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

multiply through by 2

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

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

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

$$\frac{-4\frac{dy}{dx} - \frac{d^2y}{dx^2}}{-12e^{-6x}} = B \qquad \therefore \frac{4\frac{dy}{dx} + \frac{d^2y}{dx^2}}{12e^{-6x}} = B$$

Substitute A and B into the degenerate equation.

$$\therefore y = \frac{6\frac{dy}{dx} + \frac{d^2y}{dx^2}}{8} \times e^{-6x} + \frac{4\frac{dy}{dx} + \frac{d^2y}{dx^2}}{12e^{-6x}} \times e^{-6x}$$

$$y = \frac{6\frac{dy}{dx} + \frac{d^2y}{dx^2}}{8} + \frac{4\frac{dy}{dx} + \frac{d^2y}{dx^2}}{12}$$

$$y = \frac{-12\frac{dy}{dx} - 12\frac{d^2y}{dx^2} + 32\frac{dy}{dx} + 8\frac{d^2y}{dx^2}}{96}$$

$$y = \frac{-10\frac{dy}{dx} - 4\frac{d^2y}{dx^2}}{96}$$

$$96y = -40\frac{dy}{dx} - 4\frac{d^2y}{dx^2}$$

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

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

Adesipe daniel oluwaseyi
17/sc.it/0052
Civil Engineering
GNG 228

(a) A differential equation is a relationship between an independent variable(x) and dependent variable (y) and are more derivative of y with respect to x

examples (i) $\frac{dy}{dx} = 2 + y/x$

(ii) $dy/dx = y + y/x$

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

(i) A second order differential equation

(ii) A second order differential equation can be formed because it contains 2 constants in the degenerate equation.

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

Solution

$$dy/dx = 4Ae^{-4x} - 6Be^{-6x} \quad \text{——— (i)}$$

$$dy/dx = 16Ae^{4x} + 36Be^{-6x} \quad \text{——— (ii)}$$

Solving eqn (i) and (ii) simultaneously

multiply eqn (i) by 6

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

~~$\frac{dy}{dx} = +16Ae^{-4x} - 36Be^{-6x}$ ——— (iii)~~

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

$$\frac{6dy}{dx} + \frac{d^2y}{dx^2} = -8Ae^{-4x}$$

$$\therefore A = \frac{6dy/dx + \frac{d^2y}{dx^2}}{-8e^{-4x}} \quad \text{——— (v)}$$