

# W1 L8 - SEPARABLE EQUATIONS WITH INITIAL VALUES

Sep. Eq. w/ initial values

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

$$\int \frac{1}{y} dy = \int e^x dx$$

$$\ln|y| = e^x + C_1$$

$$|y| = e^{e^x + C_1}$$

$$|y| = e^{C_1} \cdot e^{e^x}$$

$$y = \pm e^{C_1} \cdot e^{e^x}$$

$$y = C e^{e^x} \quad \leftarrow \text{General Solution}$$

$$2e = C e^{e^0}$$

$$2e = C e$$

$$2 = C$$

$$y = 2e^{e^x} \quad \leftarrow \text{Particular Solution}$$

EX

$$\frac{dy}{dx} = 3x^2 \cdot (y^2 + 1); \quad y(0) = 1$$

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

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

$$\tan^{-1}(1) = 0^3 + C$$

$$\frac{\pi}{4} = C$$

$$\tan^{-1} y = x^3 + \frac{\pi}{4}$$

$$y = \tan\left(x^3 + \frac{\pi}{4}\right)$$

EX

$$\frac{dy}{dx} = y \cot(x) ; y\left(\frac{\pi}{2}\right) = \frac{\pi}{2}$$

$$\int \frac{1}{y} dy = \int \cot(x) dx$$

$$\ln|y| = \ln|\sin(x)| + C_1$$

$$|y| = e^{\ln|\sin(x)| + C_1}$$

$$|y| = e^{C_1} \cdot e^{\ln|\sin(x)|}$$

$$y = \pm e^{C_1} \cdot \sin(x)$$

$$y = C \cdot \sin(x)$$

$$\frac{\pi}{2} = C \cdot \sin\left(\frac{\pi}{2}\right)$$

$$\frac{\pi}{2} = C$$

$$y = \frac{\pi}{2} \sin(x)$$