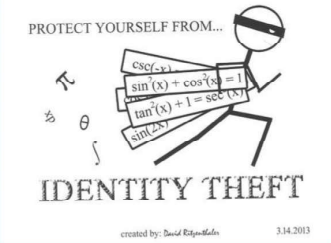
4.5 day 3 - Trig Integration using u-substitution 5/3/18

Homework:

- Assignment # 108
- Quiz 4.5 Tuesday 5/8

Objective:

Integrate trig functions using u-substitution



Do Now: Evaluate

$$\int 42x(x^2+4)^{20}\,dx$$

$u = x^2+4$

$\frac{du}{dx} = 2x$

$dx = \frac{du}{2x}$

$\int 42x\, u^{20} \cdot \frac{du}{2x} = u^{21} + C$

$= (x^2+4)^{21} + C$

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HW Questions?

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Integrate Trig functions using u-substitution:

1) $\int 5\cos(5x)\,dx$

$u = 5x$

$\frac{du}{dx} = 5$

$dx = \frac{du}{5}$

$= \int 5\cos u \cdot \frac{du}{5}$

$= \sin u + C$

$= \boxed{\sin(5x) + C}$

2) $\int \sin^2(3x)\cos(3x)\,dx$

$u = \sin(3x)$

$\frac{du}{dx} = 3\cos(3x)$

$dx = \frac{du}{3\cos(3x)}$

$= \int u^2 \cos(3x) \cdot \frac{du}{3\cos(3x)} = \frac{u^3}{9} + C = \boxed{\frac{\sin^3(3x)}{9} + C}$

$\frac{d}{dx}\left(\frac{\sin^3(3x)}{9} + C\right) = \frac{3\sin^2(3x)\cos(3x)\cdot 3}{9}$

$= \sin^2(3x)\cos(3x)$ ✓

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Integrate Trig functions using u-substitution:

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

$u = \cos x$

$\frac{du}{dx} = -\sin x$

$dx = \frac{du}{-\sin x}$

$= \int u^2 \sin x \cdot \frac{du}{-\sin x} = -\int u^2\,du = -\frac{u^3}{3} + C$

$= \boxed{-\frac{\cos^3 x}{3} + C}$

$\frac{d}{dx}\left(-\frac{\cos^3 x}{3} + C\right)$

$= -\frac{3\cos^2 x(-\sin x)}{3}$

$= \cos^2 x \sin x$

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

$u = x^2 + 1$

$\frac{du}{dx} = 2x$

$dx = \frac{du}{2x}$

$\int x\cos(u)\frac{du}{2x} = \frac{1}{2}\sin u + C$

$= \boxed{\frac{1}{2}\sin(x^2+1) + C}$

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This is an interesting problem:

What should we choose as our u value?

5) $\int \sin(2x)\cos(2x)dx$

$u = \sin(2x)$

$\frac{du}{dx} = 2\cos(2x)$

$dx = \frac{du}{2\cos(2x)}$

$= \int u \cos(2x) \cdot \frac{du}{2\cos(2x)}$

$= \int u^2 \, du$

$= \frac{u^2}{4}$

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

$u = \cos(2x)$

$\frac{du}{dx} = -2\sin(2x)$

$dx = \frac{du}{-2\sin(2x)}$

$\int \sin(2x)\, u \cdot \frac{du}{-2\sin(2x)}$

$= -\frac{u^2}{4} + C$

$= -\frac{\cos^2(2x)+C}{4}$

Answers on next page

Mar 23-4:44 PM

This is an interesting problem:

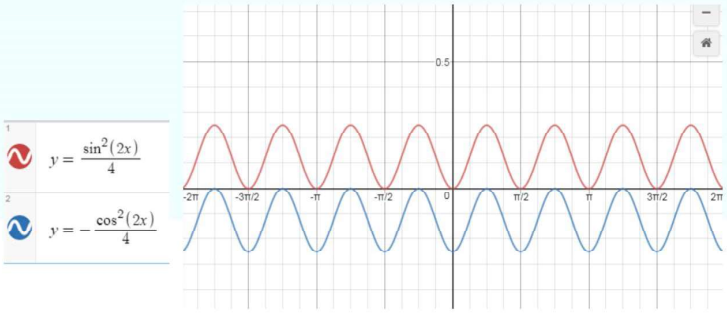
What should we choose as our u value?

5) $\int \sin(2x)\cos(2x)dx$

$u = \sin(2x)$

$u = \cos(2x)$

Why did we get different answers? Is this a problem? Can we even trust math anymore?



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4.5 Day 3.notebook April 29, 2018

Integrate Trig functions using u-substitution:

6) $\int \frac{\sec^2(4x)}{\tan^3(4x)}\,dx$ $= \int \frac{\sec^2(4x)}{u^3} \cdot \frac{du}{4\sec^2(4x)}$

$u = \tan(4x)$

$\frac{du}{dx} = 4\sec^2(4x)$

$dx = \frac{du}{4\sec^2(4x)}$

$= \frac{1}{4}\int u^{-3}\,du$

$= \frac{1}{4} \cdot \frac{u^{-2}}{-2} + C = -\frac{1}{8u^2} + C$

$= \boxed{\frac{-1}{8\tan^2(4x)} + C}$

$\frac{d}{dx}\left(\frac{-1}{8\tan^2(4x)} + C\right) =$ -1

$= \frac{-1}{8}\left(\frac{-2}{\tan^3(4x)}\right) \cdot \sec^2(4x) \cdot 4$

$= \frac{\sec^2(4x)}{\tan^3(4x)}$ ✓

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