

$$1) \frac{dy}{dx} = -4Ae^{-4x} - 6Be^{-6x} \quad (1)$$

$$\frac{d^2y}{dx^2} = -16Ae^{-4x} + 36Be^{-6x} \quad (2)$$

multiply eqn 1 by 6

$$= 6 \frac{dy}{dx} = -24Ae^{-4x} - 36Be^{-6x} \quad (3)$$

add eqn 2 by 3

$$= \frac{dy}{dx} + \frac{d^2y}{dx^2} = 8Ae^{-4x} \quad (4)$$

$$A = - \left(\frac{6 \frac{dy}{dx} + \frac{d^2y}{dx^2}}{8Ae^{-4x}} \right) \cdot \frac{1}{8Ae^{-4x}}$$

sub A in eqn 2.

$$\frac{d^2y}{dx^2} = 16 \left(\frac{6 \frac{dy}{dx} + \frac{d^2y}{dx^2}}{8e^{-4x}} \right) e^{-4x} \cdot \frac{1}{8e^{-4x}} + 36Be^{-6x}$$

$$\frac{d^2y}{dx^2} = -12 \frac{dy}{dx} - 2 \frac{d^2y}{dx^2} + 36Be^{-6x}$$

$$36Be^{-6x} = \frac{3d^2y}{dx^2} + \frac{12dy}{dx} \quad \text{divide through by 3}$$

$$12Be^{-6x} = \frac{d^2y}{dx^2} + \frac{4dy}{dx}$$

$$B = \left(\frac{d^2y}{dx^2} + \frac{4dy}{dx} \right) \times \frac{1}{12e^{-6x}}$$

$$y = Ae^{-4x} + Be^{-6x}$$

$$y = e^{-4x} \times \frac{1}{8e^{-4x}} \left(\frac{6 \frac{dy}{dx} + \frac{d^2y}{dx^2}}{8e^{-4x}} \right) + e^{-6x} \times \frac{1}{12e^{-6x}}$$

$$\left(\frac{d^2y}{dx^2} + \frac{4dy}{dx} \right)$$

$$y = \frac{1}{8} \left(\frac{6 \frac{dy}{dx} + \frac{d^2y}{dx^2}}{dx^2} + \frac{1}{12} \left(\frac{d^2y}{dx^2} + \frac{4dy}{dx} \right) \right)$$

$$-3 \left(6 \frac{dy}{dx} + \frac{d^2y}{dx^2} \right) + 2 \left(\frac{d^2y}{dx^2} + 4 \frac{dy}{dx} \right)$$

$$24y = -18 \frac{dy}{dx} - 3 \frac{d^2y}{dx^2} + 2 \frac{d^2y}{dx^2} + 8 \frac{dy}{dx}$$

$$24y = -10 \frac{dy}{dx} - \frac{d^2y}{dx^2}$$

$$\left(\frac{d^2y}{dx^2} + 10 \frac{dy}{dx} + 24y = 0 \right) \text{ 2nd order ODE}$$