JANUARY 27

How does the chain rule help you when trying to find the antiderivative of the product of two functions?

How can you find the antiderivative of:

$$\int (9x^2 - 10x)(3x^3 - 5x^2)^4\,dx$$

JANUARY 27

Students will verbally explain how to find the integral by substitution

(using the words:
inside, outside, product, differential...)

$$\int (4x-6)(2x^2-6x+15)^6 dx$$

$$\int \sqrt[3]{x^2-6x+8}(2x-6)\, dx$$

$$\int \underline{\sqrt{4x^3-7x}}(12x^2-7)\, dx = \frac{2(4x^3-7x)^{3/2}}{3} + C$$

$$\int (9x^2-10x)\underline{(3x^3-5x^2)}^4 dx = \frac{(3x^3-5x^2)^5}{5} + C$$

$$\int (7x^6-5x^4)(x^7-x^5+9)^6 dx = \frac{(x^7-x^5+9)^7}{7} + C$$

$$\int (4x-6)(2x^2-6x+15)^6 dx$$

pick u

$u = 2x^2-6x+15$

find du

$du = (4x-6)dx$

Solve for dx

$\frac{du}{4x-6} = \frac{(4x-6)dx}{4x-6}$

$\frac{du}{4x-6} = dx$

substitute into original

$\int (4x-6)(u)^6 \left(\frac{du}{4x-6}\right)$

simplify

$\int (u)^6 du$

antiderivative

$= \frac{u^7}{7} + C$

sub u back in

$= \frac{(2x^2-6x+15)^7}{7} + C$

$$\int \sqrt[3]{x^2-6x+8}\,(2x-6)\,dx$$

$u = x^2-6x+8$

$\frac{du}{2x-6} = \frac{(2x-6)\,dx}{2x-6}$

$\frac{du}{2x-6} = dx$

$$\int \sqrt[3]{u}\,(2x-6)\left(\frac{du}{2x-6}\right)$$

$$= \int \sqrt[3]{u}\,du = \int u^{1/3}\,du$$

$$= \frac{u^{4/3}}{\frac{4}{3}} + C = \frac{3u^{4/3}}{4} + C = \frac{3(x^2-6x+8)^{4/3}}{4} + C$$

$$\int \frac{6x^2+4x-18}{x^3+x^2-9x+12}\,dx$$

$u = x^3+x^2-9x+12$

$\frac{du}{3x^2+2x-9} = \frac{(3x^2+2x-9)\,dx}{(3x^2+2x-9)}$

$\frac{du}{(3x^2+2x-9)} = dx$

$$\int \frac{6x^2+4x-18}{u} \cdot \frac{du}{3x^2+2x-9}$$

$$= \int \frac{2(3x^2+2x-9)}{u} \cdot \frac{du}{(3x^2+2x-9)}$$

$$= \int \frac{2}{u}\,du = 2\int \frac{1}{u}\,du$$

$$= 2\ln|u| + C$$

$$= 2\ln|x^3+x^2-9x+12| + C$$

$\int \tan x \, dx$

$= \int \frac{\sin x}{\cos x} dx$

~~$u = \sin x$~~

~~$\frac{du}{\cos x} = \frac{\cos x \, dx}{\cos x}$~~

~~$\frac{du}{\cos x} = dx$~~

~~$\int \frac{u}{\cos x} \cdot \frac{du}{\cos x}$~~

~~$= \int \frac{u}{\cos^2 x} du$~~

$\int \frac{\sin x}{\cos x} dx$

$u = \cos x$

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

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

$\int \frac{\sin x}{u} \cdot \frac{du}{-\sin x}$

$= \int -\frac{1}{u} du$

$= -\ln|u| + C$

$= -\ln|\cos x| + C$

$\int \cot x \, dx$

$= \ln|\sin x| + C$

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(multiples of 3)