Reminders...

Online Quizzes are open. **Online Quiz 3** closes Saturday.

Test 2 is coming soon.

Homework 04 is posted for next Monday.

EMCFs are due each MWF.

20	21 MLK Day No Class	22. UH events this week **Last day to add**	23 Notes, video notes, video EMCF03 due at 9am-key **Homework 1 due** in lab/workshop Homework 2 posted	24 Exam 1 and PT1 close	25 EMCF04 due at 9am-key Notes, video notes, video Quiz in lab/workshop	26 Quiz 1 closes (7.1-7.2)
27 **Free Access ends today!! Purchase your Access Code!!**	28 EMCF05 due at 9am-key Notes – page, 4-per video notes, video Homework 2 due in lab/workshop	29 UH events this week	30 EMCF06 due at 9am-key Notes: page, 4-per video notes, video Homework 3 posted **Last day to drop without receiving a W**	31 Register on CourseWare for Exam 2	February 1 EMCF07 due at 9am-key Notes: page, 4-per, video notes, video Quiz in lab/workshop	2 Quiz 2 closes (7.3-7.5) Help with selected problems in 7.7 and 7.8.
3	4 EMCF08 due at 9am Blank Slides: page, 4-per Homework 3 due in lab/workshop	5	6 EMCF09 due at 9am Homework 4 posted	7	8 EMCF10 due at 9am Quiz in lab/workshop	9 Quiz 3 closes (7.6-7.8)
10	11	12	13	14 **Exam 2 starts** Check the dates on CourseWare	15	16 Quiz 4 closes (8.1-8.3)

Please tell your high school friends and former teachers about our High School Mathematics Contest

February 9th
University of Houston

Free

http://mathcontest.uh.edu

Popper Number 04

Popper
Spring 2013
Math 1432 13 209

2012-2-13596-1-2-1

Use a No. 2 Pencil. Do Not Write Outside of This Box.

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Popper Number 04

1. Give the slope of the normal line to the graph of $f(x) = \arctan(2^x)$ at the point where $x = 0$.

2. The function f is invertible. Also, the tangent line to the graph of f at $x = -2$ is given by $y = -3x + 5$. Give the slope of the tangent line to the graph of f^{-1} at $x = 11$.

3. Give the slope of the tangent line to the graph of

$$F(x) = \sinh(x^2)$$

at the point where $x = 2$.

More Integration by Parts

Comments Through Examples...

$$\int \underbrace{\ln(x+1)}_{u}\underbrace{dx}_{dv} = (x+1)\ln(x+1) - \int (x+1)\frac{1}{x+1}dx$$

$u = \ln(x+1)$ $\quad du = \frac{1}{x+1}dx$

$dv = dx$ $\quad v = x+1$

$= (x+1)\ln(x+1) - x + C$

$$\int x\arctan(x)dx =$$

See today's video or the notes from last time.

$$\frac{1}{3}\int 3x^2 e^{x^3} dx = \frac{1}{3}e^{x^3} + C$$

Not a "parts" problem.

$u = x^3$

$du = 3x^2 dx$

Today...

Integrating Powers and Products of Trigonometric Functions

Section 8.3 - Part I

Products of Sine and Cosine

Integrals of

$$\cos^m(x),\ \sin^m(x),\ \cos^m(x)\sin^n(x)$$

Examples: * $\int \sin^2(x)dx =$

* $\int \cos^4(x)dx =$

→ $\int \cos^4(x)\sin^3(x)dx =$

* $\int \cos^4(x)\sin^2(x)dx =$

Identities:

$$\cos^2(x)+\sin^2(x)=1$$

$$\cos^2(x)=\frac{1+\cos(2x)}{2}$$

$$\sin^2(x)=\frac{1-\cos(2x)}{2}$$

Learn these soon.

