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)

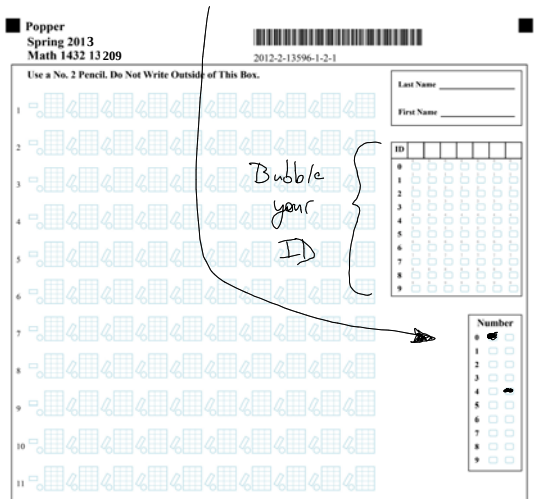
Please tell your high school friends and former teachers about our High School Mathematics Contest

February 9th
University of Houston

Free

http://mathcontest.uh.edu

Popper Number 04



Popper 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...

$\int \ln(x+1)\,dx =$ $(x+1)\ln(x+1) - \int \frac{x+1}{x+1}\,dx$

$u = \ln(x+1)$ $du = \frac{1}{x+1}\,dx$ $= (x+1)\ln(x+1) - x + C$

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

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

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

learn these soon.

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

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

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

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

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

SAM

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

omg

$= SAM - \int (\cos^2(x))^2 dx$

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

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

$\left(\frac{1}{2} + \frac{1}{2}\cos(4x)\right)$

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

SUZY

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

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

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

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

Example: $\int \cos^4(x)\sin^3(x)dx =$

odd

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

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

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

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

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