



Handout 6

MATH 140 Lab: Section 1

Lab Instructor (TA): Mohammed Kaabar

Student's Name:-----

Student's ID:-----

Note: This handout contains a review for some important things in limits and derivatives.

- If you cannot find the limit for a particular question using any method you studied before, then there is still one possible way to solve that. This method is called *L'Hôpital's Rule*.

For example: Find $\lim_{x \rightarrow 1} \left(\frac{\ln(x)}{x-1} \right)$.

Solution: *L'Hôpital's Rule:*

1- Find the derivative for

Numerator (The derivative of natural logarithm of x is $\frac{1}{x}$).

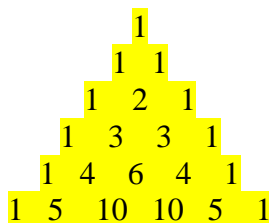
2- Find the derivative for Denominator (The derivative of $(x - 1)$ is 1).

$$3- \lim_{x \rightarrow 1} \left(\frac{\ln(x)}{x-1} \right) = \lim_{x \rightarrow 1} \left(\frac{\frac{1}{x}}{1} \right) = \frac{1}{1} = 1.$$

- The derivative of f , denoted by $f'(x)$, can be written as follows:

$$f'(x) = \lim_{h \rightarrow 0} \left(\frac{f(x+h) - f(x)}{h} \right) \text{ provided that the limit exists.}$$

- Pascal Triangle Method for Simplification:**



Examples:

$$(x + y)^2 = x^2 + 2xy + y^2$$

$$(x + y)^4 = x^4 + 4x^3y + 6x^2y^2 + 4xy^3 + y^4$$

$$(x - y)^4 = (x + (-y))^4$$

- The derivative of f , denoted by $f'(x)$, can be written in the following three different ways:

$$f'(x) = \lim_{h \rightarrow 0} \left(\frac{f(x+h) - f(x)}{h} \right)$$

OR

$$f'(a) = \lim_{h \rightarrow 0} \left(\frac{f(a+h) - f(a)}{h} \right)$$

OR

$$f'(a) = \lim_{x \rightarrow a} \left(\frac{f(x) - f(a)}{x - a} \right)$$

- Important Theorems:**

Derivatives:

- The derivative of $\sin(x)$ is: $\cos(x)$
- The derivative of $\cos(x)$ is: $-\sin(x)$
- The derivative of $\tan(x)$ is: $\sec^2 x$
- The derivative of $\cot(x)$ is: $-\csc^2 x$
- The derivative of $\sec(x)$ is: $\sec(x) \tan(x)$
- The derivative of $\csc(x)$ is: $-\csc(x) \cot(x)$
- The derivative of $\ln(x)$ is: $\frac{1}{x}$
- The derivative of e^{2x} is $2e^{2x}$

Simplifications:

- $\cos(A+B) = \cos(A)\cos(B) - \sin(A)\sin(B)$
- $\sin(A+B) = \sin(A)\cos(B) + \sin(B)\cos(A)$

Trigonometric Functions:

- $\sin(0) = 0$
- $\cos(0) = 1$
- $\sin(90) = 1$
- $\cos(90) = 0$
- $\sin(180) = 0$
- $\cos(180) = -1$
- $\sin(360) = 0$
- $\cos(360) = 1$
- $\sin(30) = \frac{1}{2}$

10- $\cos(60) = \frac{1}{2}$

11- $\tan(45) = 1$

12- $\tan(90) = \text{Undefined}$

13- $\sin(45) = \cos(45) = \frac{\sqrt{2}}{2}$



Good Luck in MATH 140 Exam 1

Math is Fun

Do not get scared from Math

