Calc II Recitation D **Name: ____________________**

Recitation Four: 7/9/2015

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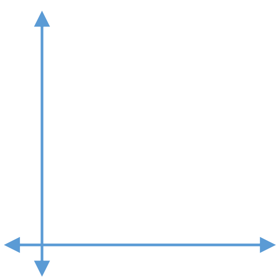
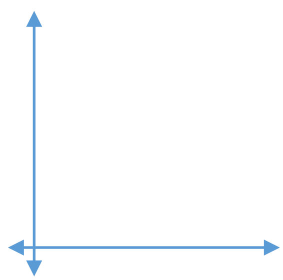
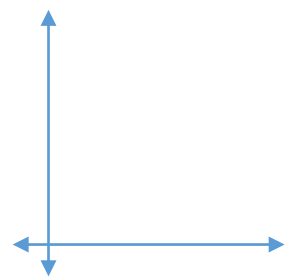
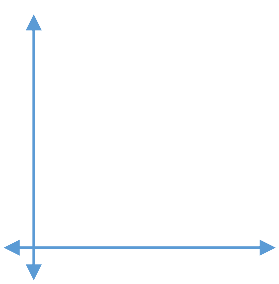
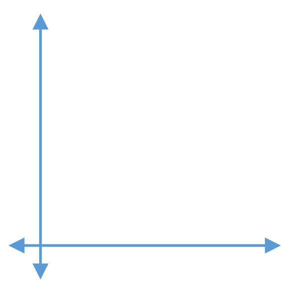
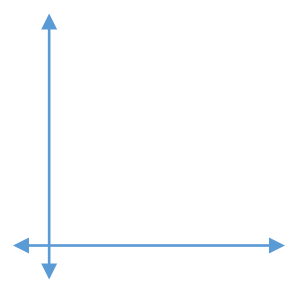
Objectives:
1. Area Approximations
2. Antiderivatives (Integrals!)
3. First Fundamental Theorem of Calculus

I. Area Approximations

Common Summations (In Lecture Notes)

$$\sum_{i=1}^{n} \mathbf{1} = \boldsymbol{n}$$

$$\sum_{i=1}^{n} \boldsymbol{c} = \boldsymbol{cn}$$

$$\sum_{i=1}^{n} \boldsymbol{i} = \frac{\boldsymbol{n(n+1)}}{\mathbf{2}}$$

$$\sum_{i=1}^{n} \boldsymbol{i^2} = \frac{\boldsymbol{n(n+1)(2n+1)}}{\mathbf{6}}$$

$$\sum_{i=1}^{n} \boldsymbol{i^3} = \frac{\boldsymbol{n^2(n+1)^2}}{\mathbf{4}}$$

Practice! (We need a lot of practice with this…)

Example One:

Write the following sum in summation Notation:

$$x + \frac{x^2}{2} + \frac{x^3}{3} + \cdots + \frac{x^{10}}{10}$$

Example Two:

Evaluate the limit:

$$\lim_{n\to\infty} \frac{1^2 + 2^2 + 3^2 + \cdots + n^2}{n^3}$$

Example Three: Axe of Kindness

Your friend is struggling on the following calculus problem. Fortunately for him you are feeling generous and decide to help him out, because if you don't he will fail and be chopped from the class by the AXE OF KINDNESS. Hurry! The problem is due in 5 minutes. (Wow Matt. Not even original… so sad ☹) ☺!

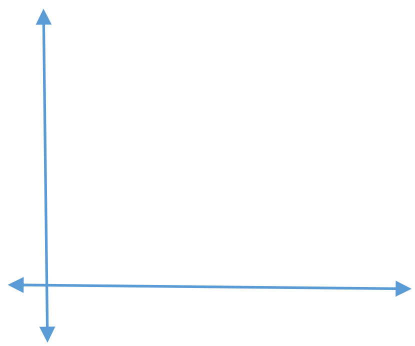
A) Approximate the area between f(x) & the x axis using summations.

