

Exam 1 Review

Math 1100-005

Topics to Study **ALGEBRA review**

- Know how to factor, simplify, perform operations with exponents and radicals
- Know how to solve linear and quadratic equations

Limits & Continuity

- Know how to take limits, algebraically and graphically, as well as how to take one-sided limits
- Know how to determine where a function is continuous/discontinuous

Derivatives

- Know how to find the slope of a tangent line
- Know how to state and use the definition of a derivative
- Know how to use the differentiation rules to find derivatives (power, product, quotient, chain)
- Know how to take higher order derivatives
- Know how to find average, instantaneous and marginal rates of change

How to Study

- REDO and make sure to understand ALL HOMEWORK problems (from homeworks 1, 2 and 3)
- DO problems from sections 2.5 & 2.6 for practice
- DO the optional problems given on the homeworks
- REDO all the examples given in class
- REDO handout practice sheets given in class
- DO the following review

Equations TO KNOW!

$$m = \lim_{\Delta x \rightarrow 0} \frac{f(x + \Delta x) - f(x)}{\Delta x} \quad (\text{Slope of Tangent Line})$$

$$f'(x) = \lim_{\Delta x \rightarrow 0} \frac{f(x + \Delta x) - f(x)}{\Delta x} \quad (\text{Definition of Derivative})$$

$$\frac{\Delta y}{\Delta x} = \frac{f(b) - f(a)}{b - a} \quad (\text{Average Rate of Change})$$

$$\frac{d}{dx}[x^n] = nx^{n-1} \quad (\text{POWER RULE})$$

$$\frac{d}{dx}[f(x)g(x)] = f'(x)g(x) + f(x)g'(x) \quad (\text{PRODUCT RULE})$$

$$\frac{d}{dx} \left[\frac{f(x)}{g(x)} \right] = \frac{f'(x)g(x) - f(x)g'(x)}{[g(x)]^2} \quad (\text{QUOTIENT RULE})$$

$$\frac{d}{dx}[f(g(x))] = f'(g(x))g'(x) \quad (\text{CHAIN RULE})$$

$$\text{Profit} = \text{Total Revenue} - \text{Total Cost}$$

$$\text{Revenue} = \text{price} * \text{quantity}$$

$$\text{Cost} = \text{Fixed Costs} + \text{Variable Costs}$$

Review Problems - DON'T ONLY study these!!

1. Find the limit (if it exists):

(a) $\lim_{x \rightarrow -3} \frac{x^2 - x - 12}{x + 3}$

(b) $\lim_{t \rightarrow 9} \frac{9 - t}{3 - \sqrt{t}}$

2. For the following equation, find the limits (if they exist):

$$h(x) = \begin{cases} x & \text{if } x < 0 \\ x^2 & \text{if } 0 < x \leq 2 \\ 8 - x & \text{if } x > 2 \end{cases}$$

(a) $\lim_{x \rightarrow 0^+} h(x)$

(b) $\lim_{x \rightarrow 0} h(x)$

(c) $\lim_{x \rightarrow 1} h(x)$

(d) $\lim_{x \rightarrow 2^+} h(x)$

(e) $\lim_{x \rightarrow 2^-} h(x)$

(f) $\lim_{x \rightarrow 2} h(x)$

3. Describe the **intervals** on which the function is continuous:

(a)

$$f(x) = \begin{cases} 1 - x & \text{if } x \leq 2 \\ x^2 - 2x & \text{if } x > 2 \end{cases}$$

(b)

$$f(x) = \begin{cases} \frac{1}{x^2} & \text{if } x \neq 0 \\ 1 & \text{if } x = 0 \end{cases}$$

4. Write the equation to find the slope of a tangent line.

5. Explain what a derivative means (include why we take derivatives).

6. Find the derivative using the definition of a derivative (**simplify** as much as possible):

(a) $f(x) = \frac{1}{x}$

7. Find the derivative:

(a) $f(x) = (5x^2 - 2)^{25}$

(b) $y = \frac{x^2}{\sqrt{6x-x^2}}$

(c) $f(x) = x^4 - 2x^2 + 2$

(d) $y(x) = \sqrt{x^3 - 2x^2 - 1}$

(e) $f(x) = (x^2 - 2x)^2(x + 3)^5$

8. For $f(x) = x^{10} - 6x^3 + \frac{1}{x}$, find the indicated derivatives:

(a) $f'(x)$

(b) $f^{(4)}(x)$

9. Suppose that the height of a projectile fired vertically upward from a height of 64 feet with an initial velocity of 48 feet per second is given by $h(t) = -16t^2 + 48t + 64$

(a) Find the height of the object at 3 seconds.

(b) What is the average velocity of the projectile for the time interval from $t=0$ to $t=1.5$?

(c) At what time does the object reach its maximum height?

(d) How fast is the object traveling when it hits the ground?

(e) What is the projectile's acceleration?

10. Describe the difference between average, marginal, and instantaneous.

11. Write general equations for profit, cost and revenue.