

A) A differential equation is an equation that shows the relationship between an independent variable  $x$  and a dependent variable  $y$  with respect to one/more variable

B) It is a second order differential equation

ii It is a second order equation because it has two arbitrary constants.

iii  $y = Ae^{-4x} + Be^{-6x}$  ---- (i)

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

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

$$A = \frac{y - Be^{-6x}}{e^{-4x}}$$
 ---- (iv)

Sub eqn (iv) into eqn (ii)

$$\frac{dy}{dx} = -4 \left( \frac{y - Be^{-6x}}{e^{-4x}} \right) e^{-4x} - 6Be^{-6x}$$

Make B subject of formula

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

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

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

sub eqn (v) into eqn (iv)

$$A = \frac{y - Be^{-6x}}{e^{-4x}}$$

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

$$A = y + \frac{dy}{dx} \frac{1}{2} e^{-2x}$$
 ---- (vi)

$$\frac{d^2 y}{dx^2} = 16y + \frac{16dy}{2dx} + 32y - \frac{36dy}{2dx} - 72y$$

$$\frac{d^2 y}{dx^2} = 16y + 18\frac{dy}{dx} + 32y - 18\frac{dy}{dx} - 72y$$

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

~~$$\frac{d^2 y}{dx^2} + 24y + 10\frac{dy}{dx}$$~~

$$\frac{d^2 y}{dx^2} + 24y + 10\frac{dy}{dx} = 0$$

The Differential eqn