

Differential Equations

- mad minute
- go over online assignment questions
- notes

Differential Equations

- An equation involving a derivative
- a solution is all the functions of y (family of functions)
- ★ The family of functions is the General Form to the differential equation.

ex 1: Solve the differential equation:

a. $\left(\frac{dy}{dx}\right) = \csc^2 x + 2x + 5$

$$y = -\cot x + x^2 + 5x + C$$

b. you try...

$$\frac{dy}{dx} = 3x^2 - 4x$$

$$y = x^3 - 2x^2 + C$$

c. you try again...

$$\frac{dy}{dx} = 3^x \ln 2 \cdot -1$$

$$\left. \right\} \frac{d}{dx} 3^x = 3^x \ln 3$$

$$\frac{dy}{dx} = 3^x \ln 3 + \frac{-1}{\sqrt{1-x^2}}$$

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

Initial Value Problems

Find the particular solution to the differential equation $\frac{dy}{dx}$, whose graph goes through a given point (x, y) .

a. $\frac{dy}{dx} = x^2 + 1$ $\left(\begin{matrix} x & y \\ 0 & 1 \end{matrix} \right)$

$$y = \frac{x^3}{3} + x + C$$
 general solution

$$1 = \frac{0^3}{3} + 0 + C$$

$$1 = C$$

$$y = \frac{x^3}{3} + x + 1$$

you try. . .

b. $\frac{dy}{dt} = \frac{1}{t^2} + t$ and $y = 1$ when $t = 2$

$$y = -t^{-1} + \frac{t^2}{2} + C$$

$$1 = -2^{-1} + \frac{2^2}{2}$$

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

$$y = -t^{-1} + \frac{t^2}{2} - \frac{1}{2}$$

Solve the initial value problem using
Fundamental Theorem of Calculus.

$$\frac{dy}{dx} = \cos(x^2) \quad \text{and} \quad y=10 \quad \text{when} \quad x=2$$
$$f(2)=10$$

$$\int_2^x \cos(x^2) dx = F(x) - F(2)$$

$$F(2) + \int_2^x \cos(x^2) dx = F(x)$$

$$10 + \int_2^x \cos(x^2) dx = F(x)$$