Math 342 Workshop - Taylor Polynomials **Name:** ________________

1. Write a Python program to find and sum the terms of the 20th degree Maclaurin polynomial to approximate e^6. Instead of writing a for-loop, I recommend using a **generator expression**:

   $$(\textit{expression}\ \textbf{for}\ \textit{item}\ \textbf{in}\ \textit{iterable}).$$

   For example, the code below would estimate e^1 using a 9th degree Maclaurin polynomial:

   ```
   from math import *
   sum(1/factorial(n) for n in range(10))
   ```

2. Use the `exp` function in the Python math library to find the "exact" value of e^6. Compare this with your approximation. What is the relative error in your approximation?

3. Adjust your program to find the 20th degree Maclaurin polynomial approximation for e^{-6}.

4. Compare your answer to the actual value of e^{-6}. What is the relative error?

5. The Maclaurin polynomial of degree $2n+1$ for $\sin x$ is

$$P_{2n+1}(x) = \sum_{k=0}^{n} (-1)^n \frac{x^{2k+1}}{(2k+1)!}.$$

(a) Write a Python function to evaluate the 21st degree Maclaurin polynomial for $\sin x$ and use it to approximate $\sin(4\pi)$. What do you get?

(b) What is $\sin(4\pi)$ according to Python (using the `sin()` function and `pi` from the `math` library)?

(c) What is the actual value of $\sin(4\pi)$ without using a computer?

6. Use the Maclaurin series for $\cos x$ to find the Maclaurin series for $\cos\sqrt{x}$. Then integrate to find the Maclaurin series for $\displaystyle\int \cos\sqrt{x}\,dx$.

7. Use Python to approximate $\displaystyle\int_0^1 \cos\sqrt{x}\,dx$.