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1. Solve the ODE (20%)

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$$y^2 dx - (1 - 2xy) dy = 0$$

2. Solve the nonhomogenous Euler-Cauchy Equation (20%)

$$xy'' - \frac{2}{x}y = 1$$

3. Using the Gauss elimination solve the system (20%)

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$$\begin{bmatrix} 4 & 0 & -3 & 1 \\ 1 & 1 & 1 & 0 \\ 3 & 1 & -1 & 1 \\ 0 & -2 & 1 & 4 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \end{bmatrix} = \begin{bmatrix} -6 \\ 6 \\ 1 \\ -5 \end{bmatrix}$$

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4. Find the eigenvalues and the corresponding eigenvectors of A. (20%)

$$A = \begin{bmatrix} 1 & 0 & 4 \\ 3 & 2 & 3 \\ 4 & 0 & 1 \end{bmatrix}$$

5. If $L[f'(t)] = SF(S) - f(0)$.

Using the Laplace transform to find the $L[f(t)]$. (20%)

$$f(t) = \cos^2 t$$

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