1. (10%)Find the general solution of the given differential equation

    $(y^2 + yx)\,dx - x^2 dy = 0$

2. (10%)Solve the given differential equation

    $y'' + 3y' + 2y = \sin e^x$

3. (10%)Use the LAPLACE Transform to solve the given initial value problem

    $y'' + 9y = e^t$ $y(0) = 0$ $y'(0) = 0$

4. (10%)Find the inverse of

    $A = \begin{bmatrix} 2 & 2 & 0 \\ -2 & 1 & 1 \\ 3 & 0 & 1 \end{bmatrix}$

5. (10%)Determine whether the given matrix A is diagonalizable. If so, find the matrix P that diagonalizes A and the diagonal matrix D such that $D = P^{-1}AP$

    $A = \begin{bmatrix} 1 & -1 & 1 \\ 0 & 1 & 0 \\ 1 & -1 & 1 \end{bmatrix}$

6. (10%)Find the curl and divergence of the given vector field

    $\vec{F}(x,y,z) = yz \ln x\,\vec{i} + (2x - 3yz)\vec{j} + xy^2 z^3 \vec{k}$

7. (10%)Verify stokes' theorem. Assume that the surface S is oriented upward

    $\vec{F} = 5y\vec{i} - 5x\vec{j} + 3\vec{k}$; S that portion of the plane z=1 within the cylinder

    $x^2 + y^2 = 4$

8. (10%)Expand the given function in an approximate cosine or sine series

    $f(x) = x^2$ $-1 < x < 1$

9. (10%)Determine whether the four points

    $P_1(1,1,-2)\ P_2(4,0,-3)\ P_3(1,-5,10)\ P_4(-7,2,4)$ lie in the same plane

10. (10%)Compute all roots

    $(-1 - \sqrt{3}\,i)^{\frac{1}{4}}$