Example: $\int \sin^2(x)dx = \int \left(\frac{1}{2} - \frac{1}{2}\cos(2x)\right)dx$

$\sin^2(x) = \frac{1}{2} - \frac{1}{2}\cos(2x)$

$= \frac{1}{2}x - \frac{1}{4}\sin(2x) + C$

Sam

Example: $\int \cos^4(x)dx = \int (\cos^2(x))^2 dx$

$$\cos^2(x) = \frac{1}{2} + \frac{1}{2}\cos(2x)$$

$$= \int \left(\frac{1}{2} + \frac{1}{2}\cos(2x)\right)^2 dx$$

$$= \int \left(\frac{1}{4} + \frac{1}{2}\cos(2x) + \frac{1}{4}\cos^2(2x)\right) dx$$

$$= \frac{1}{4}x + \frac{1}{4}\sin(2x) + \frac{1}{4}\int \cos^2(2x)\,dx$$

$$\cos^2(u) = \frac{1}{2} + \frac{1}{2}\cos(2u)$$

$$= \frac{1}{4}x + \frac{1}{4}\sin(2x) + \frac{1}{4}\int \left(\frac{1}{2} + \frac{1}{2}\cos(4x)\right) dx$$

$$= \frac{1}{4}x + \frac{1}{4}\sin(2x) + \frac{1}{8}x + \frac{1}{32}\sin(4x) + C$$

$$= \frac{3}{8}x + \frac{1}{4}\sin(2x) + \frac{1}{32}\sin(4x) + C$$

SAM

Popper Number 04

4. The answer is -7/3.

5. The answer is 0.

Example: $\int \cos^{4}(x)\sin^{2}(x)\,dx =$

$4+2=6$

$$\int \cos^4(x)\left(1-\cos^2(x)\right)dx$$

$$= \int \cos^4(x)\,dx - \int \cos^6(x)\,dx$$

SAM

$(a+b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$

omg

$$= \text{SAM} - \int \left(\cos^2(x)\right)^3 dx$$

$$= \text{SAM} - \int \left(\tfrac{1}{2} + \tfrac{1}{2}\cos(2x)\right)^3 dx$$

$$= \text{SAM} - \int \left(\tfrac{1}{8} + \tfrac{3}{8}\cos(2x) + \tfrac{3}{8}\cos^2(2x) + \tfrac{1}{8}\cos^3(2x)\right)dx$$

$\cos^2(2x) \leftrightarrow \left(\tfrac{1}{2} + \tfrac{1}{2}\cos(4x)\right)$

$$= \text{SAM} - \tfrac{1}{8}x - \tfrac{3}{16}\sin(2x) - \tfrac{3}{16}x - \tfrac{3}{64}\sin(4x) - \tfrac{1}{8}\int \cos^3(2x)\,dx$$

SUZY

$$= \text{SAM} + \text{SUZY} - \tfrac{1}{8}\int \cos^2(2x)\cos(2x)\,dx$$

$$= \text{SAM} + \text{SUZY} - \tfrac{1}{8}\int \left(1-\sin^2(2x)\right)\cos(2x)\,dx$$

$$= \text{SAM} + \text{SUZY} - \tfrac{1}{8}\cdot\tfrac{1}{2}\sin(2x) + \tfrac{1}{8}\int \sin^2(2x)\cos(2x)\,dx$$

$$= \text{SAM} + \text{SUZY} - \tfrac{1}{16}\sin(2x) + \tfrac{1}{48}\sin^3(2x) + C$$

Example: $\int \cos^4(x)\sin^{3}(x)\,dx =$ ← ODD

$$= \int \cos^4(x)\sin^2(x)\sin(x)\,dx$$

$$= \int \cos^4(x)\left(1-\cos^2(x)\right)\sin(x)\,dx$$

$$= \int \cos^4(x)\sin(x)\,dx - \int \cos^6(x)\sin(x)\,dx$$

$$= -\frac{\cos^5(x)}{5} + \frac{\cos^7(x)}{7} + C$$

Strategy for products of sine and cosine with even powers:

Use

$$\cos^2(u) = \frac{1}{2} + \frac{1}{2}\cos(2u)$$

$$\sin^2(u) = \frac{1}{2} - \frac{1}{2}\cos(2u)$$

Strategy for products of sine and cosine with at least one odd power:

split off one of the odd powers. Change everything else to the other one and integrate