1. Calculate the slope of the line segment joining the points (3, -1) and (-2, 4).

$m = \frac{\Delta y}{\Delta x} = \frac{y_1 - y_2}{x_1 - x_2} = \frac{-1-4}{3-(-2)} = \frac{-5}{5} = -1$

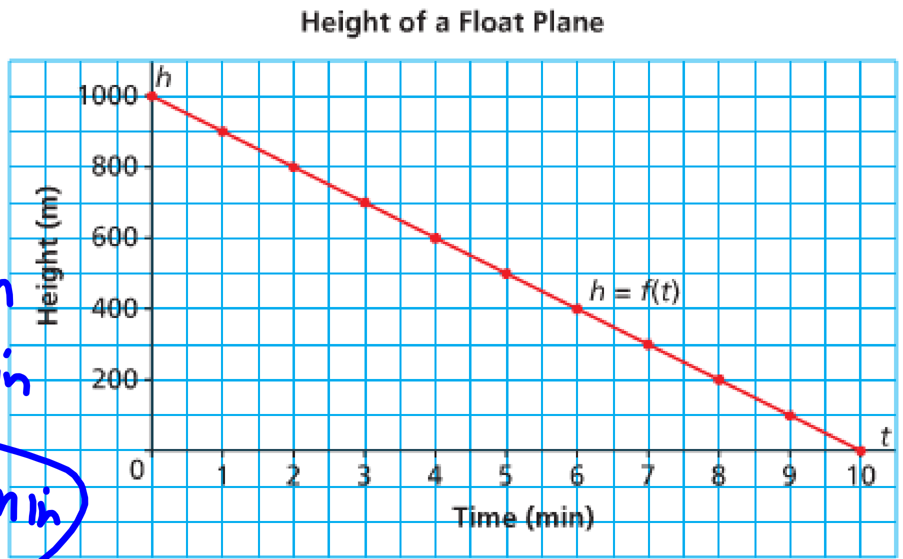
2. Using the graph shown below, calculate the rate of change in the height of the plane.

slope

Slope $= \frac{\text{rise}}{\text{run}}$

$= \frac{-1000 \text{ m}}{10 \text{ min}}$

$= -100$ m/min



Calculus 120
Unit 1: Rate of Change and Derivatives

January 30, 2019: Day 1

1. Course Outlines Distributed

2. Assignment #1 Distributed

3. Textbook Sign-Out

4. Rate of Change Review and Notes

Jan 9-1:43 PM

Curriculum Outcomes

C1. Explore the concepts of average and instantaneous rate of change.

Jan 24-9:32 AM

Slope Review:

- Slope is a measure of steepness.

- Slope can be calculated in a number or ways:

1. From a graph: $slope = \dfrac{rise}{run}$

2. From a pair of coordinates: $m = \dfrac{\Delta y}{\Delta x} = \dfrac{y_2 - y_1}{x_2 - x_1}$

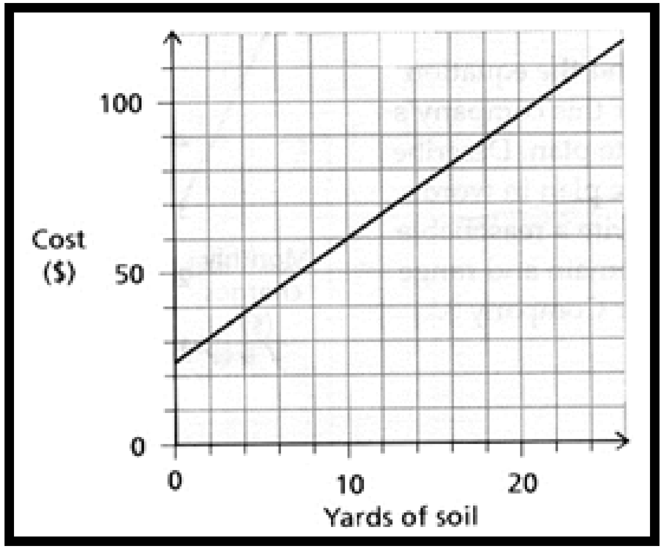
3. From an equation of a line in the form $y = \boxed{m}x + b$

$y = 6x + 1$

slope = 6

Jan 26-1:18 PM

The rate of change of a linear function can be determined by calculating the slope.



Linear functions have constant rates of change.

Functions which increase from left to right have + slopes.

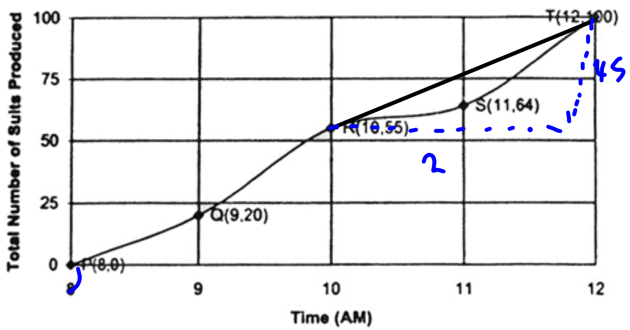
Functions which decrease from left to right have − slopes.

