warm-up

$$\int 3(3x+1)^4\,dx = \int (3x+1)^4 \cdot \underbrace{3\,dx}_{du} = \int u^4\,du$$

$$= \frac{u^5}{5} + c = \boxed{\frac{(3x+1)^5}{5} + C}$$

$u = 3x+1$

$$\frac{d}{dx}u = \frac{d}{dx}3x+1$$

$$\frac{du}{dx} = 3$$

$du = 3\,dx$

$$\int u^n\,du$$

$$\int x^3\,dx = \frac{x^4}{4} + c$$

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think: turn into $\underline{\int u^n\,du}$

$$\int (5x+7)^6\,dx$$

$u = 5x+7$

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

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

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

$$= \int u^6 \cdot \frac{1}{5}\,du = \frac{1}{5}\int u^6\,du$$

$$= \frac{1}{7}\cdot\frac{1}{5}u^7 + c$$

$$= \frac{1}{35}(5x+7)^7 + C$$

Practice:

$$\int u^n\,du = \frac{u^{n+1}}{n+1} + C$$

$$\int \cos u\,du = \sin u + C$$

$$\int \cos(8x)\,dx = \int \cos(u)\,\frac{1}{8}\,du$$

$u = 8x$

$du = 8\,dx$

$\frac{1}{8}du = dx$

$$= \frac{1}{8}\int \cos(u)\,du$$

$$= \frac{1}{8}\sin(u) + C = \boxed{\frac{1}{8}\sin(8x) + C}$$

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

$$\boxed{\frac{1}{12}(1+2x)^6 + C}$$

see 2 next to dx?

No.

well, insert it

think: $\int u^5\,du$

$u = 1 + 2x$

$du = 2$

only put in / compensate with constants!!

$$\int u^1\,du$$

using substitution:

$u = 3 - 4x^2$

$du = -8x\,dx$

$$\frac{1}{-8}\int (3-4x^2)(-8)x\,dx$$

see $-8x$?

No. Insert & Compensate

$$-\frac{1}{8}\int u\,du = \left(\frac{1}{2}\right)\cdot -\frac{1}{8}u^2 + C = \boxed{-\frac{1}{16}(3-4x^2)^2 + C}$$

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Name

Antiderivatives 4

Find the indicated antiderivative. Check your answers.

1. $\int 3x^2 \cos\left(x^3\right)\, dx =$ $\quad \int \cos(u)\, du$

$u = x^3$
$du = 3x^2$

$5 \int x^2 \cos(x^3)\, dx$

$\frac{5}{3} \int \cos(x^3)\, 3x^2\, dx \longrightarrow \frac{5}{3} \sin\left(x^3\right) + c$

2. $\int x \sin\left(x^2 + 1\right)\, dx =$ $\quad \int \sin u\, du$

~~3. $\int 2x^3 \sec\left(x^4 - 1\right) \tan\left(x^4 - 1\right)\, dx =$~~

4. $\int 3x^2 \sec^2\left(x^3\right)\, dx =$

5. $\int \; (5x)\, dx =$

cos