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ENG 282 ASSIGNMENT SOLUTION

a. Define differential equation and two examples

Differential equation is a relationship between an independent variable $x$, a dependent variable $y$ and one or more derivatives of $y$ with respect to $x$

e.g $x \cdot dy/dx = y \sin x = 0$

$xy\, d^2y/dx^2 + y\, dy/dx + e^{5x} = 0$

The order of a differential equation is given by the highest derivative involved in the equation.

b. An expression has been obtained for an engineering system to be a given eqn (i)

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

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

Second Order differential equation (2nd order)

ii. The differential equation has a function with two arbitrary constants

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

Using the second-order relationship

$aAm^2e^{mx} + bAme^{mx} + cAe^{mx} = 0$

Dividing both sides by $Ae^{mx}$

$am^2 + bm + c = 0$

$y = Ae^{m_1x} + Be^{m_2x}$

This contains two arbitrary constants

Solution of $a\frac{d^2y}{dx^2} + b\frac{dy}{dx} + cy = 0$ is seen to be $y = Ae^{m_1x} + Be^{m_2x}$

$Ae^{-4x} + Be^{-6x}$

$m_1 = -4$ $m_2 = -6$

$(m+4)(m+6) = 0$

$m^2 + 10m + 24 = 0$ (Auxilliary equation)

the differential equation

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