Assignment 1 ENG 282

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(1) A differential equation is a relationship between a dependent and independent variable and one or more derivatives. Examples (i) $y\frac{d^2y}{dx^2} + x\frac{dy}{dx} + 19x^2 = \sin 4y$

(ii) $e^{8x} + 9xy\frac{d^2y}{dx^2} + \frac{y\,dy}{dx} = 3$

(b) $Y = Ae^{-4x} + Be^{-6x}$ — (1)

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

~~$4Ae^{-4x}$~~ =

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

∴ From eqA (2)

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

$A = \left(-\frac{dy}{dx} - 6Be^{-6x}\right)\frac{1}{4e^{-4x}}$ —— (4)

Substitute eqA (4) in (3)

$\frac{d^2y}{dx^2} = 16\left(-\frac{dy}{dx} - 6Be^{-6x}\right)\cdot\frac{1}{4e^{-4x}}\cdot e^{-4x} + 36Be^{-6x}$

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

$\frac{d^2y}{dx^2} = -4\frac{dy}{dx} - 24Be^{-6x} + 36Be^{-6x}$

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

$B = \left(\frac{d^2y}{dx^2} + 4\frac{dy}{dx}\right)\cdot\frac{1}{12e^{-6x}}$ —— (5)

Substitute eqA (5) in (4)

$A = \left(-\frac{dy}{dx} - 6\left(\frac{d^2y}{dx^2} + 4\frac{dy}{dx}\right)\cdot\frac{1}{12e^{-6x}}\cdot e^{-6x}\right)\cdot\frac{1}{4e^{-4x}}$

$A = \left(-\frac{dy}{dx} - \frac{1}{2}\frac{d^2y}{dx^2} - 2\frac{dy}{dx}\right)\cdot\frac{1}{4e^{-4x}}$

$$A = \left(-\frac{3dy}{dx} - \frac{d^2y}{2dx^2}\right) \cdot \frac{1}{4e^{-4x}} \longrightarrow (6)$$

Put eq A ~~(4), (5) &~~ (6) & (5) in (1)

$$y = \left(-\frac{3dy}{dx} - \frac{d^2y}{2dx^2}\right) \cdot \frac{1}{4e^{-4x}} \cdot e^{-4x} + \left(\frac{d^2y}{dx^2} + \frac{4dy}{dx}\right) \cdot \frac{1}{12e^{-6x}} \cdot e^{-6x}$$

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

$$y = \frac{3}{4}\frac{dy}{dx} - \frac{d^2y}{8dx^2} + \frac{d^2y}{12dx^2} + \frac{dy}{3dx}$$

$$y = \frac{5dy}{12dx} - \frac{d^2y}{24dx^2}$$

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