

Jude - Shima Favour

17/ENG021039

Computer Engineering

ENG 282 Assignment 1

A) A differential equation is the relationship between an independent variable x and a dependent variable y and one or derivations of y with respect to x .

b) i) It is a second order differential equation.

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

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

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

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

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

Sub eqn (iv) into eqn (ii)

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

$$= -4y + 4Be^{-6x} - 6Be^{-6x}$$
$$= -4y - 2Be^{-6x} \quad \text{--- (v)}$$

Make B the subject of formula

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

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

$$-\frac{1}{20} \left[\frac{dy}{dx} + 4y \right] = B \quad \text{--- (vi)}$$

Sub eq (VI) into eqn (IV)

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

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

$$A = y + \frac{dy}{2dx} + 2y$$

$$\frac{e^{-4x}}{e^{-4x}} \text{ --- (VII)}$$

Sub eqn (VII) and eqn (V) into eqn (III)

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

$$= 16 \left[y + \frac{dy}{2dx} + 2y \right] + 36 \left[\frac{-1}{2e^{-6x}} \left[\frac{dy}{dx} + 6y \right] \right] e^{-4x}$$

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

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

$$= -24y - \frac{18dy}{dx}$$

$$\frac{d^2 y}{dx^2} + 24y + \frac{18dy}{dx} = 0$$

Differential equation for

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