3.5 - Slopes of Parallel and Perpendicular Lines

Slope-Intercept Form - Review

$y = mx + b$

- Slope
- Rate of change (per)
- Coefficient

- y-intercept
- Initial value
- Constant term

$m = \text{Slope} = \frac{\text{Rise}}{\text{Run}} = \frac{y_2 - y_1}{x_2 - x_1}$

$A(2,4)\quad B(-7,1)$

Step 1: Find the slope

$$m = \frac{1-4}{-7-2} = \frac{-3}{-9} = \frac{1}{3}$$

Step 2: Use the slope and a single point to find the y-intercept.

$y = mx + b$

$4 = \left(\frac{1}{3}\right)\cdot 2 + b \quad \frac{12}{3} = \frac{2}{3} + b \quad b = \frac{10}{3}$

$1 = \left(\frac{1}{3}\right)\cdot -7 + b \quad \frac{3}{3} = \frac{-7}{3} + b \quad b = \frac{10}{3}$

Step 3: Plug the slope and y-intercept into the equation $y = mx + b$

$$y = \frac{1}{3}x + \frac{10}{3}$$

Example 1: With help

Find an equation of the line that has a slope of $-\frac{1}{7}$ and passes through the point (5,2).

$y = mx + b$

$2 = -\frac{1}{7}(5) + b$

$2 = -\frac{5}{7} + b$

$b = 2\frac{5}{7}$ or $\frac{19}{7}$

$y = -\frac{1}{7}x + \frac{19}{7}$

Example 2: On your own

Find the equation of the line in slope-intercept form that passes through the points $P(-7,2)$ and $R(1,-4)$.

$m = \frac{2-(-4)}{-7-1} = \frac{6}{-8} = -\frac{3}{4}$

$y = mx + b$

$2 = -\frac{3}{4}(-7) + b$

$2 = \frac{21}{4} + b$

$b = -3\frac{1}{4}$ or $-\frac{13}{4}$

$y = -\frac{3}{4}x - \frac{13}{4}$

$m = \frac{-4-2}{1-(-7)} = \frac{-6}{8} = -\frac{3}{4}$

$y = mx + b$

$-4 = -\frac{3}{4}\cdot 1 + b$

$-\frac{16}{4} = -\frac{3}{4} + b$

$b = -\frac{13}{4}$

$y = -\frac{3}{4}x - \frac{13}{4}$

Writing the equation of a line in slope-intercept form $y = mx + b$

Step 1: Find the slope - How?

- You are given the slope!
- Find the slope using 2 points and the slope formula (rise/run)
- Compare the slope to another line (What does this mean?!?)

Step 2: Use the slope and a single point to find the y-intercept.

Step 3: Plug the slope and y-intercept into the equation.

Parallel Lines

Parallel lines have the same slope, but *usually* different y-intercepts.

- Examples of parallel lines

$y = 4x + 1$
$y = 4x + 2$
Both have slope of 4

$y = \frac{2}{3}x + 1$
$y = \frac{2}{3}x - 6$
Both have slope of 2/3

$x = 5$
$x = 0$
Both have an undefined slope (vertical)

3.5 - Slopes of Parallel and Perpendicular Lines

EXAMPLE **Writing an Equation of a Parallel Line**

Write an equation of the line passing through the point $(-1, 1)$ that is parallel to the line $y = 2x - 3$.

$y = 2x - 3$, $m = 2$ $\longrightarrow$ $y = mx + b$, $1 = 2(-1) + b$, $1 = -2 + b$, $b = 3$ $\longrightarrow$ $y = 2x + 3$

Perpendicular Lines

Perpendicular lines have the slopes that are *opposite reciprocals*

- **Opposite = different signs**
- **Reciprocals = numerator and denominator are flipped**

- Examples of perpendicular lines

$y = \frac{2}{5}x + 2$, $y = -\frac{5}{2}x + 1$ — Slopes are opposite reciprocals

$y = \frac{1}{4}x$, $y = -4x + 5$ — Slopes are opposite reciprocals

$y = 2$, $x = -3$ — Perpendicular with one vertical and one horizontal line.

EXAMPLE **Writing an Equation of a Perpendicular Line**

Write an equation of the line passing through the point $(2, 3)$ that is perpendicular to the line $2x + y = 2$.

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

Homework

- 3.5 p.160 #7-12,14-20 Evens (Day 1)