Math 204

Due Date: Saturday 24.12.1429

Homework Assignment 03

Question No.1. Find the orthogonal trajectories of the family of curves

\[ y = ce^{-\frac{x^2}{2}} \]

Question No.2. If the growth rate of culture of bacteria is proportional to the number of bacteria present and after one day it increases to three times the original number. Find within what interval of time will be number of bacteria (a) double, (b) triple?

Question No.3. A metal bar whose temperature is 30\(^\circ\)C is dropped in boiling water. How long it take to heat the bar to 95\(^\circ\)C, if temperature of the bar after 2 minutes is 50\(^\circ\)C? What will be the temperature of bar after 10 minutes?

Question No.4.

(i) By applying Kirchhoff's law to a circuit we obtain the differential equation

\[ 4 \frac{d^2 I}{dt^2} - 4 \frac{dI}{dt} - 5I = 0 \]

Where I is current and t is time, find Current I when

\[ t = 0, \quad I = 0 \quad \text{and} \quad \frac{dI}{dt} = 3. \]

(ii) Solve the boundary value problem

\[ y'' - 2y' + 2y = 0, \quad y(0) = 1, y(\pi) = 1. \]

(iii) Solve the differential equation

\[ \frac{d^4 y}{dx^4} - 20 \frac{d^2 y}{dx^2} + 4y = 0. \]

Question No.5. Find the third order differential equation for which the general solution is

\[ y = c_1 e^x + e^{-2x} \left[ c_2 \cos 3x + c_3 \sin 3x \right] \]