1. Find a polynomial \( f(x) \) which has the same values as \( g(x) = \frac{120}{x} \) for \( x = 1, 2, 3, 4, 5 \).
   (That is, we need \( f(1) = 120, f(2) = 60, \) etc.)

2. Suppose \( A \) and \( B \) are square matrices of the same size, and that \( ABABA = I \).
   (a) Explain why \( A \) is invertible.
   (b) Show that \( AB = BA \).

3. The exponential function is defined for square matrices \( A \) by the usual power series:
   \[
   e^A = I + A + \frac{1}{2} A^2 + \ldots = \sum_{n=0}^{\infty} \frac{1}{n!} A^n
   \]
   Compute \( e^A \) when \( A = \begin{pmatrix} 1 & 1 \\ -2 & 4 \end{pmatrix} \).

4. A linear transformation \( L : \mathbf{R}^n \to \mathbf{R}^n \) is called a projection if \( L(L(v)) = L(v) \) for each \( v \in \mathbf{R}^n \). For example the function \( L(x, y, z) = (2y + 3z, y, z) \) is a projection in \( \mathbf{R}^3 \).
   Show that the only possible eigenvalues of a projection \( L \) are 0 and 1.

5. Find an invertible matrix \( P \) for which \( PAP^{-1} = B \) where
   \[
   A = \begin{pmatrix} 1 & 2018 \\ 0 & 1 \end{pmatrix} \quad \text{and} \quad B = \begin{pmatrix} 1 & 41 \\ 0 & 1 \end{pmatrix}
   \]