1. Solve the equation \( xy' + 2y = e^x \), \( y(1) = 0 \),
   (a) the general solution
   (b) the particular solution?

2. Solve the equation (using the separating variables method)
   \( y' + \frac{1}{x} y^2 = x y^2 \), \( y(1) = 1 \) (a) the general solution (b) the particular solution.

3. Find the solution of the following equation by the method of Laplace transform
   \( y'' + 2y' + y = te^{-t} \), \( y(0) = 1 \), \( y'(0) = -2 \)

4. Find the solution of the following equation by the method of Laplace transform
   \( y'' - y = t \), \( y(0) = 1 \), \( y'(0) = 1 \)

5. If \( A = \begin{bmatrix} 3 & -1 \\ 6 & 2 \end{bmatrix} \), \( B = \begin{bmatrix} 1 & 4 \\ -2 & 3 \end{bmatrix} \) find
   (a) the inverse of \( A \)? (b) the addition of \( A \) and \( B \).

6. The matrix \( A \) find
   (a) Eigen-values ?
   (b) Eigen-vector of matrix \( A \)?
   \[
   A = \begin{bmatrix}
   -2 & -2 & -3 \\
   2 & 1 & -6 \\
   -1 & -2 & 0
   \end{bmatrix}
   \]
7. Evaluate the integral \( \int C \nabla \phi \cdot d\vec{r} \), where \( \phi(x, y, z) \) function is \( \phi(x, y, z) = xy + yz + xz \), and the path \( c: x = \cos(t), \ y = \sin(t), \ z = t, \ 0 \leq t \leq \pi \).

8. Evaluate the integral \( \iint_S \vec{F} \cdot d\vec{A} \), where the surface is

\[ S: \ x^2 + y^2 + (z-1)^2 = 9, \ 1 \leq z \leq 4, \ z = 1 \text{ and } \vec{F} = [x, \ y, \ z-1] \]

9. Solve the Eigen value problems \( y'' + \lambda y = 0, \ y(0) = 0, \ y(L) = 0 \)
   (a) the Eigen values.
   (b) the Eigen functions.

10. The time function is \( f(t) = 1, \ 0 \leq t \leq \pi \).
    (a) Expand in Fourier sine series.
    (b) Sketch the function.