CHE290 Programming for Chemical Engineers
Day 5 Practice Problem Statements

Program descriptions

1. The value of *exp(x)* can be calculated using the following equation:

$$\exp(x) = \sum_{n=0}^{\infty} \frac{x^n}{n!}$$

Complete the function `my_exp()` according to the description provided in the TODO.

- Test your code first using `test_my_exp_1()` for a large tolerance.
  - This test provides an example of how you can write tests for loops by performing a hand calculation for a few iterations as a check.
- Once you have passed the first set of tests, run the 2nd test function, `test_my_exp_2()`.
  - The second test is then used to compare the fully implemented function against an accepted value.

2. Edmond Halley (the astronomer famous for Halley's comet) invented a fast algorithm for computer the square root of a number, A. Halley's algorithm approximates $\sqrt{A}$ as follows:

Start with an initial guess, x_1. The new approximation is then given by:

$$y_n = \frac{1}{A} x_n^2$$

$$x_{n+1} = \frac{x_n}{8}\left[15 - y_n\left(10 - 3y_n\right)\right]$$

These two calculations are repeated until the following is true:

$$\left|x_{n+1} - x_n\right| \le \varepsilon$$

Complete the function `my_sqrt()` that approximates the square root of a number. The function should have `A` as an input and the result of the calculation as an output. Once you have completed the function, test your code using `test_my_sqrt()`.

NOTES:

- For the initial guess, use $x_1 = 1$ for $A \ge 1$ and $x_1 = \frac{A}{2}$ for $A < 1$.
- For the tolerance, use $\varepsilon = 10^{-8}$.