Practice Questions

Question 1

Solving diff equation using matlab command 'dsolve' and find the minimum value from the plot.

$$\frac{\partial^2 y}{\partial x^2} + 2\frac{\partial y}{\partial x} = e^x, y(0) = 1, y'(0) = 0$$

Answer: Use Matlab

Question 2

A system is described by $\frac{dy}{dx} = 1 + xy$ for an application under investigation. Find the solution behavior of the system in matlab using ode45 between (-2,2) with initial conditions between (-1 ,1). Show the plots of the direction field and solutions.

Answer: Use Matlab

Question 3

Given the following Rosenbrock's banana function:

$$f(x,y) = (1-x)^2 + 100(y-x^2)^2$$

a. Plot the function (Use meshgrid, surf commands)
b. Find the minimum for function (Use fminsearch command)

Answer: Use Matlab

Question 4

Solve $\frac{\partial^2 u}{\partial x \partial y} = 8e^y \sin 2x$ given that at $y = 0$, $\frac{\partial u}{\partial x} = \sin x$, and at $x = \frac{\pi}{2}$, $u = 2y^2$

Answer:

Question 5

An elastic string is stretched between two points 40 cm apart. Its centre point is displaced 1.5 cm from its position of rest at right-angles to the original direction of the string and then released with zero velocity. Determine the subsequent motion u(x, t) by applying the wave equation:

$$\frac{\partial^2 u}{\partial x^2} = \frac{1}{c^2}\frac{\partial^2 u}{\partial t^2} \text{ with } c^2 = 9$$

Answer:

Question 6

A metal bar, insulated along its sides, is 4 m long. It is initially at a temperature of 10°C and at time t = 0, the ends are placed into ice at 0°C. Find an expression for the temperature at a point P at a distance x m from one end at any time t seconds after t = 0

Answer: