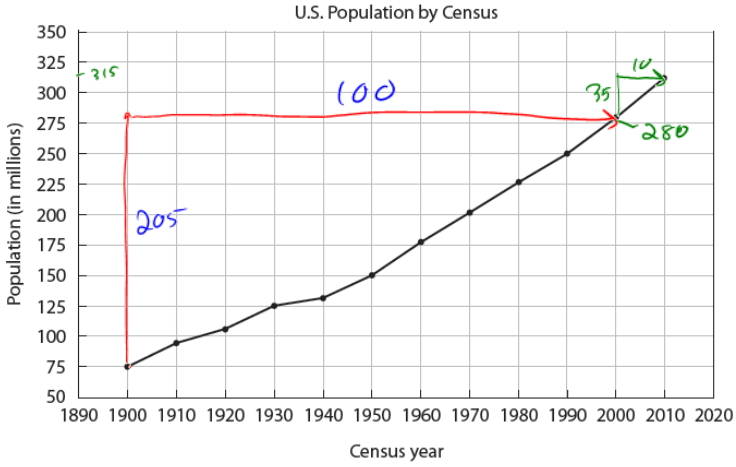
Math 9 – Coordinate Geometry Name: Mr. Hagen

Lesson #5: Slope as a Rate of Change Part 2 - Notes Date: March 6, 2018

In our last lesson, we learned that the Rate of Change is just the slope of a line. However, what if we don't have one straight line? Look at the following graph:



What is the rate of change from 1900 to 2000?

$m = \frac{Rise}{Run} = \frac{205 \text{ people}}{100 \text{ years}}$

$= 2.05 \text{ people/year.}$

What is the rate of change from 2000 to 2010?

$m = \frac{35}{10} = 3.5 \text{ people/year}$

Which ~~year~~ decade has the slowest population growth?

1930 to 1940 has the lowest rise or the flatest line.

As you can see, the rate of change is not the same throughout the 110 years. When we calculate the rate of change in this situation, we call it the **Average Rate of Change.**

Rate of Change Without a Graph

Having a graph is great as it allows us to visualize the information and actually see the steepness (or its flatness, yes, that's a word). However, we do not always have a graph:

Example 1: 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?

Wait—why are we asking for the average rate of change?

we don't know what is happening in between 2 and 6 hours, so we don't know if the Rate of Change is consistent or inconsistent.

Since rate of change = slope, the rate of change is also $m = \frac{y_2 - y_1}{x_2 - x_1}$. If we could create two points, we could then calculate the slope/RoC!

Solve Example 1:

We need 2 points, (x_1, y_1) and (x_2, y_2)

→ (independent, dependent) → 99% of the time, time is X.

∴ x = hours (h, ft) $(2, 400)$

y = feet $(6, 700)$

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{700 - 400}{6 - 2} = \frac{300\ ft}{4\ h} = 75\ ft/h$$

Example 2: 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?

(second, ft)

$(10, -30)$

$(40, -100)$

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-100 - (-30)}{40 - 10} = \frac{-70\ ft}{30\ sec}$$

$$= -2.3\ ft/sec.$$

∴ the scuba diver's rate of change is -2.3 ft/sec

Example 3: 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? What about miles per minute?

→ $2.5 \times 60 = 150$

(sec, miles)

$(30, 1)$

$(150, 5)$

$$m = \frac{5 - 1}{150 - 30}$$

$$m = \frac{4}{120} = 0.0\bar{3}\ miles/sec.$$

(min, mile)

$(0.5, 1)$

$(2.5, 5)$

$$m = \frac{5 - 1}{2.5 - 0.5} = \frac{4}{2} = 2\ miles/min$$

Example 4: A plane left Chicago at 8:00 A.M. At 1: P.M., the plane landed in Los Angeles, which is 1500 miles away. What was the average speed of the plane for the trip?

(hours, miles)

(8am, 0) ← the plane is IN Chicago.

(1pm, 1500)

$$m = \frac{1500 - 0}{1pm - 8am} = \frac{1500}{5} = 300\ miles/h$$

Example 5: Susan is paid a base salary plus commission for selling kitchen appliances. One week, her sales totalled $3800, and she earned $594. In a busier week, her sales totalled $5750, and she earned $652.50.

a) What is commission? Give examples.

→ percentage of a sale that you earn.

→ Real Estate Agents, car salesman,

b) Given as a percentage, what rate of commission is Susan paid?

Selling determines the earning
X Y

(3800, 594)

(5750, 652.5)

$$m = \frac{652.5 - 594}{5750 - 3800} = \frac{58.5}{1950} = 0.03$$

$= 3\%/\text{sale}$

c) What is Susan's weekly base salary?

Susan sold $3800, ∴ her commision is $3800 × 0.03 = $114

∴ The base salary is $594 − $114 = $480

d) How much would Susan earn in a week if her sales totalled $4325?

Commision earnings: $4325 × 0.03 = $129.75

$480.00 Base Salary

$609.75