Show your work!

1) Suppose $N = 9$ students make the following measurements of the length of the classroom in meters:
   5.056; 5.012; 5.084; 5.011; 5.113; 5.062; 5.099; 5.044; 5.055
   Calculate the mean, standard deviation, and standard deviation of the mean for this sample distribution. Please do this by hand, rather than using software which automatically gives the values (and may be incorrect!)

2) You want to estimate the energy $E$ stored in a capacitor, using the relation $E = \frac{1}{2}CV^2$ where $C$ is the capacitance, and $V$ the voltage across the capacitor. You measure the voltage across the capacitor to be 1.584 V with 0.7 % error, and the capacitor has a nominal value of 100 pF, with a 1.0 % error.
   2A) What is the energy stored in the capacitor?
   2B) What is your uncertainty in the energy?
   2C) Which error, voltage or capacitance, contributes most to the uncertainty?

3) What does this script do?
   ```matlab
   clear;
   vals=1:10;
   for ii=vals;
   v(ii)=rand;
   x(ii)=ii;
   pause(1);
   plot(x,v);
   end
   ```
   How would you achieve the same output with a one-line command?

4) MATLAB can be used for calculations other than data acquisition and statistical analysis. For instance, it can be used for “Monte-Carlo” calculations, which are especially useful for evaluating multidimensional integrals: Imagine that despite your ability to easily evaluate a function describing a closed surface, integrating it cannot be done analytically. The Monte-Carlo technique would be to simply draw rectangular bounds along all dimensions, and uniformly sample the (known) interior volume, counting only the points which fall inside the boundary of integration. Then, the integral is simply the sum of the samples, normalized by the total number of sample points. Write a MATLAB script to evaluate the volume of a sphere of known radius using this Monte-Carlo method. Compare this to the analytic solution, and extract a calculated value for $\pi$. What happens as the number of sample points increases?