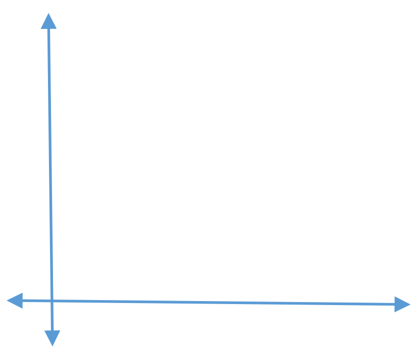
b) Find the exact area by taking the limit as n approaches infinity.

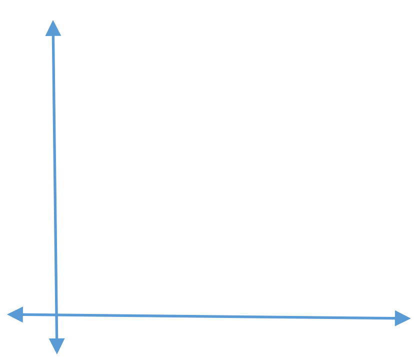
$$f(x) = x^3 \ \ [0,3]$$

Example Four: (Yo Matt I'm getting tired… Is the candy even worth it? YES!!!!!! WAKE UP PLEASE! ☺)
Use Left, Right & Midpoint Reimann Sums to approximate the area between the x axis and f(x).

$f(x) = 9 - x^2 \quad [0,3] \quad with\ n = 3$







Example Five:

There was once a math TA who gave his students many **many** problems on the same topic and made them tirelessly work on them. His cruelty truly knew no bounds and the candy he offered as soon became tasteless, not worth the effort it took to lift a pencil/pen. It was a difficult time.
UNTIL one person stood up and said: “YO dis stinks!”
And Matt said “How about $10,000?”
And that one person said: “okay” hahaha
IDK – Lets do one last Area Problem (For Today)

A) Approximate the area between the x axis & f(x) using summations
B) Use limits to find the exact area.

$f(x) = \ x + 2 \ \ [0,2]$

Antiderivatives:
OH MY GAWD- Let's get some shoes… OH MY GAWD SHOES (OLD Youtube video)
(Actually thank goodness we are moving on)

General:

$$\int F'(x)dx = F(x) + C$$

RULES: (We RULER!... I mean Rule)

$$\int \mathrm{x}^{\mathrm{n}}\mathrm{dx} = \frac{1}{\mathrm{n}+1}\mathrm{x}^{\mathrm{n}+1} + \ \mathrm{C} \ \text{ iff } \ \mathrm{n} \ \neq 1$$

$$\int \mathrm{x}^{-1}\mathrm{dx} = \ln(\mathrm{x}) + \mathrm{C}$$

$$\int e^{x}dx = e^{x} + C$$

$$\int e^{ax}dx = \frac{1}{a}e^{x} + C$$

$$\int \sin(x)\,dx = -\cos(x) + C$$

$$\int \cos(x)\,dx = \sin(x) + C$$

$$\int \sec^2(x)\,dx = \tan(x) + C$$

$$\int \csc^2(x)\,dx = -\cot(x) + C$$

$$\int \sec(x)\tan(x)\,dx = \sec(x) + C$$

$$\int \csc(x)\cot(x)\,dx \ = \ -\csc(x) + C$$

Logs & Exponents:

Exponential Rules

Logs:

Fundamental Theorem of Calculus:

*Proof in Lecture Notes
*Formula & Practice Here

$$\int_a^b F'(x)dx = [F(x)]_a^b = F(b) - F(a)$$

Definite Integrals!

U Substitution:
Remember the chain rule

$$D_x\big[f\big(g(x)\big)\big] = g'(x)f'(g(x))$$

Now we want to do the reverse (Anti-Derivatives)

$$\int g'(x)f'\big(g(x)\big)dx = f\big(g(x)\big) + C$$

To make this easier we do **u substitution:**

$$\int g'(x)f'\big(g(x)\big)dx = \int f'(u)du = f(u) + C = f\big(g(x)\big) + C$$

$$u = g(x) \qquad du = g'(x)dx$$

(*Please remember you must change the bounds if you use u substitution in definite integrals)

Team Competition
-1 pt for each completed & correct problem
-Winning Team gets BIG Candy Bars (**Please make sure not to eat it all at once :l**)

***Problems will be on attached sheets**