1. Compute the rank of the following matrix and decide whether it is invertible. If so, find its inverse: 
\[ A = \begin{bmatrix} 1 & 1 & -1 \\ 1 & -1 & 2 \\ 1 & 2 & 0 \end{bmatrix}. \]

2. Find the least square solution to \( Ax = b \), where 
\[ A = \begin{bmatrix} 1 & 1 & 2 \\ 1 & 0 & 1 \\ 0 & 1 & 1 \end{bmatrix} \] and 
\[ b = \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}. \]

3. Consider the system of equations
\[
\begin{align*}
x - 2y + az &= 2 \\
x + y + z &= 0 \\
3y + z &= 2.
\end{align*}
\]
For which values of \( a \), if any, does this system have (a) a unique solution? (b) no solution? (c) infinitely many solutions?

4. Find the interval of convergence of 
\[ \sum\frac{1}{k}x^k. \]

Each problem is worth 25pts.