Assignment I

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Eng 282: Engineering mathematics II.

(a) A differential equation is a relationship between dependent and independent variable and one or more derivatives of the dependent variable with respect to independent variable.

i) $x\,dy/dx = 2x - y$

ii) $y = x\,dy/dx - x^2/2\ d^2y/dx^2$

b i) Second order Equation

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

iii) $y = Ae^{-4x} + Be^{-6x}$ ---(1)

$dy/dx = -4Ae^{-4x} - 6Be^{-6x}$ ---(2)

$d^2y/dx^2 = 16Ae^{-4x} + 36Be^{-6}$ ---(3)

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

Substituting eqn (4) into (2)

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

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

$= -4y - 2Be^{-6x}$ ---- (5)

Making B the subject of the formular

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

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

$$\frac{-1}{2e^{-6x}}\left[\frac{dy}{dx} + 4y\right] = B \quad \text{---- (6)}$$

Substituting equation 6 into 4

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

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

$$A = \frac{y + dy/2dx + 2y}{e^{-4x}} \quad \text{---- (7)}$$

Substituting eqn 7 and 6 into 8

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

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

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

$$\frac{d^2y}{dx^2} = 16y + \frac{18dy}{2dx} + 32y - \frac{8dy}{dx} - 72y$$

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