

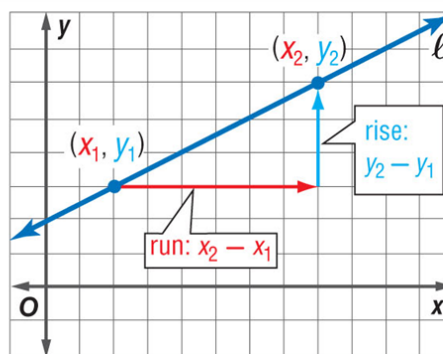
Section 2.8 Slope and Equations of Lines

 **KeyConcept** Slope of a Line

In a coordinate plane, the **slope** of a line is the ratio of the change along the y -axis to the change along the x -axis between any two points on the line.

The slope m of a line containing two points with coordinates (x_1, y_1) and (x_2, y_2) is given by the formula

$$m = \frac{y_2 - y_1}{x_2 - x_1}, \text{ where } x_1 \neq x_2.$$



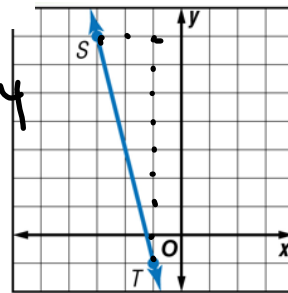
$$m = \frac{\text{rise}}{\text{run}} = \frac{y_2 - y_1}{x_2 - x_1}$$

S

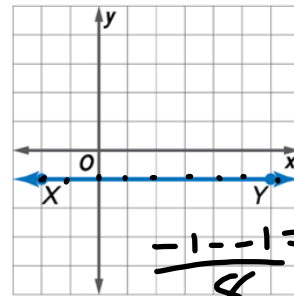
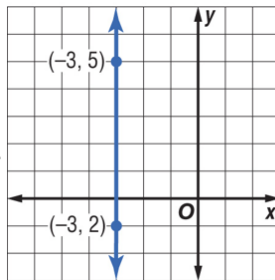
Example 1 Find the Slope of a Line

A. Find the slope of the line.

$$m = -\frac{8}{2} = -4$$

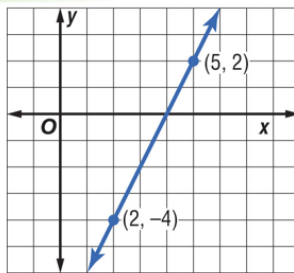


undefined = $\frac{5-2}{-3-3} = \frac{3}{-6} = -\frac{1}{2}$

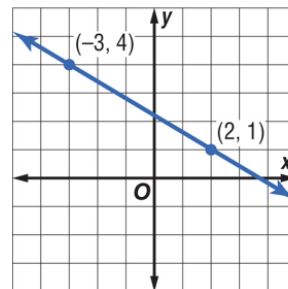


$$-\frac{1-1}{8} = \frac{0}{8} = 0$$

$$m = \frac{2 - -4}{5 - 2} = \frac{6}{3} = 2$$



$$\frac{4-1}{-3-2} = -\frac{3}{5}$$



Point-Slope Form of an Equation

$$y - y_1 = m(x - x_1) \quad (x_1, y_1) \text{ a pt on line}$$

Write an equation in point-slope form of the line whose slope is $-\frac{3}{5}$ that contains $(-10, 8)$. Then graph the line.

$$y - 8 = -\frac{3}{5}(x + 10)$$

x_1, y_1
 $(x+10)$

Write an equation in point-slope form of the line whose slope is $\frac{1}{3}$ that contains $(6, -3)$.

$$y + 3 = \frac{1}{3}(x - 6)$$

Slope Intercept Form $y = mx + b$ b is the y intercept

Write an equation of a line that goes through the point $(-6, 4)$ with a slope of $\frac{1}{2}$ in slope intercept form.

$$4 = \frac{1}{2} \left(\begin{matrix} 3 \\ -6 \\ 1 \end{matrix} \right) + b \quad \begin{matrix} x \\ y \end{matrix}$$

$$4 = -3 + b \quad y = \frac{1}{2}x + 7$$

$$+3 \quad +3$$

$$b = 7$$

Write an equation of a line that goes through the point $(-9, -2)$ with a slope of $\frac{2}{3}$ in slope intercept form.

