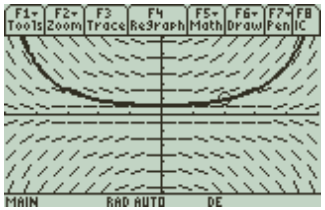
i will derive

$dy/dx = 0.2xy$ where $y(2) = 1$

preview:



$$\int \frac{1}{y}\,dy = \int .2x\,dx$$

$$\ln|y| + C_1 = .1x^2 + C_2$$

$$\ln|y| = .1x^2 + C_3$$

$$|y| = e^{.1x^2 + C_3}$$

$$|y| = e^{.1x^2} \cdot e^{C_3}$$

$$|y| = e^{.1x^2} \cdot C_4$$

$$y = \pm e^{.1x^2} \cdot C_4$$

$$\boxed{y = C \cdot e^{.1x^2}}$$

$1 = C \cdot e^{.1(2)^2}$

$C \approx .670$

$$\boxed{y = .670 \cdot e^{.1x^2}}$$

$y' = \underbrace{.670 \cdot e^{.1x^2}}_{y}(.2x)$

Target 6C Techniques!

Technique #1 "I ♡ u"

(Integration by Substitution)
(Undoing the chain rule)

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

$\frac{d}{dx}[\sqrt{u}] = \frac{1}{2\sqrt{u}} \cdot u'$

$\frac{d}{dx}[u^8] = 8u^7 \cdot u'$

$\frac{d}{dx}[e^{4x^2+1}] = 8x \cdot e^{4x^2+1}$

ex $\int (4x+2)(2x^2+2x+3)^4\,dx$

"Do you see a func in a func?"

"Do you see a func whose derivative is hanging around?"

$\int (4x+2)(2x^2+2x+3)^4\,dx$

$= \int u^4\,du$

$= \frac{1}{5}u^5 + C$

$= \frac{1}{5}(2x^2+2x+3)^5 + C$

$u = 2x^2+2x+3$

$\frac{du}{dx} = 4x+2$

$du = (4x+2)\,dx$

ex. $\int x \cdot e^{x^2+1}\, dx$

$u = x^2+1$

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

$du = 2x\,dx$

$= \int \frac{2}{2} x \cdot e^{x^2+1}\, dx$

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

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

$= \frac{1}{2} e^{x^2+1} + C$

ex $\int \sin 3x \, dx$

$u = 3x$

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

$du = 3\,dx$

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

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

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

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