

Name: \_\_\_\_\_ Date: \_\_\_\_\_ Block: \_\_\_\_\_

**Slope and Rate of Change:** Solving Real-Life Problems Using Slope

- Slope formula:  $m = \frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1}$
- Determine independent and dependent variables
- Time is always an independent variable (the  $x$ -values)
- Find two points and use slope formula to determine rate of change!

Example 1: Find the slope of the line formed by the points (2, 5) and (1, 3).

$$\text{slope} = m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{3 - 5}{1 - 2} = \frac{-2}{-2} = 1$$

Example 2:

A climber is on a hike. After 2 hours, he is at an altitude of 400 feet. After 6 hours, he is at an altitude of 700 feet. What is the average rate of change?

*Solution:*

The independent variable is time and the dependent variable is altitude. Write the ordered pairs involved here: (2, 400) and (6, 700). Use the slope formula to find the rate of change:

$$\text{rate of change} = \frac{\text{change in altitude}}{\text{change in time}} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{700 - 400}{6 - 2} = \frac{300}{4} = 75 \text{ feet/hr}$$

Example 3:

The table shows the year and population of a city. Find the rate of change.

*Solution:*

The year (time) represents the independent variable, and the population represents the dependent variable. Use the slope formula to find rate of change (use any two points):

| <i>Year</i> | <i>Population</i> |
|-------------|-------------------|
| 1980        | 20,000            |
| 1985        | 16,500            |
| 1990        | 13,000            |
| 1995        | 9,500             |

$$\text{rate of change} = \frac{\text{change in population}}{\text{change in time}} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{16,500 - 20,000}{1985 - 1980} = \frac{-3,500}{5} = -700 \text{ people/year}$$

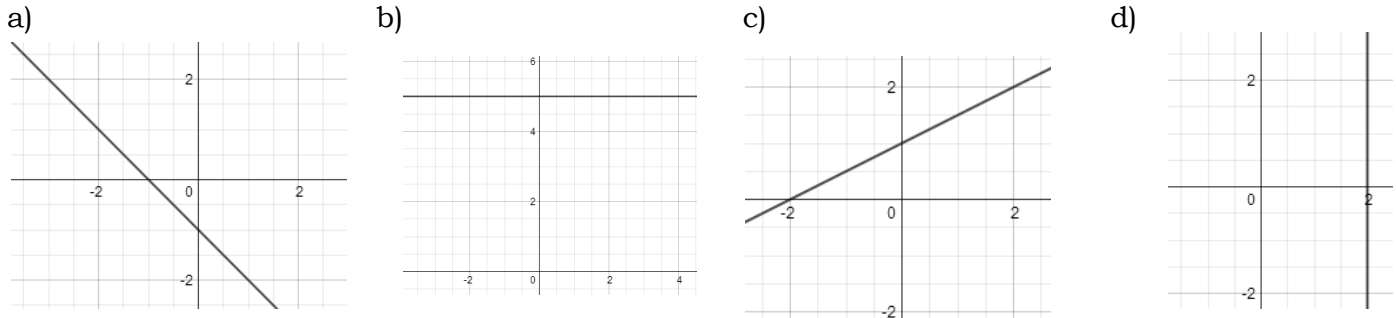
- Since our rate of change is *negative*, this means our population is *decreasing*, which makes sense when we look at the table data.
- In this situation, the decrease is constant, so we could have used any two points in the table to find this rate of change.

Exercises:

1) Find the slope of the lines formed by the following sets of 2 points. Express your answers as fractions in simplest form (that is, don't convert fractions to decimals).

- a)  $(-1, 5)$  and  $(-2, 6)$       b)  $(4, 8)$  and  $(-2, 12)$       c)  $(-5, -3)$  and  $(-2, -3)$       d)  $(-2, -4)$  and  $(-3, 9)$       e)  $(5, 3)$  and  $(5, -3)$

2) Indicate whether the following slopes are positive, negative, zero, or undefined.



3) A scuba diver is 30 feet below the surface of the water 10 seconds after he entered the water and 100 feet below the surface after 40 seconds. What is the scuba divers rate of change?

4) A rocket is 1 mile above the earth in 30 seconds and 5 miles above the earth in 2.5 minutes. What is the rockets rate of change in miles per second?

5) A teenager weighed 145 lbs in 1986 and weighs 190 lbs as an adult in 2007. What was the rate of change in weight?

6) Michael started a savings account with \$300. After 5 weeks, he had \$350 dollars, and after 10 weeks, he had \$400. What is the rate of change of money in his savings account per week?

7) After 30 baseball games, A-Rod had 25 hits. If after 100 games he had 80 hits, what is his average hits per baseball game?

8) The table at right 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            |

9) 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 (\$) | 3.99  | 4.09  | 4.19  |