4.4 Find Slope and Rate of Change

Goal • Find the slope of a line and interpret slope as a rate of change.

Your Notes

VOCABULARY

Slope The ratio of the vertical change (the rise) to the horizontal change (the run) between any two points on a nonvertical line; Represented by m

Rate of change Compares a change in one quantity to a change in another quantity

FINDING THE SLOPE OF A LINE

Words

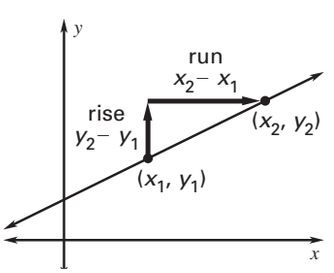
The slope of the nonvertical line passing through the two points (x_1, y_1) and (x_2, y_2) is the ratio of the rise (change in y) to the run (change in x).

Symbols

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

$$\text{slope} = \frac{\text{rise}}{\text{run}} = \frac{\text{change in } y}{\text{change in } x}$$

Graph

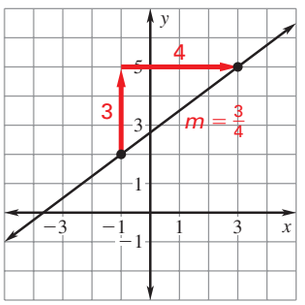


Your Notes

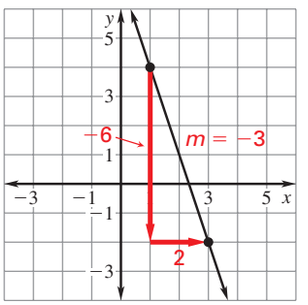
Example 1 *Find a slope*

Find the slope of the line shown.

a. Let $(x_1, y_1) = (-1, 2)$ and $(x_2, y_2) = (3, 5)$.



b. Let $(x_1, y_1) = (1, 4)$ and $(x_2, y_2) = (3, -2)$.



Keep the *x*- and *y*-coordinates in the same order in the numerator and denominator when calculating slope. This will help avoid error.

Solution

a. $m = \dfrac{y_2 - y_1}{x_2 - x_1}$ **Write formula for slope.**

$= \dfrac{\boxed{5} - 2}{\boxed{3} - (-1)}$ **Substitute.**

$= \dfrac{3}{4}$ **Simplify.**

The line rises from left to right. The slope is positive.

b. $m = \dfrac{y_2 - y_1}{x_2 - x_1}$ **Write formula for slope.**

$= \dfrac{\boxed{-2} - 4}{\boxed{3} - 1}$ **Substitute.**

$= \dfrac{-6}{2} = -3$ **Simplify.**

The line falls from left to right. The slope is negative.

✔ ***Checkpoint*** **Find the slope of the line passing through the points.**

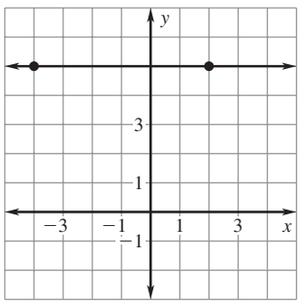
1. $(-3, -1)$ and $(-2, 1)$ 2	**2.** $(-6, 3)$ and $(5, -2)$ $-\frac{5}{11}$

Your Notes

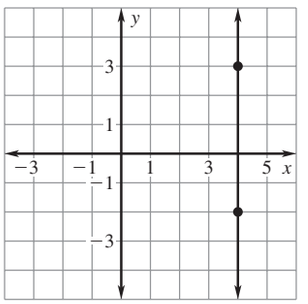
Example 2 ***Find the slope of a line***

Find the slope of the line shown.

a. Let $(x_1, y_1) = (2, 5)$ and $(x_2, y_2) = (-4, 5)$.



b. Let $(x_1, y_1) = (4, -2)$ and $(x_2, y_2) = (4, 3)$.



Solution

a. $m = \dfrac{y_2 - y_1}{x_2 - x_1}$ **Write formula for slope.**

$= \dfrac{5 - \boxed{5}}{4 - \boxed{2}}$ **Substitute.**

$= \dfrac{0}{-6}$ **Simplify.**

The line is horizontal. The slope is zero.

b. $m = \dfrac{y_2 - y_1}{x_2 - x_1}$ **Write formula for slope.**

$= \dfrac{3 - \boxed{(-2)}}{4 - \boxed{4}}$ **Substitute.**

$= \dfrac{5}{0}$ **Simplify.**

The line is vertical. The slope is undefined.

✔ ***Checkpoint*** **Find the slope of the line passing through the points. Then classify the line by its slope.**

3. (1, −2) and (1, 3) undefined; vertical	**4.** (−3, 7) and (4, 7) 0; horizontal

Your Notes

Example 3 ***Find a rate of change***

Gas Prices The table shows the cost of a gallon of gas for a number of days. Find the rate of change with respect to time.

Time (days)	Day 1	Day 3	Day 5
Price/gal ($)	1.99	2.09	2.19

$$\text{Rate of change} = \frac{\text{change in cost}}{\text{change in time}}$$ **Write formula.**

$$= \frac{2.09 - \boxed{1.99}}{3 - \boxed{1}}$$ **Substitute.**

$$= \frac{\boxed{0.1}}{\boxed{2}} = \frac{0.05}{1}$$ **Simplify.**

The rate of change in price is 5 cents per day.

Checkpoint

5. The table shows the change in temperature over time. Find the rate of change in degrees Fahrenheit with respect to time.

Temperature (°F)	**Time (hours)**
38	0
43	2
48	4
53	6

2.5°F per hour

Homework