Directions: Work all six questions. Hand in any scratch work that you want graded. Answers with no supporting explanation will receive no credit.

1. Find the general solution of the equation
\[ \left( \frac{y}{x} + 6x \right) \, dx + (\ln x - 2) \, dy = 0, \quad x > 0. \]

2. Solve the initial value problem
\[ y' = \frac{e^{-x} - e^x}{3 + 4y}, \quad y(0) = 1. \]

3. Solve the initial value problem
\[ x' = \begin{bmatrix} 5 & -1 \\ 3 & 1 \end{bmatrix} x, \quad x(0) = \begin{bmatrix} 2 \\ -1 \end{bmatrix}. \]

4. Find the general solution of the equation
\[ y^{(6)} - y'' = 0. \]

5. Find the general solution of the equation
\[ y'' + 4y = 3 \sin 2t. \]

6. You are given that the 2 × 2 matrix \( A \) has eigenvalues 1 and \(-2\), an eigenvector corresponding to 1 is
\[ \begin{bmatrix} 1 \\ 2 \end{bmatrix}, \]
and an eigenvector corresponding to \(-2\) is
\[ \begin{bmatrix} 5 \\ 1 \end{bmatrix}. \]

Compute \( e^{At} \).