Geom

3 -3 Slopes of Lines

Slope:
   * The steepness of a line.
   * Also known as rate of change (how a
      quantity changes over time).

   * $m = \dfrac{\text{vertical rise}}{\text{horizontal run}}$

   $m = \dfrac{y_2 - y_1}{x_2 - x_1}$ $x_1 \neq x_2$

   $\dfrac{\Delta y}{\Delta x}$

   (x_1, y_1)
   (x_2, y_2)

Parallel Lines:
   * Slopes will be equal
   * Two nonvertical lines will have the same
      slope iff they are parallel.

   *$m_1 = m_2$

Perpendicular Lines:
   * Slopes will be negative reciprocals.
   * Two nonvertical lines are $\perp$ iff the product
      of their slopes is -1.

   * $(m_1)(m_2) = -1$ Ex. $m = \dfrac{2}{3}$

   $m_\perp = -\dfrac{3}{2}$

Vertical Lines:

    * Slope is undefined.

    * $x_1 = x_2$

$$\frac{y_2 - y_1}{x_2 - x_1}$$

* example: $\dfrac{5}{0}$

Horizontal Lines:

    * Slope will always be zero.

    * $y_1 = y_2$

---

1. Determine whether line FG and line HJ are *parallel*, *perpendicular*, or *neither*.

$$\frac{y_2 - y_1}{x_2 - x_1}$$

a. F (1, -3), G (-2, -1), H (5, 0), J (6, 3)

$$m_{\overline{FG}} = \frac{\Delta y}{\Delta x} = \frac{-1 - -3}{-2 - 1} = \frac{2}{-3} = -\frac{2}{3}$$

$$m_{\overline{HJ}} = \frac{\Delta y}{\Delta x} = \frac{3 - 0}{6 - 5} = \frac{3}{1} = 3$$

neither

b. F (4, 2), G (6, -3), H (-1, 5) J (-3, 10)

$$m_{\overline{FG}} = \frac{\Delta y}{\Delta x} = \frac{-3 - 2}{6 - 4} = -\frac{5}{2}$$

$$m_{\overline{HJ}} = \frac{\Delta y}{\Delta x} = \frac{10 - 5}{-3 - 1} = -\frac{5}{2}$$

parallel

2. For one manufacturer of camping equipment, between 1990 and 2000 annual sales increased by $7.4 million per year. In 2000, the total sales were $85.9 million. If sales increase at the same rate, what will be the total sales in 2010?

$(2000, 85.9)$
$(2010, Y)$

$m = \frac{Y_2 - Y_1}{X_2 - X_1}$

$\frac{7.4}{1} \cancel{\times} \frac{Y - 85.9}{2010 - 2000}$

$Y - 85.9 = 7.4(10)$
$Y - 85.9 = 74$
$\underline{+85.9 \quad 85.9}$
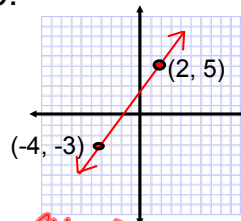$Y = 159.9 \text{ million}$

---

3. Find the slope of each line.

a.

$x_1 \; y_1$
$(-2, 7)$
$(6, -3)$
$x_2 \; y_2$

$m = \frac{\Delta y}{\Delta x} = \frac{-3 - 7}{6 - -2} = \frac{-10}{8} \div 2$

$m = -\frac{5}{4}$

b.

$(2, 5)$
$(-4, -3)$
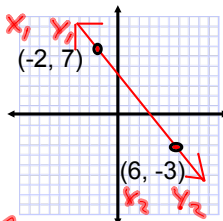
$m = \frac{\Delta y}{\Delta x} = \frac{-3 - 5}{-4 - 2} = \frac{-8}{-6} = \frac{4}{3}$

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

4. Graph the line that contains Q (5, 1) and is parallel to line MN with M (-2, 4) and N (2, 1).

$m = \dfrac{rise}{run} = -\dfrac{3}{4}$