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

One way to compute Taylor polynomials in Python is to use a **generator expression**:

(*expression* **for** *item* **in** *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))
```

1. What is the 20th degree Maclaurin polynomial approximation of e^6? Use 5 significant digits to write your answer here and in the following exercises.

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

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

4. What is the relative error in your approximation of e^{-6}?

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

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

   (a) Write a Python expression 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 $\cos\sqrt{x}$ with pencil and paper. Then integrate to find the Maclaurin series for $\displaystyle\int \cos\sqrt{x}\,dx$.

7. Use Python to approximate $\displaystyle\int_0^1 \cos\sqrt{x}\,dx$ with a 20th degree polynomial.