Department of Mathematics and Natural Sciences

MAT 350

ONLINE ASSIGNMENT 3

FALL 2023

1. Solve the following BVP in $[1, 2]$ and plot the solution using MATHEMATICA.

$$x^2 \frac{d^2 y}{dx^2} - 5x \frac{dy}{dx} + 8y = 0, \ y(1) = 0, y(2) = 24.$$

2. A thin bar located on the x axis has its ends at $x = 0$ and $x = 2$. The initial temperature of the bar is $f(x)$, $0 < x < L$, and the ends $x = 0, x = 2$ are maintained at constant temperatures 0 and T respectively. Assuming the surrounding medium is at temperature u_0 and that Newton's law of cooling applies, the partial differential equation for the temperature of the bar at any point at any time is given by $\dfrac{\partial u}{\partial t} = k \dfrac{\partial^2 u}{\partial x^2} - \beta(u - u_0)$. Consider $\beta = 1$. Determine the initial condition and the boundary conditions. Write a MATHEMATICA code to solve the BVP and then plot the solution using Manipulate command for varying values of u_0 and T for

   (a) $f(x) = x^2$
   (b) $f(x) = \sin \pi x$