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1. The equation is given as Created by Unregistered Version

$$(y + xy)dx + x dy = 0$$

- (1) Find the integrating factor of the equation. (10%)
(2) Find the general solution of the equation. (10%)

2. Solve the non-homogeneous ODE (20%)

$$y'' + 2y' - 3y = e^x + 2$$

3. The matrix $A = \begin{bmatrix} 5 & 2 & 6 & 1 \\ 1 & 1 & -3 & 0 \\ 4 & 1 & 1 & -2 \\ 2 & 0 & 3 & 0 \end{bmatrix}$ UNREGISTERED
Created by Unregistered Version Find the (a) determinant $|A|$ (12%) and (b) Rank(A) (3%)

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

- (1) Find A^{-1} (5%)
(2) Find the eigenvalues and the corresponding eigenvectors of A. (10%)
(3) Find two nonsingular matrices Q and P such that QAP is a diagonal matrix (對角化矩陣). (5%)

5. Use the Laplace transform to find the solution. (15%)

$$y'' - 3y' - 4y = 1 \quad y(0) = 0, y'(0) = 0$$

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6. For the partial differential equation

$$\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2} ; u(0,t) = u(\pi,t) = 0 ; u(x,0) = 10 \sin x$$

Find the solution. (10%)