Computational Physics Assignment 2: Numerical Errors

The exponential function e^x can be calculated using the Maclaurin series

$$e^x = \sum_{n=0}^{\infty} \frac{x^n}{n!} \tag{1}$$

(a) Starting with $n = 0$, add terms one at a time to estimate the function e^x at $x = 1$.

(b) After each term is added, compute the true relative error. Make a plot of the error as a function of the number of terms in series (1).

(Hint: calculate the true error by subtracting the value of the truncated series (1) from the true value $e = 2.71828182845904523536028 74\ldots$.)

(c) How many terms need to be included in the sum (1) in order to reach a precision of 10^{-15}?

(d) How the error behaves when you add more terms in the sum (1) after you reach the precision of 10^{-15}? Explain this behavior.

(e) Repeat **(a)-(d)** for $x = 2$. How do the results change? Explain.

(f) Repeat **(a)-(d)** for $x = 10$. How do the results change? Explain.