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

$$dy/dx = -4(y - Be^{-6x}) - 6Be^{-6x} \longrightarrow 5$$

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

$$dy/dx = -4y - 2Be^{-6x} \longrightarrow 7$$

In eqn 7, make B the subj of formula.

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

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

$$B = -\frac{1}{2}e^{-6x}\left[dy/dx + 4y\right] \quad \ldots 8.$$

Sub equation 8 into eqn 4.

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

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

$$A = \frac{y + \left[dy/dx + 2y\right]}{e^{-4x}} \longrightarrow 9.$$

Sub equation 9 and 8 into eqn 3.

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

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

$$= 16(y + dy/dx + 2y) + 36(-dy/dx - 2y)\frac{1}{2}$$

$$= 16y + 16\,dy/dx + 32y - 36(dy/dx) - 72y$$

$$= -20dy - 24y - 18\,dy/dx + 8\,dy/dx$$

$$d^2y/dx^2 = -24y - 10\,dy/dx$$

$$d^2y/dx^2 + 24y + 10\,dy/dx = 0.$$

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ENG 282 ASSIGNMENT II
Electrical Electronics Engineering.

a) Define differential equation and give two examples.

b) An expression has been obtained for engineering system to be as given in Equation (i).

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

i) What is the order of the differential equation that can be formed from the expression?

ii) Give a reason for your answer in b(i)

iii) Form a differential equation from the expression.

Solution

a) Differential equation is the relationship between a dependent variable and one or more derivative of dependent variable with respect to the independent variable.

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

- $y\tan x\frac{dy}{dx} = (4+y^2)\tan^2 x.$

b) Second Order differential equation.

ii) This is because it has two constants A and B.

iii) $y = Ae^{-4x} + Be^{-6x}$ ——→ i

$dy/dx = -4Ae^{-4x} - 6Be^{-6x}$ ——→ ii

$d^2y/dx^2 = 16Ae^{-4x} + 36Be^{-6x}$ ——→ (iii)

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

Let $A = \frac{y - Be^{-6x}}{e^{-4x}}$ ——→ (iv)

Sub eqn (iv) in ii