

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

(b) it is a second order differential equation

(c) it is a second order equation because it has two arbitrary constants.

(d)  $y = Ae^{-4x} + Be^{-6x} \dots \dots \dots \textcircled{1}$

$$\frac{dy}{dx} = -4Ae^{-4x} - 6Be^{-6x} \dots \dots \dots \textcircled{2}$$

$$\frac{d^2y}{dx^2} = 16Ae^{-4x} + 36Be^{-6x} \dots \dots \dots \textcircled{3}$$

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

Sub equ (4) into (ii)

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

Make B subject of formulae

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

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$$-\frac{1}{2}e^{6x} \left( \frac{dy}{dx} + 4y \right) = B \dots \dots \dots \textcircled{5}$$

Sub equ (iii) into equ (iv)

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

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

$$A = y + \frac{dy}{dx} \dots \dots \dots \textcircled{6}$$

Sub equ (vi) into equ (ii)

$$-4y + 36Be^{-6x}$$

$$\frac{d^2y}{dx^2} = 16y + 16\frac{dy}{dx} + 3ey - 36\frac{dy}{dx} - 72y$$

$$\frac{d^2y}{dx^2} = 16y + 16\frac{dy}{dx} + 3ey - 18\frac{dy}{dx} - 72y$$

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

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

Differential equation form

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