1. If \( A = \begin{bmatrix} 1 & x & z \\ 0 & 1 & y \\ 0 & 0 & 1 \end{bmatrix} \) and \( A^2 + \begin{bmatrix} 0 & -1 & 0 \\ 0 & 0 & -1 \\ 0 & 0 & 0 \end{bmatrix} = I_3 \), then find the sum \( x + y + z \).
2. Find $N(x, y)$ that makes the given DE exact $(\cos x \sin x - \frac{(\ln x)y^2}{x^2})dx + N(x, y)dy = 0$. 
3. Solve the initial value problem

\[ xy' + 5y = 7x^2, \quad y(2) = 5 \]
4. Use Gauss-Jordan method to solve the homogeneous linear system

\[
\begin{align*}
4x_1 + x_3 - x_5 - 10x_6 &= 0 \\
2x_2 - 3x_3 - 2x_4 - 10x_5 + 6x_6 &= 0 \\
x_1 + 2x_2 - 2x_4 - 2x_5 - 2x_6 &= 0
\end{align*}
\]
5. Find a suitable substitution for each of the following differential equations and then identify the resulting equation (DO NOT SOLVE IT).

(a) \( x(x + y) \frac{dy}{dx} + y(3x + y) = 0. \)
(b) \( y'' = y'(1 + y'). \)
(c) \( 3 \frac{dy}{dx} = 2y + e^{-x}y^{-2}. \)
6. (Extra 10pts) A thermometer reading 70°F is placed in an oven preheated to a constant temperature. If the thermometer reads 100°F after 1/2 a minute and 145°F after 1 minute, then how hot is the oven?