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17/ENG02/063
COMPUTER ENGINEERING

ENGINEERING MATHS ASSIGNMENT

a. A differential equation is an equation which shows the relationship between the independent variable, dependent variable and one or more derivatives of the dependent variable with respect to the independent variable.

Example:

i) $\frac{dy}{dx} - 5y = x + 1$ ii) $(x+2)\frac{dy}{dx} = y^2$

b. $y = Ae^{-4x} + Be^{-6x} \quad - - \quad - (1)$

i) Order of the differential equation => Second Order differential equation

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

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

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

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

let $R = Ae^{-4x}$

$S = Be^{-6x}$

$\therefore y = R + S$

$\frac{dy}{dx} = -4R - 6S$

$\frac{d^2y}{dx^2} = 16R + 36S$

let

$$\frac{dy}{dx} = -4R - 6S \quad \text{----(1)}$$

$$\frac{d^2y}{dx^2} = 16R + 36S \quad \text{----(2)}$$

multiply eqn(1) by 36
multiply eqn(2) by 6

$$36\frac{dy}{dx} = -144R - 216S$$

$$-6\frac{d^2y}{dx^2} = -96R - 216S$$

$$36\frac{dy}{dx} + 6\frac{d^2y}{dx^2} = -48R$$

$$R = -\frac{3}{4}\frac{dy}{dx} - \frac{1}{8}\frac{d^2y}{dx^2}$$

put R into eqn(1)

$$\frac{dy}{dx} = -4\left[-\frac{3}{4}\frac{dy}{dx} - \frac{1}{8}\frac{d^2y}{dx^2}\right] - 6S$$

$$S = \frac{1}{3}\frac{dy}{dx} + \frac{1}{12}\frac{d^2y}{dx^2}$$

$$y = R + S$$

$$y = \left[-\frac{3}{4}\frac{dy}{dx} - \frac{1}{8}\frac{d^2y}{dx^2}\right] + \left[\frac{1}{3}\frac{dy}{dx} + \frac{1}{12}\frac{d^2y}{dx^2}\right]$$

$$y = -\frac{5}{12}\left[\frac{dy}{dx}\right] - \frac{1}{24}\frac{d^2y}{dx^2}$$

$$y = \frac{1}{12}\left[-5\frac{dy}{dx} - \frac{1}{2}\frac{d^2y}{dx^2}\right]$$

$$12y = -5\frac{dy}{dx} - \frac{1}{2}\frac{d^2y}{dx^2}$$

multiply both sides of the equation by 2

$$2(12y) = 2\left[-5\frac{dy}{dx}\right] - 2\left[\frac{1}{2}\frac{d^2y}{dx^2}\right]$$

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

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