Horizontal lines have 0 slope.

Vertical lines have undefined slopes.

Average Rate of Change – An Introduction

The graph below shows the total production of suits by *Raggs* Ltd. during one morning of work. Industrial psychologists have found curves like this typical of the production of factory workers.



1. What was the hour-by-hour production for the morning?

8-9: 20 suits/hr 10-11: 9 Suits/hr
9-10: 35 Suits/hr 11-12: 36 Suits/hr

2. a) What was the average hourly production from 10 am to 12 noon?

$\frac{45 \text{ suits}}{2 \text{ hrs}} = 22.5$ Suits/hr

Slope $= \frac{45}{2} = 22.5$

b) What is the slope of the segment RT?

3. What was the average number of suits produced per hour from 8 am to 12 noon?

What is the slope of PT?

4. What conjecture can you make about the average production and the slopes of the segments?

Jan 26-1:34 PM

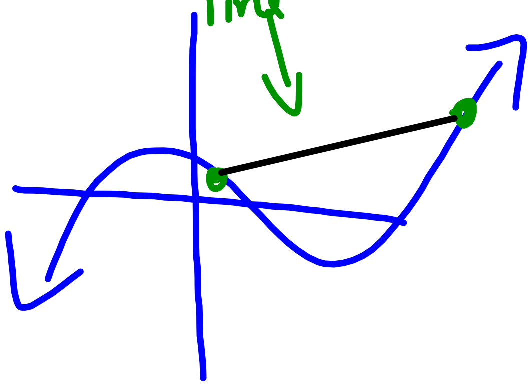
The average rate of change of any function over an interval can be determined by calculating the slope of the *secant* line connecting the endpoints of the interval.

* **A secant is a line that cuts a curve at two points.**

$$\text{Average Rate of Change} = \frac{\overset{y_1 - y_2}{f(x_1) - f(x_2)}}{x_1 - x_2}$$

A.R.O.C.

Secant line



Ex: A thermometer is taken from a room where the temperature is 20^{o} C to the outdoors where the temperature is 5^{o} C. Temperature readings (T) are taken every half-minute and are shown in the table below.

t (minutes	0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0
T (Degrees Celsius)	20	15	12	9.8	8.3	7.2	6.5	6.0	5.7

a) Determine the average rate of change of the temperature over the 4 minutes.

$AROC = \frac{y_1 - y_2}{x_1 - x_2} = \frac{20-5.7}{0-4} = \frac{14.3}{-4} \approx -3.6°/min$

b) Determine the average rate of change in temperature from t = 1.5 to t = 3.0 minutes.

$AROC = \frac{y_1 - y_2}{x_1 - x_2} = \frac{9.8-6.5}{1.5-3} = \frac{3.3}{-1.5} = -2.2°/min$

Ex. 2. A rock breaks loose from the top of a cliff. What is its average speed during the first two seconds of fall? Experiments show that a dense solid object dropped from rest to fall freely near the surface of the earth will fall $y = 16t^2$ **feet in the first** ***t*** **seconds.**

$$\text{AROC} = \frac{f(x_1) - f(x_2)}{x_1 - x_2}$$

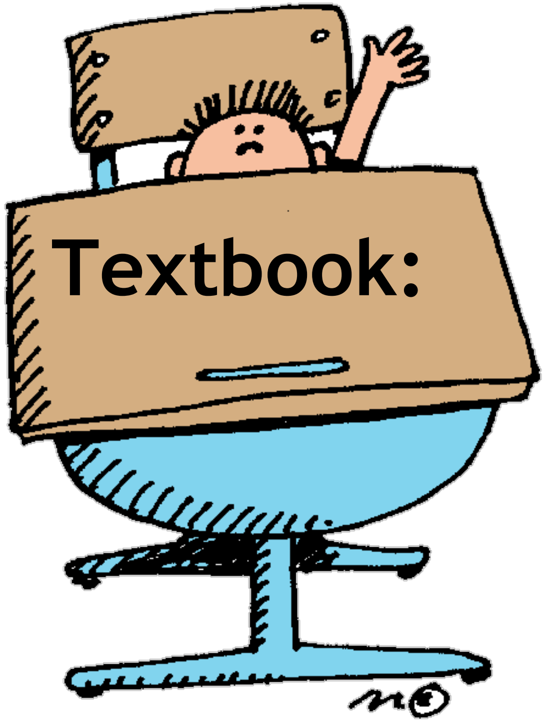
$$= \frac{f(0) - f(2)}{0 - 2}$$

$$= \frac{0 - 16(2)^2}{-2}$$

$$\frac{0 - 64}{-2}$$

$$\boxed{32 \text{ ft/sec}}$$

Jan 26-2:07 PM



Minimum Preparation

Page 66-67 #1, 2, 69a, 70 ab

Green Book

Attachments

- 2.1_74_AP.html
- 2.1_74_AP.swf
- 2.1_74_AP.html