### Important Note

Show all work.  
Use of programmable calculator is not allowed.  
Mobiles and paging devices should not be carried during examination.

Instructor: F. D. Zaman
Q1) Solve the following differential equations by the indicated method:

(a) \( \sin x (e^{2y} - y) \frac{dy}{dx} = e^y \cos x \) (separation of variables)
Q 1)(b) \( (x^2 - 1) \frac{dy}{dx} + 2xy = 3x, \quad y(0) = 1. \) (linear differential equation) (3)
Q2) Reduce the following to a DE with homogeneous coefficients and solve
\[
\frac{dy}{dx} = \frac{x - y + 1}{x + y}
\]
Q 3) Solve the following problem

\[ x^2 \frac{dy}{dx} - 2xy = 3y^4, \ y(1) = 1. \]
Q 4) Solve the system of equations

\[
\begin{align*}
    x_1 + x_4 &= 3 \\
    2x_2 + x_3 &= 5 \\
    4x_1 - 2x_3 &= 6 \\
    2x_1 + 2x_2 - x_3 - 2x_4 &= 5
\end{align*}
\]}
Q5) Show that the following system has no solution. 
\begin{align*}
5x_1 &+ 2x_2 + 18x_3 = 2 \\
x_2 &+ 4x_3 = 4 \\
4x_1 &+ x_2 + 12x_3 = 1
\end{align*}