Calc II Recitation D **Name: ____________________**

Recitation Six: 7/13/2015

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Objectives:
1. Integration by Parts
2. Partial Fractions
3. Review:
   - a. Definition of Derivative
   - b. Implicit Differentiation
   - c. Chain Rule
   - d. U substitution
   - e. Logrithmic Differentiation
   - f. Limits & L'Hopital's Rule
   - g. Newton's Method
   - h. Linear and Quadratic Approximations
   - i. Area Approximations
   - j. Summations
   - k. Antiderivatives
   - l. Trig Integrals
   - m. Trig Substitution
   - n. Partial Fractions
   - o. Integration by Parts

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1. Integration by Parts! Yay!

What's it all about Matt?

<u>U</u>LTRA ~~<u>V</u>IOLENT~~ (<u>V</u>IOLET) <u>V</u>OO <u>DU</u>U! (Magic!)

Equation:

$$\boldsymbol{Goal: \int udv = uv - \int vdu}$$

Proof from Lecture:

$$Goal: \int udv = uv - \int vdu$$

Given: $u' = du$ & $v' = dv$

$$Dx[u(x) * v(x)] = \frac{du}{dx} * v + \frac{dv}{dx} * u$$

$$Dx[u * v] = u' * v + v' * u$$

$$v'u = Dx[u * v] - u'v$$

$$\int udv = \int Dx[u * v] - \int v\, du$$

$$\int udv = u * v - \int vdu$$

When do we use it? – For Difficult Integrals!

Example one: Mister Super Simple Example Yawn

Use Integration by parts to solve the following integral

$$\int xe^x dx$$

Tabular Method! (Sweet!)

NOTE!!! (Why so serious? SMILE!) ☺

******Tabular method to be used ONLY if U differentiates to zero & dV can be continuously integrated!*****

Example Two: Mister Super Simple Example Yawn Returns!!!

Follow Matt doing Tabular Method on the board.

MATTTTT!!!???

-Yes?

- WE WANT PRACTICE!!

-Okay okay if you insist ☺ (So proud)

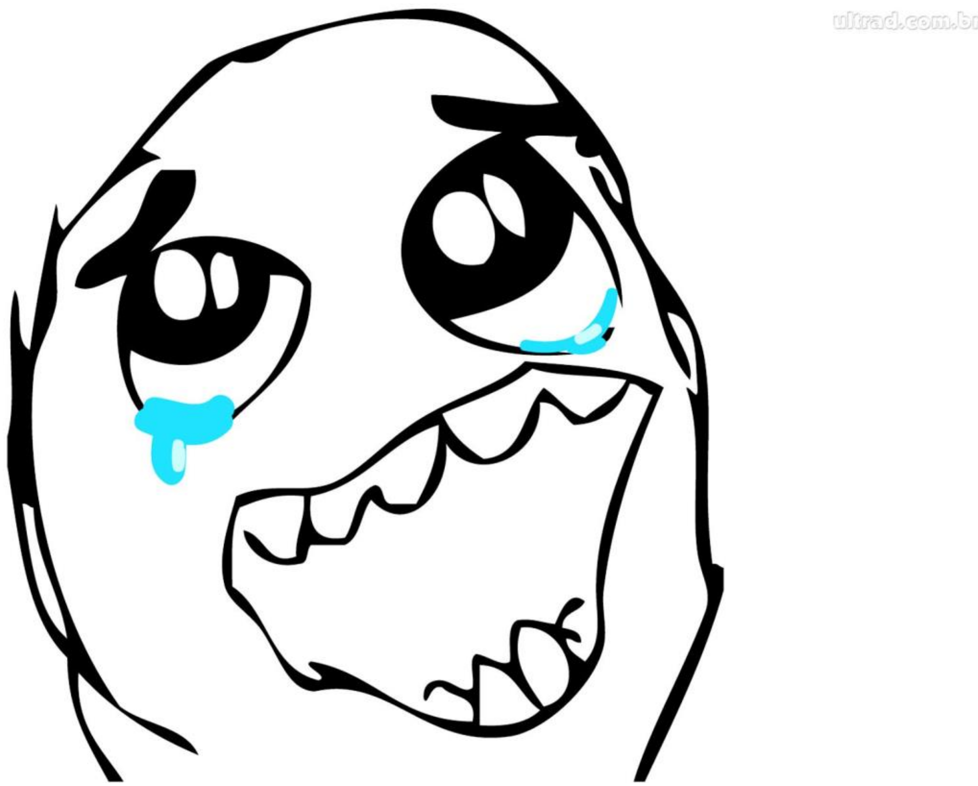
PREMIDTERM COMPETITION!

