4)$ , we can substitute those into the point-slope equation:

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

$$y - 4 = 3(x - (-1))$$

$$y - 4 = 3(x + 1).$$

Now the problem says to write the final answer in slope-intercept form. To do this, we simply solve for  $y$ .

$$y - 4 = 3(x + 1)$$

$$y - 4 = 3x + 3$$

$$y = 3x + 7$$

So the line parallel to  $y = -\frac{1}{3}x - 5$  through the point  $(-1, 4)$  is  $y = 3x + 7$ .