Intro

Goal: find the unknown function y, f

$f(x)$, $f(t)$

typical answer:

$y = 3x^2 + 6$

$f(x) = \sin x \cdot e^x$

what if the derivative is:

Hint

$\boxed{y' = x^3}$ # an example of a differential eq.

Integrate:

$\int y' dx = \int x^3 dx$

$y = \frac{1}{4}x^4$ ← this is not the function I was thinking of.

Hint: $\boxed{y(1) = 2}$

plugin 1 for x, get $y = 2$.

$y = \frac{1}{4}x^4$

plug in:

$$y = \frac{1}{4} \cdot 1^4 = \frac{1}{4}$$

$$y(1) = \frac{1}{4}$$ Doesn't work.

$$y = \frac{1}{4}x^4 + C$$

examples of antiderivatives of x^3:

$$y = \frac{1}{4}x^3 + 2$$ satisfies $y' = x^3$

$$y = \frac{1}{4}x^3 - 11$$ satisfies $y' = x^3$

which value of c gives $y(1) = 2$?

plug in $y(1) = 2$

$$2 = \frac{1}{4}1^4 + C$$

$$2 = \frac{1}{4} + C$$

$$2 = \frac{1}{4} + c$$

$$-\frac{1}{4} \qquad -\frac{1}{4}$$

$$\frac{4}{4} \cdot 2 - \frac{1}{4} = c$$

$$\frac{8}{4} - \frac{1}{4} = c$$

$$\boxed{\frac{7}{4} = c}$$

the unknown function is

$$\boxed{y = \frac{1}{4}x^4 + \frac{7}{4}}$$

Ex2 Find y.

diff. eq.

if $\boxed{y = \frac{x}{2} \cdot y'}$

Goal: Find $y = \underline{\quad ? \quad}$ that makes the equation true.

How do we do this?

NO IDEA.

where did this come from?

Is $\boxed{y = x^2}$ a solution to this diff. eq.

find $y' = 2x$

plug in $y = x^2$, $y' = 2x$ into $y = \frac{x}{2} \cdot y'$

$$x^2 = \frac{x}{\cancel{2}} \cdot \cancel{2}x$$

$$x^2 = x^2 \checkmark$$

Yes, $y = x^2$ is a solution.