What you'll Learn About

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

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

18) $\int x\cos(2x^2)dx$ $u = 2x^2$ $\frac{du}{dx} = 4x$ $\frac{du}{4x} = dx$

$\int x\cos(u)dx$

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

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

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

21) $\int \frac{dx}{x^2+9}$ $u = \frac{x}{3}$ $u = \frac{1}{3}x$ $\frac{du}{dx} = \frac{1}{3}$

$x = 3u$ $3du = dx$

$\int \frac{1}{x^2+9}dx$

$\int \frac{1}{(3u)^2+9}\cdot 3du = 3\int \frac{1}{9u^2+9}du = 3\int \frac{1}{9(u^2+1)}du = \frac{3}{9}\int \frac{1}{u^2+1}du$

$= \frac{1}{3}\arctan(u)+C$

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

$8\cdot\frac{1}{4}\cdot\frac{1}{3}(x^4+4x^2+1)^3+C$

✓ $(x^4+4x^2+1)^2(4x^3+8x)$

$u = x + 2$

$\frac{du}{dx} = 1$

$\int u^5\,du$

$\frac{1}{6}u^6 + C$

$\frac{1}{6}(x+2)^6 + C$

A) $\int (x+2)^5\,dx = \frac{1}{6}(x+2)^6 + C$

B) $\int \sqrt{4x-1}\,dx$

$\int (4x-1)^{1/2}\,dx$

$\boxed{\frac{1}{4}\cdot\frac{2}{3}(4x-1)^{3/2} + C}$

$u = 1 + x^2$

C) $\int 2x\sqrt{1+x^2}\,dx$

$\int 2x(1+x^2)^{1/2}\,dx = \frac{2}{3}(1+x^2)^{3/2} + C$

✓ $(1+x^2)^{1/2} \cdot 2x$

D) $\int 3x^2(x^3+1)^{1/3}\,dx$

$\int 3x^2(x^3+1)^{1/3}\,dx$

$\boxed{\frac{3}{4}(x^3+1)^{4/3} + C}$

✓ $(x^3+1)^{1/3} \cdot 3x^2$

$2(t^3-2t+4)^{1/2}$

D) $\int (2-3t^2)\sqrt{2t^3-4t+8}\,dx$

$\int \boxed{(2-3t^2)}(2t^3-4t+8)^{1/2}\,dx$

$\boxed{-\frac{1}{2}\cdot\frac{2}{3}(2t^3-4t+8)^{3/2} + C}$

✓ $(2t^3-4t+8)^{1/2} \cdot \boxed{(6t^2-4)}$

E) $\int \frac{(5\sqrt{x}+2)^2}{\sqrt{x}}\,dx$

$\int x^{-1/2}(5x^{1/2}+2)^2\,dx$

$\boxed{\frac{2}{5}\cdot\frac{1}{3}(5x^{1/2}+2)^3 + C}$

✓ $\cancel{\frac{2}{5}}(5x^{1/2}+2)^2 \cdot \cancel{\frac{5}{2}}x^{-1/2}$