

03/2019

ENG282 Assignment 1

1a A differential equation is a relationship between an independent variable, a dependent variable y , and one or more derivatives of y with respect to x .

Examples of differential equation;
 $x^2 \frac{dy}{dx} = y \sin x = 0$

$$x^2 y \frac{d^2 y}{dx^2} + y \frac{dy}{dx} + e^{3x} = 0$$

1b) $y = Ae^{-4x} + Be^{-6x}$

This is a second order differentiation

ii) It has two constants A and B

iii) let Ae^{-4x} be R
and let Be^{-6x} be S

$$\begin{aligned} \therefore y &= R + S & y &= Ae^{-4x} + Be^{-6x} \\ \frac{dy}{dx} &= -4Ae^{-4x} + (-6Be^{-6x}) \\ \frac{d^2 y}{dx^2} &= 16Ae^{-4x} + 36Be^{-6x} \end{aligned}$$

$$\begin{aligned} \therefore y &= R + S \quad \dots (i) \\ \frac{dy}{dx} &= -4R - 6S \quad \dots (ii) \end{aligned}$$

$$\frac{d^2 y}{dx^2} = 16R + 36S \quad \dots (iii)$$

Put equation (iii) From equation (ii)

$$R = \left(\frac{dy}{dx} + 6S \right) \frac{1}{4} \quad \dots (iv)$$

2 $r = (t^2 + 8t)j - 2 \sin 8t j + 3e^{2t} k$

a $\frac{ds}{dt} = (2t + 8)j - (6 \cos 8t)j + 6e^{2t} k$

b $\frac{d^2r}{dt^2} = 2i + (18 \sin 8t)j + 12e^{2t} k$

c ~~$\frac{d^2r}{dt^2}$~~ at $t=0$

$$\frac{d^2r}{dt^2} = 2i + 12k$$

$$\left| \frac{d^2r}{dt^2} \right| = \sqrt{2^2 + (12)^2}$$

$$= 2\sqrt{37} \text{ or } 12.17 \text{ units}$$