Lab 4: A Plethora of Derivatives

Objectives:

1. To become familiar with the various Rules of Differentiation

2. Introduce the Chain Rule

Introduction

This lab will consist of a number of worksheets which you will need to complete which will give you practice with the particular rules of differentiation that we have been learning. As you are filling out the Tables, think about what rules you are applying to get your answer. Let's begin by **you** filling in the list of rules below:

Addition and Subtraction Rule

$$[f(x) + g(x)]' = \underline{\hspace{4cm}}$$
$$[f(x) - g(x)]' = \underline{\hspace{4cm}}$$

Constant Multiple Rule

$$[cf(x)]' = \underline{\hspace{4cm}}$$

Power Rule

$$[x^p]' = \underline{\hspace{4cm}}$$

Product Rule

$$[f(x) \cdot g(x)]' = \underline{\hspace{4cm}}$$

Quotient Rule

$$\left[\frac{f(x)}{g(x)}\right]' = \underline{\hspace{4cm}}$$

§1. Table A

$f(x)$	$f'(x)$	$f''(x)$
$3x$		
	x^2	
$2 + \ln(x)$		
	$\frac{1}{2}e^x$	
$-3\sin(x)$		
$\cos(x)$		
	$\dfrac{5}{x^3}$	
	$4 + 1/x$	
	$(\ln \pi)\pi^x$	
$5\sqrt{x} + 7$		

§2. Table B

$f(x)$	$f'(x)$
$3x \cdot e^x$	
$\dfrac{2}{\ln(x)}$	
$3x \cdot 3^x$	
$3x \cdot x^3$	
$\dfrac{\cos(x)}{\sin(x)}$	
$\cos(x) \cdot \sin(x)$	
$\cos(x) \cdot \cos(x)$	
$\dfrac{\sqrt{x}}{x^4}$	
$\sqrt{x} \cdot x^4$	
$x^2 \cdot \ln(x) \cdot 2^x$	

§3. Table C

f	f'
$x^3 + 5$	
$(x^3 + 5)^2$	
u^2	
$(\cos(x))^2$	
w^2	
$(g(x))^2$	
$(g(x))^3$	
$3^{g(x)}$	

The Funkiest Function

So you think you can differentiate anything now, huh? We want a general formula for the derivative of a function $f(x)$ raised to a power $g(x)$.

$$[(f(x))^{g(x)}]' = \underline{\hspace{4cm}}$$

HINT, if $f(x) = g(x) = x$, then $(x^x)' = x^x(\ln(x) + 1)$

Write-Up

No Write-up! Each group turn in one neat copy of this worksheet **ONE WEEK FROM TODAY**.