1. Show that the inner product, \((x,y)=\sum_{i=1}^{n} \xi_i \bar{\eta}_i\) satisfies the requirements of
   a. Conjugate symmetry
   b. Linearity
   c. Positiveness

   and thus is a suitable inner product.

2. Show that the weighted inner product, \((x,y)=\sum_{i=1}^{n} \xi_i w_i \bar{\eta}_i\) satisfies the requirements of
   a. Conjugate symmetry
   b. Linearity
   c. Positiveness

   and thus is a suitable inner product. Be sure to state any restrictions on \(w\).

3. Show that the Euclidean norm \(\|x\| = \sqrt{\sum_{i=1}^{n} |\xi_i|^2}\), satisfies
   a. Scalar multiplication, i.e. \(\|\alpha x\| = |\alpha| \|x\|\)
   b. Positiveness
   c. Triangle inequality

4. Linear regression:

   Use theory or "experiment" (i.e., numerical experiment) to determine how the error in
   typical fit coefficients scales with

   a. the number of points in the sample.
      Does is matter how they are distributed over the interval?

   b. The "noise" or uncertainty in the measurements.

   You will need to define the problem clearly before you can answer a and b.