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Quiz : Differential Equation  
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# QUIZ NO # 04

## QUS NO # 5

Exer

$$y' = 2xy$$

Solution:

$$\text{let } y' = 2xy$$

$$y = a_0 + a_1x + a_2x^2 + a_3x^3 + a_4x^4 + a_5x^5 + \dots$$

$$y' = a_1 + 2a_2x + 3a_3x^2 + 4a_4x^3 + 5a_5x^4 + \dots$$

$$y' - 2xy = 0$$

$$(a_1 + 2a_2x + 3a_3x^2 + 4a_4x^3 + 5a_5x^4 + \dots) - 2x(a_0 + a_1x + a_2x^2 + a_3x^3 + a_4x^4 + a_5x^5 + \dots) = 0$$

$$(a_1 + 2a_2x + 3a_3x^2 + 4a_4x^3 + 5a_5x^4 + 6a_6x^5 + \dots) - (2xa_0 + 2a_1x^2 + 2a_2x^3 + 2a_3x^4 + 2a_4x^5 + 2a_5x^6 + \dots) = 0$$

$$a_1 = 0, \quad 2a_2 - 2a_0 = 0, \quad 3a_3 - 2a_1 = 0$$

$$4a_4 - 2a_2 = 0, \quad 5a_5 - 2a_3 = 0, \quad 6a_6 - 2a_4 = 0$$

$$a_6 = \frac{a_0}{3!}$$

$$a_1 = 0, \quad a_3 = 0, \quad \cancel{a_5 = 0}, \quad a_5 = 0$$

$$a_2 = \frac{a_0}{1!}, \quad a_4 = \frac{a_2}{2} = \frac{a_0}{2!}, \quad a_6 = \frac{a_0}{3!}$$

$$\text{So } y = a_0 + a_0x^2 + \frac{a_0}{2!}x^4 + \frac{a_0}{3!}x^6 + \dots$$

$$y = a_0(1 + x^2 + \frac{x^4}{2!} + \frac{x^6}{3!} + \dots) = a_0 e^{x^2}$$



Quiz NO # 04

Qus NO # 05

$$y'' = 3y' + 2y = 0$$

$$\text{let } y = \sum_{n=0}^{\infty} a_n x^n, \quad y' = \sum_{n=0}^{\infty} (n+1) a_{n+1} x^n$$

$$y'' = \sum_{n=0}^{\infty} (n+2)(n+1) a_{n+2} x^n$$

$$y'' - 3y' + 2y = \sum_{n=0}^{\infty} [(n+2)(n+1) a_{n+2} - 3(n+1) a_{n+1} + 2a_n] x^n$$

$$y'' - 3y' + 2y = 0$$

$$a_{n+2} = \frac{3}{n+2} a_{n+1} - \frac{2}{(n+1)(n+2)} a_n \quad (n \geq 0)$$

$$a_2 = \frac{3}{2} a_1 - a_0, \quad a_3 = a_2 - \frac{1}{3} a_1 = \frac{7}{6} a_1 - a_0 + \dots$$

$$y = a_0 + a_1 x + \left(\frac{3}{2} a_1 - a_0\right) x^2 + \left(\frac{7}{6} a_1 - a_0\right) x^3 + \dots$$