MTH1W – Unit 6: Coordinate Geometry

Name: Ms. Jacobs

Lesson 6.4: Slope as a Rate of Change

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Learning Goal: We are learning to connect rate of change to the slope of a line.

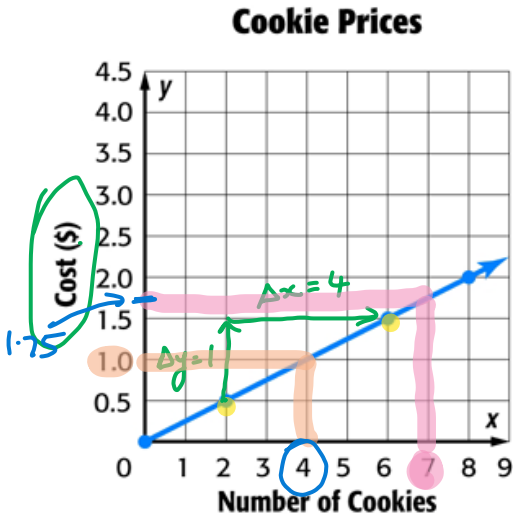
To explore what "rate of change" is, we first need to refamiliarize ourselves with "rate". A **rate** is a comparison of two quantities expressed as different units:

Examples: 30 pages/1h. , 20km/2h , 2 cookies/$4

A line on a graph is always changing (unless it is flat or $m = 0$). Rate of change, then, is the rate at which a line on a graph is changing. Thankfully, we know how to calculate this change by calculating the slope! Thus,

Rate of change = $m = \frac{Rise}{Run} = \frac{\Delta y}{\Delta x}$

Example 1: Given the graph to the right:



a) Calculate the rate of change. Include the units (always include units).

$RoC = m = \frac{\Delta y}{\Delta x} = \frac{\$1}{4 \text{ cookies}} = \$1/4 \text{ cookies}.$

b) What does the rate of change represent?

RoC represents how many cookies you get for a dollar

c) How much would 7 cookies cost? If I spent one dollar, how many cookies would I get?

7 cookies cost $1.75. For $1, I will get 4 cookies.

INTERPOLATION

EXTRAPOLATION

d) The information for question c) was in the graph. The rate of change allows us to go beyond the graph. How much would 20 cookies cost?

RoC = $1/4 cookies ∴ For 20 cookies = 20 ÷ 4 = $5

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:

$P_1(2,400)$ $P_2(6,700)$

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?

This is because the climber cannot cover the same distance in the same time with the progress in time; he could get tired.

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:

$$RoC = m = \frac{\Delta y}{\Delta x} = \frac{(700-400)\text{feet}}{(6-2)\text{ h}} = \frac{300\text{ ft}}{4\text{ h}} \quad (75)$$

Ans: RoC = 75 feet/h

Example 2: In 2015, a loaf of bread was \$2.35. Today (2025), a loaf of bread costs \$4.05. What is the rate of inflation per year?

$P_1(2015, \$2.35)$ $P_2(2025, \$4.05)$

$$m = \frac{\Delta y}{\Delta x} = \frac{\$(4.05-2.35)}{2025-2015} = \frac{\$1.7}{10\text{ years}}$$

$\therefore$ Inflation = \$0.17/year

Success Criteria

- I can recognize that slope and rate of change are the same thing
- I can find rate of change on a graph, by finding its slope
- I can create two ordered pairs from a given scenario