10 Minutes

The team that has the most answers correct on the handed out worksheets will receive 5pts. Team at the end of the recitation will receive prizes next recitation!! ☺

***1 extra point for using tabular method for a maximum of 4 extra points!**

Worksheet to be handed out.



So proud

***Repeating Integrals**

Example: $\int e^{x}cos(x)dx$

Will go over if desired

***Reduction Formulas (Midterm and Test Material: Prove Left = Right: Use Integration by Parts)**

$$\int \boldsymbol{cos^{n}(x)dx} = \frac{\boldsymbol{1}}{\boldsymbol{n}}\boldsymbol{cos^{n-1}(x)sin(x)} + \frac{\boldsymbol{n-1}}{\boldsymbol{n}}\int \boldsymbol{cos^{n-2}(x)dx}$$

$$\int \boldsymbol{sin^{n}(x)dx} = -\frac{\boldsymbol{1}}{\boldsymbol{n}}\boldsymbol{sin^{n-1}(x)cos(x)} + \frac{\boldsymbol{n-1}}{\boldsymbol{n}}\int \boldsymbol{sin^{n-2}(x)dx}$$

2. Partial Fractions!

Beware of Triangle-chu

Partial Fraction Knowledge!
What you'll encounter in the wild:

- **-Linear Non-repeating**
- **-Linear Repeating**
- **-Quadratic Non-repeating**
- **-Quadratic Repeating**
- **-Quadratic Reducible!**

What does it look like Matt? What type of Problems!?

-Stuff like this!

$$\int \frac{x+1}{(x+2)(x^2+5)^2}dx = \frac{A}{x+2} + \frac{Bx+C}{x^2+5} + \frac{Dx+E}{(x^2+5)^2}$$

-Dang that don't look so good Matt… Its fine! We can do it!

Let's break it down now yall!

It's about to get **Funky! Funky!**

Linear Non-Repeating:

Takes the following form:

$$\int \frac{p(x)}{x \pm a}\, dx =$$

Note: "a" can equal 0, therefore x^1 is a linear term

Linear Repeating:

Takes the following form:

$$\int \frac{p(x)}{(x \pm a)^n}\, dx =$$

Quadratic Non-repeating:

Takes the following form:

$$\int \frac{p(x)}{Ax^2 \pm Bx \pm C}\, dx =$$

Quadratic Repeating

Takes the following form:

$$\int \frac{p(x)}{(Ax^2 \pm Bx \pm C)^n}\, dx =$$

Methods for determining Coefficients:

I. Plug in values for x (you chose)
II. Cover Up Method (Only for Linear)
III. Equating Similar Terms (OUR FAVORITE)

****Let's see them in examples!**

So Majestic

Example Three: Ms. Cow (Cover Up Method LOL)

Ms. Cow is a delightful cow living in the forests of Adventure Land. She is rather shy about her udders and typically keeps a bag over them. The bag won't come off unless we solve an integral involving linear partial fractions (I have no idea why haha). Anyways let's help Ms. Cow out and help her get over her shyness.

Evaluate the following integral to help Ms. Cow!

$$\int \frac{\boldsymbol{x^2}}{\boldsymbol{x^2+5x+6}}\boldsymbol{dx}$$

***Cue the Youtube video**

-Cover up Method – Get it? LOL?

-Wow Matt that was a little twisted… Sorry ☹ haha?

Example Four: Equating Like Terms Example (Do you beeelieve in life after love… I can feel something in inside me say… Calculus is aweeesome)

Break the following integral into its partial fractions and use the equating like terms method

$$\int \frac{20x^3+\ 6x^2+x+5}{5x^4+8x^2}dx$$

Procedure for Partial Fractions:

1. Check if numerator has a higher degree than the denominator. If it does then do long division! & then go straight to evaluating!
2. Determine if denominator contains linear, repeating linear, quadratic or repeating quadratic forms
3. Break down as necessary
4. Solve for coefficients.
5. Plug back into integral notation
6. Evaluate.

PRACTICE!!

Worksheet number TWO!

-10 minutes to work in teams

-The team that gets the most correct will receive 5pts

**Worksheet attached

Review! (If time)

1. PLEASE PLEASE COME TO OFFICE HOURS TONIGHT 7pm – WHENEVER EVERYONE LEAVES

2. From the following please pick which topics we would like to review:

a. Definition of Derivative

b. Implicit Differentiation

c. Chain Rule

d. U substitution

e. Logrithmic Differentiation

f. Limits & L'Hopital's Rule

g. Newton's Method

h. Linear and Quadratic Approximations

i. Area Approximations

j. Summations

k. Antiderivatives

l. Trig Integrals

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o. Integration by Parts

Matt's Review Notes will be attached to the Scanned Notes Online