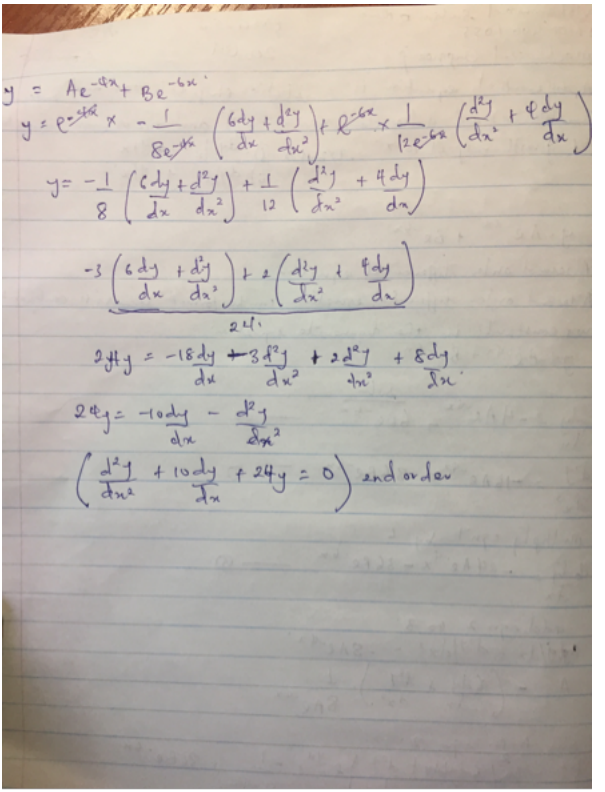
Maths ass1


$y = Ae^{-4x} + Be^{-6x}$
$y = e^{-4x} \times -\frac{1}{8e^{-4x}} \left(\frac{6dy}{dx} + \frac{d^2y}{dx^2}\right) + e^{-6x} \times \frac{1}{12e^{-6x}} \left(\frac{d^2y}{dx^2} + 4\frac{dy}{dx}\right)$
$y = -\frac{1}{8}\left(\frac{6dy}{dx} + \frac{d^2y}{dx^2}\right) + \frac{1}{12}\left(\frac{d^2y}{dx^2} + 4\frac{dy}{dx}\right)$
$-3\left(\frac{6dy}{dx} + \frac{d^2y}{dx^2}\right) + 2\left(\frac{d^2y}{dx^2} + 4\frac{dy}{dx}\right)$
$24y = -18\frac{dy}{dx} - 3\frac{d^2y}{dx^2} + 2\frac{d^2y}{dx^2} + 8\frac{dy}{dx}$
$24y = -10\frac{dy}{dx} - \frac{d^2y}{dx^2}$
$\left(\frac{d^2y}{dx^2} + 10\frac{dy}{dx} + 24y = 0\right)$ 2nd order

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ASS 1

i) A differential equation is a relationship between and independent variable (x) and a dependent variable (y) and one or more derivative of y with respect to x. Example (i) $dy/dx = 2 + 3/x$

ii) $dy/dx = y + 3/x$

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

i) A second order differential equation

ii) A second order differential equation can be formed because it contains two constants in the degenerate equation

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

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

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

multiply eqn 1 by 6

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

add eqn 2 to 3

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

$A = \left(6\frac{dy}{dx} + \frac{d^2y}{dx^2}\right) \cdot \frac{1}{8e^{-4x}}$

Sub A in eqn 2

$\frac{d^2y}{dx^2} = 16\left(6\frac{dy}{dx} + \frac{d^2y}{dx^2}\right)e^{-4x} \cdot -\frac{1}{8e^{-4x}} + 36Be^{-6x}$

$\frac{d^2y}{dx^2} = -12\frac{dy}{dx} - 2\frac{d^2y}{dx^2} + 36Be^{-6x}$

$36Be^{-6x} = 3\frac{d^2y}{dx^2} + 12\frac{dy}{dx}$ divide through by 3

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

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