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17HENG04 1057

Electrical Electronics Engineering.

Engineering Mathematics Assignment 1.

(a) Define differential equation and give two examples:

- A differential equation is a relationship between an independent variable, x, a dependent variable y and one or more derivatives of y with respect to x.

- Examples;

(i). $x^2 \frac{dy}{dx} - y^2 = 0$.

(ii). $xy \frac{dy}{dx} + y\, dy/dx + \sin 8x = 0$.

(b) Obtain an Different

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

(i) What order of the differential equation can be formed from the expression

(ii) Give Reason.

(iii) Form an equation

Solution (B).

(i) It is a second order differential equation that can be formed from the expression.

ii) ~~Because~~ A second order differential equation is formed because the equation has 2 arbitrary constant.

iii) Form an Equation:

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

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

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

Solving this simultaneously.

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

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

$$\therefore 6\frac{dy}{dx} = -24Ae^{-4x} - 36Be^{-6x}$$

$(+)$

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

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

$$\therefore \quad A = \frac{6\,dy/dx + d^2y/dx^2}{-8\cancel{e}^{-4x}}$$

Substituting the equation, (A) into (1).

$$\therefore \quad dy/dx = 4\left[\frac{6\,dy/dx + d^2y/dx^2}{8e^{-4x}}\right] e^{-4x} - 6Be^{-6x}.$$

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

Multiplying thro by 2.

$$\therefore \quad 2\,dy/dx = 6\,dy/dx + d^2y/dx^2 - 12Be^{-6x} \quad \text{(collected like terms).}$$

$$\therefore 2\,dy/dx - 6\,dy/dx = d^2y/dx^2 - 12Be^{-6x}.$$

$$\therefore \quad -4\,dy/dx = d^2y/dx^2 - 12Be^{-6x}.$$

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

$$B = \frac{-4\,dy/dx - d^2y/dx^2}{-12e^{-6x}}$$

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

∴ Substituting A and B into the gotten eqn

∴

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

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

$$y = \frac{-72\,dy/dx - 12\,d^2y/dx^2 + 32\,dy/dx + 8\,d^2y/dx^2}{96}$$

collecting like terms;

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

$$\therefore\ 96y = -40\,dy/dx - 4\,d^2y/dx^2.$$

∴ Dividing thru by 4.

$$\therefore\ 24y = -10\,dy/dx - d^2y/dx^2$$

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

(2nd order).

∴ The generated differential equation is given as;

$$y = Ae^{-4x} + Be^{-6x} \Rightarrow \frac{d^2y}{dx^2} + 10\frac{dy}{dx} + 24y = 0$$