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 DEPARTMENT: ELECT/ELECT ENGR.
 COURSE: ENGR. MATHEMATICS

ASSIGNMENT 1

1a. A differential equation is a relationship between an independent variable 'x' and dependent variable 'y' and one or more derivative of y with respect to x.

E.g (x) $\frac{dy}{dx} = y + \frac{y}{x}$

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

i.) A second order differential equation

ii.) This is because it contains two variables

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

Solution

$\frac{dy}{dx} = -4Ae^{-4x} - 6Be^{-6x} \dots (1)$

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

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

solve eqn (1) and (2) simultaneously

multiply eqn (1) by 6

$6 \frac{dy}{dx} = -24Ae^{-4x} - 36Be^{-6x} \dots (3)$

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

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

$\therefore A = \frac{6 \frac{dy}{dx} + \frac{d^2y}{dx^2}}{8e^{-4x}} \dots (5)$

subst. eqn (5) into eqn (1)

$\frac{dy}{dx} = 4 \left(\frac{6 \frac{dy}{dx} + \frac{d^2y}{dx^2}}{8e^{-4x}} \right) e^{-4x} - 6Be^{-6x}$

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

Multiply through by 2

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

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

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

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

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

Subst. A and B into the degenerate equation

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

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

$$y = \frac{18 \frac{dy}{dx} + 3 \frac{d^2y}{dx^2} - 8 \frac{dy}{dx} - 2 \frac{d^2y}{dx^2}}{-24}$$

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

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

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