$$y = mx + b \quad \begin{matrix} x \\ y \end{matrix} \quad m$$

$$-2 = \frac{2}{3} \left(\begin{matrix} 3 \\ -9 \\ 1 \end{matrix} \right) + b$$

$$-2 = -6 + b$$

$$4 = b \quad y = \frac{2}{3}x + 4$$

$$y = mx + b$$

Write an equation of a line that goes through the point (4,-6) with a slope of $\frac{1}{3}$ in slope intercept form.

$$\begin{aligned}
 -6 &= \frac{1}{3}(4) + b && \begin{matrix} x \\ y \end{matrix} \\
 3 \cdot -6 &= \frac{4}{\cancel{3}} + 3 \cdot b \\
 -18 &= 4 + 3b && y = \frac{1}{3}x - \frac{22}{3} \\
 -\frac{22}{3} &= \frac{b}{1}
 \end{aligned}$$

Write an equation of a line that goes through the point (-1,5) with a slope of $-\frac{2}{5}$ in slope intercept form.

$$\begin{aligned}
 5 &= -\frac{2}{5}(-1) + b \\
 5 \cdot 5 &= \frac{2}{\cancel{5}} + b \cdot 5 && y = -\frac{2}{5}x + \frac{23}{5} \\
 25 &= 2 + 5b \\
 23 &= 5b \\
 b &= \frac{23}{5} && b =
 \end{aligned}$$

0

$$y = mx + b$$

Write the equation of the line that passes through the points (5,-7) and (2,4) in slope intercept form.

$$\begin{aligned} 4 &= -\frac{11}{3}(2) + b \\ 3 \cdot 4 &= -\frac{22}{\cancel{3}} + b \cdot 3 \\ 12 &= -22 + 3b \\ 34 &= 3b \\ b &= \frac{34}{3} \end{aligned}$$

$$m = \frac{4 - -7}{2 - 5} = -\frac{11}{3}$$

$$y = -\frac{11}{3}x + \frac{34}{3}$$

Write the equation of the line that passes through the points (-2,3) and (1,-2) in slope intercept form.

$$\begin{aligned} -2 &= -\frac{5}{3}(1) + b \\ 3 \cdot -2 &= -\frac{5}{3} \cdot 3 + b \cdot 3 \\ -6 &= -5 + 3b \\ -1 &= 3b \\ \frac{-1}{3} &= \frac{3b}{3} \\ b &= -\frac{1}{3} \end{aligned}$$

$$\begin{matrix} x & y \\ m &= \frac{-5}{3} \end{matrix}$$

$$y = -\frac{5}{3}x - \frac{1}{3}$$

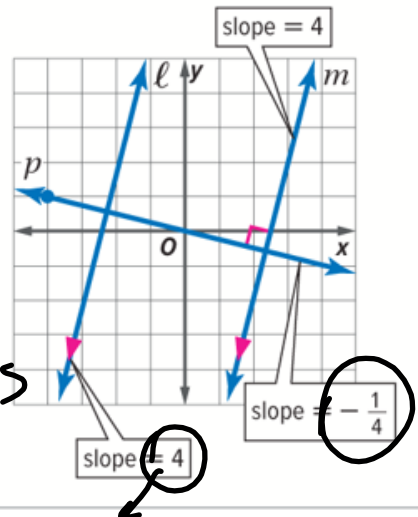
Theorems Parallel and Perpendicular Lines

2.18 Slopes of Parallel Lines Two nonvertical lines have the same slope if and only if they are parallel. All vertical lines are parallel.

Example Parallel lines ℓ and m have the same slope, 4.

2.19 Slopes of Perpendicular Lines Two nonvertical lines are perpendicular if and only if the product of their slopes is -1 . Vertical and horizontal lines are perpendicular.

Example line $m \perp$ line p
 product of slopes = $4 \cdot -\frac{1}{4}$ or -1



$n/m \perp -\frac{m}{n}$

$- \frac{10}{3} \perp \frac{3}{10}$

$4 \perp -\frac{1}{4}$