

Next test: ~~\*~~ Monday

Tutoring today; stay for DS tomorrow

What skills do I need to know for DiffEq?

DE4

- make, match, analyze slope fields

DE1

- translate a written scenario into a diff eq

DE3

- find a general solution to a diff eq  
using separation of variables

DE2

- find a particular solution " "

Each group is given an AP FRQ with a differential equation problem

- some have you make a slope field,
- some have you write a tangent line
- all have you find a particular solution

Go to a whiteboard, and work it out together

Record your solution onto your paper so you have a good example to study later

Summary:

Find  $y = \underline{\hspace{2cm}}$

Find the particular solution to  $y' = 3xy^3$

if  $y(1) = 1/\sqrt{2}$   $(1, 1/\sqrt{2})$

$$d\left(\frac{dy}{dx}\right) = (3xy^3) dx$$

gather x with dx,  
y with dy.

$$\frac{dy}{y^3} = \frac{3xy^3 \cdot dx}{y^3}$$

$$\int y^{-3} dy = \int 3x \cdot dx$$

Integrate!

$$\frac{1}{-2} y^{-2} = \frac{3}{2} x^2 + C$$

Solve for y

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

$$\frac{1}{y^2} = \frac{C - 3x^2}{1}$$

Reciprocate

$$y^2 = \frac{1}{C - 3x^2}$$

$$y = \sqrt{\frac{1}{C - 3x^2}}$$

GENERAL SOLUTION

use given pt to find C.

$$\left(\frac{1}{\sqrt{2}}\right)^2 = \left(\sqrt{\frac{1}{C - 3(1)^2}}\right)^2$$

$$\frac{1}{2} = \frac{1}{C - 3}$$

$$2 = C - 3 \Rightarrow \underline{C = 5}$$

$$y = \sqrt{\frac{1}{5 - 3x^2}}$$

particular solution.

Translating from words to a diff eq

ex 1: The rate of change of the volume V of water in a tank with respect to time t is directly proportional to the square root of the volume. Write a differential equation that describes this relationship.

$$\frac{dV}{dt} = k \cdot \sqrt{V}$$

Direct:  $y = kx$   
Indirect:  $y = \frac{k}{x}$

Let  $N$  denote the number of students in a population and  $S$  be the number of sick students. An infection spreads through the population at a rate that is directly proportional to the square of the product of sick and healthy students. Model this infection rate,  $dS/dt$ , with a differential equation.

$$\frac{dS}{dt} = k \cdot (S \cdot (N - S))^2$$

HW handout