1 Problems submitted by Sohyun Kim

1.1 Problem 1

a) $y' - 2y = 0$

$$\begin{aligned} y' - 2y &= 0 \\ Ne^{Nx} - 2e^{Nx} &= 0 \\ Ne^{Nx} &= 2e^{Nx} \\ N &= 2 \end{aligned}$$

Therefore $N = 2$.

b) $y'' + 4y = 0$

$$\begin{aligned} y'' + 4y &= 0 \\ N^2e^{Nx} + 4e^{Nx} &= 0 \\ N^2e^{Nx} &= -4e^{Nx} \\ N^2 &= -4 \end{aligned}$$

Since $N^2 >= 0$, there are no such N's.

1.2 Problem 2

a) First we shall find the derivatives of y.

$$\begin{aligned} y &= Ncos(2x) + x \\ y' &= -2Nsin(2x) + 1 \\ y'' &= -4Ncos(2x) \end{aligned}$$

Next we shall check if y is a solution.

$$\begin{aligned} &y'' + 4y \\ &= -4Ncos(2x) + 4(Ncos(2x) + x) \\ &= -4Ncos(2x) + 4Ncos(2x) + 4x \\ &= 4x \\ &= RHS \end{aligned}$$

Therefore, y is a solution.

b)

$$\begin{aligned} y'(x) &= -2Nsin(2x) + 1 \\ y'(0) &= -2Nsin(0) + 1 \\ 2 &= -2Nsin(0) + 1 \\ 2 &= -2N0 + 1 \\ 2 &= 1 \end{aligned}$$

Therefore, there are no possible solutions.

c) Linear, as it can be written in the form $a_n(x)y^{(n)}(x) + a_{n-1}(x)y^{(n-1)}(x) + ... + a_0(x)y(t) = g(x)$. Where $n = 2$, $a_2 = 1$, $a_1 = 4$, $a_0 = 0$, and $g(x) = 4x$.