3.3 DIFFERENTIATION FORMULAS

DERIVATIVE OF A CONSTANT FUNCTION

$$\frac{d}{dx}(c) = 0$$

Identity Function

$$\frac{d}{dx}(x) = 1$$

1. $f(x) = 186.5$

THE POWER RULE (GENERAL VERSION) If n is any real number, then

$$\frac{d}{dx}(x^n) = nx^{n-1}$$

$f(x) = x^2 \Rightarrow f'(x) = 2x^1$

$f(x) = x^{-2/3}$

$f(x) = x^\pi \Rightarrow f'(x) = \pi x^{\pi - 1}$

Your textbook goes to some lengths to *prove* the Power Rule for any real number, by first boot-strapping from when n is a positive integer. Good (dense) reading, but beyond our in-class discussion.

THE CONSTANT MULTIPLE RULE If c is a constant and f is a differentiable function, then

$$\frac{d}{dx}[cf(x)] = c\frac{d}{dx}f(x)$$

The derivative respects constant multiples.

$$\lim_{x\to 7}(32x) = 32\lim_{x\to 7}x = (32)(7)$$

$\frac{d}{dx}$ is linear.

$$\frac{d}{dx}[7x^5] = 7\frac{d}{dx}[x^5] = 7\cdot 5x^4 = 35x^4$$

THE SUM RULE If f and g are both differentiable, then

$$\frac{d}{dx}[f(x) + g(x)] = \frac{d}{dx}f(x) + \frac{d}{dx}g(x)$$

THE DIFFERENCE RULE If f and g are both differentiable, then

$$\frac{d}{dx}[f(x) - g(x)] = \frac{d}{dx}f(x) - \frac{d}{dx}g(x)$$

The last 3 rules let us handle derivatives of polynomials with ease! A general rule for polynomials of degree n is in the exercises (#43).

$$\frac{d}{dx}[x^3 + 4x^2 - 3x + 11] = 3x^2 + 8x - 3 = f'(x)$$

3.2 R 3.3 Fri.

_I_ learned the product rule THIS way, and that's how I'll be to do it in class:

$$\frac{d}{dx}\left(f(x)g(x)\right)=\frac{df}{dx}\cdot g(x)+f(x)\cdot\frac{dg}{dx}$$

It's helpful to _ME_ to always keep things alphabetical. I think it also helps the transition to the quotient rule.

$$(fg)'=f'g+fg'$$

"*f*-prime times *g* plus *f* times *g*-prime."

or simply: "*f*-prime *g* plus *f* *g*-prime."

Quotient Rule - My way.

$$\frac{d}{dx}\left(\frac{f(x)}{g(x)}\right)=\frac{\frac{df}{dx}\cdot g(x)-f(x)\cdot\frac{dg}{dx}}{[g(x)]^2}$$

$$\left(\frac{f}{g}\right)'=\frac{f'\,g-f\,g'}{g^2}$$

"*f*-prime times *g* MINUS *f* times *g*-prime, ALL divided by *g*-squared."

Summary of the Rules in 3.3:

$$\frac{d}{dx}(c) = 0 \qquad \frac{d}{dx}(x^n) = nx^{n-1}$$

$$(cf)' = cf' \qquad (f+g)' = f' + g' \qquad (f-g)' = f' - g'$$

$$(fg)' = f'g + fg' \qquad \left(\frac{f}{g}\right)' = \frac{f'g - fg'}{g^2}$$

3.3 II Assignment: Each of you has ONE problem to solve and share with the rest of the class. Emphasis on completeness and clarity. We won't have sufficient class time to present *all* of these in class. I will ask for volunteers to present their problems. *EVERYONE* must provide their solution to the rest of the class in writing. Either photocopy or e-copy will work.

Atkinson	Brent	99
Bone	Margaret	89
Frediani	David	100
Grzenia	Joel	90
Hurley	Joshua	97
Infante	Travis	84
Kato	Mariko	73
McDermott	Jonathan	91
Muheim	Heather	70
Neale	Lauren	71
Obigbesan	Busayo	96
Schuette	Ronald	85
Tillotson	James	78