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17/ENG03/049
CIVIL ENGINEERING.

ENG282

(a) A differential equation is a relationship bet an independent variable (x) and dependent vari and one or more derivative of y with respe the x.

Examples (i) $\frac{dy}{dx} = 2 + y/x$

(ii) $\frac{dy}{dx} = 4 + y/x$

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

(ii) A second order differential equation.

(iii) A second order differential equation can be forme because it contains 2 constants in the degenera equation.

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

Soln

$dy/dx = -4Ae^{-4x} - 6Be^{-6x}$ .... (1)

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

Solving equ (1) & (2) simultaneously.

Multiply equ (1) by (6)

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

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

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

$12\left(6\frac{dy}{dx} + \frac{d^2y}{dx^2}\right) \quad (5) \div -8e^{-4x} \quad \ldots (5)$

eqn (5) into (1)

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

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

Multiply through by 2

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

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

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

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

Substitute A and B into degenerate eqn

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

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

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

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

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

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