

## Homework One: Problem Three

5 Points: Solve the following exercises and submit your answers in a pdf file using any formatting (+2 points for using LATEX formatting):

- What are the approximate absolute and relative errors in approximating  $\pi$  by each of the following quantities (**Absolute error** = approximate value - true value and **Relative error** = (approximate value - true value)/true value)?

(a) 3

$$\text{Absolute error} = (3 - \pi) = -0.1415926535897932384626433832795$$

$$\text{Relative error} = (3 - \pi)/\pi = -0.04507034144862798538669741976491$$

(b) 3.14

$$\text{Absolute error} = (3.14 - \pi) = -0.0015926535897932384626433832795$$

$$\text{Relative error} = (3.14 - \pi)/\pi = -5.0695738289729137140996602060981e-4$$

(c) 22/7

$$\text{Absolute error} = ((22/7) - \pi) = 0.00126448926734961868021375957764$$

$$\text{Relative error} = ((22/7) - \pi)/\pi = 4.0249943477068197584079834151885e-4$$

- Consider the problem of evaluating the function  $\sin(x)$ , in particular, the propagated data error, i.e., the error in the function value due to a perturbation  $h$  in the argument  $x$ .

(a) Estimate the absolute error in evaluating  $\sin(x)$

$$\text{Absolute error} = \text{DON'T UNDERSTAND HOW TO FIGURE THIS OUT}$$

(b) Estimate the relative error in evaluating  $\sin(x)$

$$\text{Relative error} = \text{DON'T UNDERSTAND HOW TO FIGURE THIS OUT}$$

(c) Estimate the condition number for this problem.

$$\text{Condition number} = (\sin(x+h) - \sin(x))/\sin(x) / ((x+h) - x/x)$$

(d) For what values of the argument  $x$  is this problem highly sensitive?

$$\text{If you look at the graph for } \sin(x) \text{ you find curve peaks at } \dots, -2\pi, -\pi, 0, \pi, 2\pi, \dots \text{ and this is where it's highly sensitive as the derivative changes drastically } \dots$$