Hw 3

Qornain Aji
21/481767/TK/53170

- Consider 2^{nd} order homogeneous linear diff eq:

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

a) $y = e^{x}$, $y = e^{2x}$, $y = e^{-3x}$, $y = e^{-4x}$

Independencies tes, it shows that:

$$\frac{e^{x}}{e^{2x}} = \frac{1}{e^{2x}} \; ; \; \frac{e^{x}}{e^{-3x}} = e^{4x} \; ; \; \frac{e^{x}}{e^{-4x}} = e^{5x} \; ;$$

$$\frac{e^{2x}}{e^{-3x}} = e^{5x} \; ; \; \frac{e^{2x}}{e^{-4x}} = e^{6x} \; ; \; \frac{e^{-3x}}{e^{-4x}} = e^{x}$$

all of the ratio is non - constant. We can contiñue for inserting the posible answer into the equation. The only solution that are possible only two solutions.

b) $y = e^{x}$; $\frac{dy}{dx} = e^{x}$; $\frac{d^2y}{dx} = e^{x}$

$$\frac{d^2y}{dx^2} + 2\frac{dy}{dx} - 3y = e^{x} + 2(e^{x}) - 3e^{x} = 0 \quad \text{proved}$$

so $y = e^{x}$ is one of two solution's.

Let me take $y = e^{-3x}$

$y = e^{-3x}$; $\frac{dy}{dx} = -3e^{-3x}$; $\frac{d^2y}{dx^2} = 9e^{-3x}$

Let's substitute into the equation:

$$\frac{d^2y}{dx^2} + 2\frac{dy}{dx} - 3y = 9e^{-3x} + 2(-3e^{-3x}) - 3e^{-3x}$$

$$= 9e^{-3x} - 6e^{-3x} - 3e^{-3x}$$

$$= 0 \text{ // proved}$$

So, $y = e^{-3x}$ is also proved to be the last possible solutions.

b) Write down the general solution in the form of

$y(x) = c_1 y_1(x) + c_2 y_2(x)$

$= c_1 e^{x} + c_2 e^{-3x}$ //

c) Find the value of c_1 and c_2 if the condition of the initial values is : $y(0) = 0$

$\frac{dy}{dx}(0) = 8$

o) $y(0) = c_1 + c_2 = 0$

Using eliminations.

o) $\frac{dy(x)}{dx} = c_1 e^{x} - 3c_2 e^{-3x}$

$\frac{dy(0)}{dx} = c_1 - 3c_2 = 8$

$c_1 + c_2 = 0$ ----(i)

$c_1 - 3c_2 = 8$ ---- (ii)

$$\begin{array}{r} 3c_1 + 3c_2 = 0 \\ c_1 - 3c_2 = 8 \\ \hline 4c_1 \quad = 8 \end{array} \; +$$

$c_1 = 2$

$c_1 - 3c_2 = 8 = 2 - 3c_2$

$6 = -3c_2$

$-2 = c_2$ //

The value of c_1 and c_2 is $c_1 = 2$ & $c_2 = -2$ //