Problem set 2

1. Create an `ndarray` representing the following vector

$$\mathbf{x} = (1.0, 1.1, 1.0, 0.0, 33.0).$$

   - Write code which evaluates $\mathbf{y} = \mathbf{x} + 16.0$.
   - Write code which evaluates the following expression

$$\alpha = \sqrt{\sum_{i=1}^{5} \sqrt{x_i}}$$

     Print the answer in expoential notation showing 6 digits after the decimal point.

2. Write a Python function which takes N as an input, computes the factorial of N and returns the result.

   - Test your function using
     - $N = 7$
     - $N = 0$
     - $N = -2$
   - Write a better version of your factorial function which checks that n is an integer, and that $n >= 0$. In the event that n is not valid for use in your factorial function, force your function to report an appropriate error.

3. Consider the following mathematical function (from Problem set 1)

$$f(x) = \frac{\exp(x)}{(\cos(x))^3 + (\sin(x))^3}$$

   Write a Python function which evaluates $f(x)$ and returns the result. Make your Python function work with NumPy's `ndarray` objects. That is, the input should be an `ndarray` and the output should be an `ndarray`.

4. You are given two vectors, $\mathbf{x} \in \mathbb{R}^N, \mathbf{y} \in \mathbb{R}^N$

Write a Python function which evaluates the l_2 error between two vectors via:

$$E = \sqrt{\frac{1}{N}\sum_{i=1}^{N}(x_i - y_i)^2}.$$

Your function should have two arguments $\mathbf{x}, \mathbf{y}$ and return E.

- Test your function using the vectors

$$x = (1.00012, 3.003, 7.0023),$$

$$x_e = (1.0, 3.0, 7.0).$$