

P. 16

CALCULUS: Graphical, Numerical, Algebraic by Finney, Demana, Watts and Kennedy
Chapter 6: Differential Equations 6.2: Integration by Recognition

What you'll Learn About

- How to integrate a product by recognizing that one of the pieces contains the derivative of the other

$$\frac{d}{dx} \left[\frac{1}{4} \sin(2x^2) + C \right]$$

$$\frac{1}{4} \cos(2x^2) \cdot 4x$$

$$x \cos(2x^2)$$

$$\frac{d}{dx} (\arctan x)$$

$$\frac{1}{x^2+1}$$

$$18) \int x \cos(2x^2) dx \quad u = 2x^2$$

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

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

$$\int \cancel{x} \cos(u) \frac{du}{\cancel{4x}} = \frac{1}{4} \int \cos(u) du = \frac{1}{4} \sin(u) + C$$

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

$$21) \int \frac{dx}{x^2+9} \quad u = \frac{x}{3}$$

$$\int \frac{1}{x^2+9} dx = \arctan\left(\frac{x}{3}\right)$$

$$24) \int 8(x^4 + 4x^2 + 1)^2 (x^3 + 2x) dx \quad u = x^4 + 4x^2 + 1$$

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

P.18

$$u = 7x + 5$$

$$\frac{du}{dx} = 7$$

$$\frac{du}{7} = dx$$

$$D) \int \cos(7x+5) dx = \boxed{\frac{1}{7} \sin(7x+5) + C}$$

$$\int \cos(u) \frac{du}{7}$$

$$\frac{1}{7} \int \cos(u) du = \frac{1}{7} \sin(u) + C = \frac{1}{7} \sin(7x+5) + C$$

$\checkmark \frac{1}{7} \cos(7x+5) \cdot 7$

$$E) \int x^2 \sin(x^3) dx = \boxed{\frac{-1}{3} \cos(x^3) + C}$$

$$\checkmark \sin(x^3) \cdot 3x^2$$

$$F) \int \sin^4 x \cos x dx = \int (\sin x)^4 \cos x dx = \boxed{\frac{1}{5} (\sin x)^5 + C}$$

$$\checkmark (\sin x)^4 \cdot \cos x$$

\checkmark

$$G) \int \tan x \sec^2 x dx = \int (\tan x)' (\sec x)^2 dx = \frac{1}{2} (\tan x)^2 + C$$

$$\checkmark (\tan x)' \cdot \sec^2 x$$

$$58) \int_{-\pi}^{\pi} \frac{\cos x}{\sqrt{4+3\sin x}} dx = \int_{-\pi}^{\pi} \cos x (4+3\sin x)^{-1/2} dx$$

$$= \left[\frac{2 \cdot 1}{\frac{2}{3}} (4+3\sin x)^{1/2} \right]_{-\pi}^{\pi}$$

$$\checkmark \frac{2}{3} (\sqrt{4}) - \frac{2}{3} \sqrt{4} = 0$$

$$u = 4 + 3\sin x$$

$$\int_4^4 = 0$$

$$J) \int \frac{1}{x^2 + 81} dx$$

$$K) \int \frac{1}{x^2 + 16} dx$$