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17/ENG02/029
Computer Engineering
ENG082 Assignment 1

1a) 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

ai $x\,dy/dx = 2x - y$

ii $y = x\,dy/dx - x^2/6\,d^2y/dx^2$

b) Second Order Equation

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

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

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

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

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

$= 4 - x dy/dx - x^2 b d^2y/dx^2$

b) Second Order Equation

it gives a general solution because it has two arbitrary constant

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

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

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

$Ae^{-4x} = \frac{y - Be^{-6x}}{e^{-4x}}$ ... (4)

Substituting equ 4 into 2

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

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

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

Making B the subject of the formular

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

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

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

Substituting equation 6 into 4

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

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

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

Substituting equ 7 and 6 into 3

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

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

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

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

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