

## Differential Equations--Day 2

$$\frac{dy}{dx} = e^y (3x^2 - 6x)$$

$$(1) \quad \left. \frac{dy}{dx} \right|_{(1,0)} = e^0 (3-6) = -3$$

$$(1) \quad \begin{aligned} y-0 &= -3(x-1) \\ y &= -3(x-1) \end{aligned}$$

$$(1) \quad f(1.2) \approx y(1.2) = -3(1.2-1) = -.600$$

$$\frac{dy}{dx} = e^y (3x^2 - \ln x) \quad (1, 0)$$

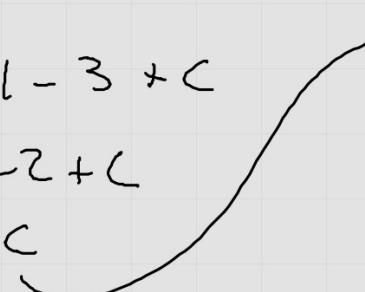
$$| \quad e^{-y} dy = (3x^2 - \ln x) dx$$

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

$$-e^0 = 1 - 3 + C$$

$$-1 = -2 + C$$

$$| \quad 1 = C$$



$$-e^{-y} = x^3 - 3x^2 + 1$$

$$e^{-y} = -x^3 + 3x^2 - 1$$

$$-y = \ln(-x^3 + 3x^2 - 1)$$

$$| \quad y = -\ln(-x^3 + 3x^2 - 1)$$

$$\frac{dy}{dx} = y \cos x \quad y = 3 \text{ when } x = 0 \quad \text{find } y = f(x).$$

$$\frac{1}{y} dy = \cos x dx$$

$$\ln|y| = \sin x + C \quad y = 3e^{\sin x}$$

$$y = e^{\sin x + C}$$

$$y = Ae^{\sin x}$$

$$3 = A$$

$$\frac{dy}{dx} = \frac{1+x}{xy} \quad y(1)=4 \quad \text{find } y=f(x).$$

$$y dy = \frac{1+x}{x} dx$$

$$y dy = \left(\frac{1}{x} + 1\right) dx$$

$$\frac{1}{2}y^2 = \ln|x| + x + C$$

$$8 = \cancel{\ln|x|} + 1 + C$$

$$7 = C$$

$$\frac{1}{2}y^2 = \ln|x| + x + 7$$

$$y^2 = 2\ln|x| + 2x + 14$$

$$y = \pm \sqrt{2\ln|x| + 2x + 14}$$

$$\text{Since } f(1)=4,$$

$$y = \sqrt{2\ln|x| + 2x + 14},$$

$$\frac{dy}{dx} = 4x^3(2y+1) \quad y(1)=2 \quad \text{find } y = f(x).$$

$$\frac{1}{2y+1} dy = 4x^3 dx$$

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

$$\ln|2y+1| = 2x^4 + D$$

$$2y+1 = e^{2x^4}$$

$$y = \frac{Ae^{2x^4} - 1}{2}$$

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

$$4 = Ae^2 - 1$$

$$5 = Ae^2 \rightarrow A = \frac{5}{e^2}$$

$$y = \frac{\frac{5}{e^2}e^{2x^4} - 1}{2}$$

$$y = \frac{5e^{2x^4} - e^2}{2e^2}$$

$$\frac{dB}{dt} = \frac{1}{5}(100 - B)$$

$$\frac{dy}{dx} = 2y^3$$

$$\frac{1}{100-B} dB = \frac{1}{5} dt$$

$$\frac{1}{-1} \ln |100-B| = \frac{1}{5} t + C$$

$$\ln |100-B| = -\frac{1}{5} t + D$$

$$100-B = Ae^{-\frac{1}{5}t}$$

$$y^3 dy = 2 dx$$

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

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