1. Solve the given differential equation by separation of variables.

(20%)

$$x\frac{dy}{dx} = 4y$$

2. Find the general solution of the given second-order differential equation.

(20%)

$$y'' - 3y' + 2y = 0$$

3. Solve the given differential equation by variation of parameters.(20%)

$$y'' - \frac{3}{x}y' + \frac{3}{x^2}y = 2x^2 e^x$$

4. Find the eigenvalues and eigenvectors of

$$A = \begin{pmatrix} 1 & 2 & 1 \\ 6 & -1 & 0 \\ -1 & -2 & -1 \end{pmatrix}$$

(20%)

5. Use Green's theorem to evaluate the given line integral

$$\oint_C (x^5 + 3y)dx + (2x - e^{y^3})dy,$$

where C is the circle $(x-1)^2 + (y-5)^2 = 4$.　(20%)