

20% 1. Solve the differential equation

$$2xyy' + 3y^2 + 4x = 0$$

20% 2. Find the eigenvalues and eigenvectors of the following matrix.

$$\begin{bmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{bmatrix}$$

20% 3. Solve the differential equation by Frobenius method.

$$(1-x^2)y'' - 2xy' + \lambda y = 0$$

obtain the condition for λ to get polynomials ~~sols~~ solutions.

20% 4. Suppose that $f(x)$ and $g(x)$ are piecewise continuous, bounded, and absolutely integrable on the x -axis. Suppose that their Fourier Transforms are $F(f)$ and $F(g)$ respectively. Obtain the Fourier Transform of the function

$$\int_{-\infty}^{\infty} f(p)g(x-p)dp$$

20% 5. Evaluate the integral

$$I = \int_{-\infty}^{\infty} \frac{x^2-1}{x^4-5x^2+4} dx$$