1. Solve all solutions of the following differential equations, including initial values.

    (1). $y' - y/x = y^3/x^4, y(1) = 1$ (10%)

    (2). $4xydx + (2x^2 + 3y^2 + 20)dy = 0, y(1) = 1$ (10%)

    (3). $y'' + 9y' + 20y = te^{-t}, y(0) = 0, y'(0) = 0$ (10%)

    (4). $y' + 5y = t^2[u(t) - u(t-1)], y(0) = 0$ (10%)

    (5). $y' - \int_0^t e^{-\tau} y(t-\tau)d\tau = \cos t, y(0) = 0$ (10%)

2. The square matrix A is as follows.

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

    Solve the following values

    (1). three eigenvalues (6%),

    (2). thee eigenvectors corresponding to three eigenvales (6%),

    (3). its inverse A^{-1} (6%),

    (4). its determination det(A) (6%),

    (5). three eigenvalues of inverse A^{-1} (6%).

3. Solve the following integral values.

    (1). $\oint_C (\dfrac{ze^{\pi z}}{z^2 - 1} + 2ze^{\pi/z})dz$,   counterclockwise around the circle $C: x^2 + 9y^2 = 9$. (10%)

    (2). $pr.v.\int_{-\infty}^{\infty} \dfrac{1}{(x-i)(x-1)^2} dx$. (10%)