Techniques! Target 6C.

1st Technique: "I ♡ u"

recall:

$$\frac{d}{dx}[\sin u] = \cos u \cdot u'$$

$$\frac{d}{dx}[e^u] = e^u \cdot u'$$

$$\frac{d}{dx}\left[\sqrt{3x^2+2}\right] = \frac{1}{2\sqrt{3x^2+2}} \cdot 6x$$

$$= \frac{3x}{\sqrt{3x^2+2}}$$

ex $\displaystyle\int \frac{4x}{\sqrt{4x^2+3}}\,dx$

Guess: $= \sqrt{4x^2+3} + C$

ck: $\dfrac{d}{dx}\left(\sqrt{4x^2+3}+C\right] = \dfrac{4x}{\sqrt{4x^2+3}}$

$\shortparallel$

☺

Is there a strategy?

ex $\int (4x+1)(2x^2+x+4)^6 \, dx$

1. Do you see a func in a func?
2. Do you see a func whose derivative is hanging around?

$$\int \underline{(4x+1)}\,\underline{(2x^2+x+4)}^6 \, \underline{dx}$$

let $u = 2x^2+x+4$

$$\frac{du}{dx} = 4x+1$$

$$du = (4x+1)\,dx$$

$$\int u^6 \, du$$

$$= \frac{1}{7}u^7 + C$$

$$\boxed{= \frac{1}{7}(2x^2+x+4)^7 + C}$$

Title: Jan 27-12:01 PM (3 of 9)

$\underline{ex}$ $\int 3x\, e^{4x^2+2}\, dx$

$u = 4x^2+2$

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

$du = 8x\,dx$

$= 3\int \frac{8}{8} x e^{4x^2+2}\, dx$

$= 3\int \frac{1}{8} e^u \, du$

$= \frac{3}{8}\int e^u du$

$= \frac{3}{8} e^u + C$

$\boxed{= \frac{3}{8} e^{4x^2+2} + C}$

$\underline{ex}$ $\frac{1}{3}\int 3\sin 3x\,dx$

$u = 3x$

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

$du = 3\,dx$

$= \frac{1}{3}\int \sin u\,du$

$= -\frac{1}{3}\cos u + C$

$\boxed{= -\frac{1}{3}\cos 3x + C}$

ex $\frac{1}{8}\int \frac{8x}{4x^2+5}\,dx$

$u = 4x^2+5$

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

$du = 8x\,dx$

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

$= \frac{1}{8}\ln|u| + C$

$= \frac{1}{8}\ln|4x^2+5| + C$

$\boxed{= \frac{1}{8}\ln(4x^2+5) + C}$

ex $\int \sec^2 x \tan x \, dx$

$u = \tan x$

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

$du = \sec^2 x \, dx$

$= \int u \, du$

$= \frac{1}{2} u^2 + C$

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

ex $\int \sec^2 x \tan x \, dx$

$u = \sec x$

$du = \sec x \tan x \, dx$

$= \int \sec x \cdot \sec x \tan x \, dx$

$= \int u \, du$

$= \frac{1}{2}u^2 + C$

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

what about $\displaystyle\int_{-3}^{3} x\sqrt{9-x^2}\,dx$

what happens w/ the bounds?