

## Day 3 - Parallel & Perpendicular Lines - Notes

Graphs: Lines do not intersect and are in the same plane.

Equations:

- Same Slopes
- Different y - intercepts

Are these lines parallel?

1.  $y = -2x + 1$  and  $y = -2x - 4$

yes → same slopes

2.  $y = 3x - 4$  and  $y = 1 + 3x$

yes → same slopes

How to Write an Equation of a Line PARALLEL to another and given a point.

1. Given equation should be solved for y ( $y = mx + b$ ).
2. Write down the Slope of that line.
3. Substitute m and  $(x_1, y_1)$  into  $y = mx + b$ .
4. Solve for b.
5. Write the equation of the line with the slope and new y-intercept.

3. Write a line parallel to the line  $y = -4x + 1$  and passes through the point  $(2, -1)$ .

$m = -4$   
 $-1 = -4(2) + b$   
 $-1 = -8 + b$   
 $7 = b$   
 $y = -4x + 7$

4. Write a line parallel to the line  $y = 3x - 5$  and passes through the point  $(-5, -2)$ .

$m = 3$   
 $-2 = 3(-5) + b$   
 $-2 = -15 + b$   
 $13 = b$   
 $y = 3x + 13$

5. Write a line parallel to the line  $y = -x - 7$  and passes through the point  $(-4, -4)$ .

$m = -1$   
 $-4 = -1(-4) + b$   
 $-4 = 4 + b$   
 $-8 = b$   
 $y = -x - 8$

6. Write a line parallel to the line  $2x + y = 3$  and passes through the point  $(-2, 5)$ .  $\hookrightarrow y = -2x + 3$

$m = -2$   
 $5 = -2(-2) + b$   
 $5 = 4 + b$   
 $1 = b$   
 $y = -2x + 1$

## Perpendicular Lines

Graphs: Lines intersect at a 90° angle.

Equations:

- Negative Reciprocal Slopes

How to Write an Equation of a Line PERPENDICULAR to another and given a point.

1. Given equation should be solved for y ( $y = mx + b$ ).
2. Write down the negative reciprocal slope of that line.  $\frac{2}{3} \rightarrow -\frac{3}{2}$
3. Substitute m and  $(x_1, y_1)$  into  $y = mx + b$ .
4. Solve for b.  $-\frac{1}{4} \rightarrow 4$
5. Write the equation of the line with the NEW slope and NEW y-intercept.

1. Write a line perpendicular to the line  $y = \frac{1}{2}x - 2$  and passes through the point (1, 0)

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

$0 = -2(1) + b$

$0 = -2 + b$

$2 = b$

$y = -2x + 2$

2. Write a line perpendicular to the line  $y = -3x + 2$  and passes through the point (6, 5)

$-3 \rightarrow \frac{1}{3}$

$5 = \frac{1}{3}(6) + b$

$5 = 2 + b$

$3 = b$

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

3. Write a line perpendicular to the line  $2x + 3y = 9$  and passes through the point (6, -1)

$2x + 3y = 9$

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

$-1 = \frac{3}{2}(6) + b$

$-1 = 9 + b$

$-10 = b$

$y = \frac{3}{2}x - 10$

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

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

4. For what value of n are the lines  $2x + 4y = 5$  and  $nx + 4y = 5$  perpendicular?

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

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

$\frac{4y}{4} = \frac{-nx + 5}{4}$

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

So, if  $m = -\frac{1}{2}$ , I need a value for n that will produce a slope of  $2 \cdot \frac{-n}{4} = 2 \cdot 4$

5. For what value of n are the lines  $9x + 3y = 8$  and  $nx + 3y = 8$  perpendicular?

$9x + 3y = 8$

$3y = -9x + 8$

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

$3y = -nx + 8$

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

So, if  $m = -3$ , I need a slope of  $\frac{1}{3}$ .

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

$-3n = 1$

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

$-\frac{n}{4} = 2 \cdot 4$   
 $n = -8$