LAB 2

Variables, Equations, and Error in Python

2.1 Bizarre Behavior

Enter the following code into python and explain why you do not get what you might expect as the result:

```
>>> d = 8
>>> e = 2
>>> from math import *
>>> sqrt(d ** e)
```

2.2 Heron's Formula

Heron's formula gives the area, *A* of a triangle with sides *a*, *b*, *c* as:

$$A = \sqrt{s(s-a)(s-b)(s-c)} \text{ , where } s = \frac{1}{2}(a+b+c).$$

Write a simple python code to evaluate the area *A* of a triangle for user input values of *a*, *b*, and *c*. Format your output so that the answer is displayed to three decimal places. Use your code to compute *A* using the values *a* = 4.503, *b* = 2.377, and *c* = 3.902. Further test your code by choosing your own values of *a*, *b*, and *c* and computing *A*.

2.3 Surface Area of the Earth

Due to its rotation, the Earth does not have a perfectly spherical shape. Rather, it is more an oblate spheroid. The World Geodetic System is a set of standards for describing the shape of the Earth. In the latest revision, the Earth's geoid is approximated to a reference ellipsoid that takes the form of an oblate spheroid with semi-major and semi-minor axes *a* = 6378137.0 meters and *c* = 6356752.314245 meters, respectively. The formula for the surface area of this oblate spheroid is given by the equation:

$$S_{obl} = 2\pi a^2 \left[1 + \left(\frac{1-e^2}{e}\right)\text{atanh}(e)\right], \text{ where } e^2 = 1 - \frac{c^2}{a^2}.$$

a) Write a python program to compute the surface area of the Earth, S_{obl}, using the above given values of *a* and *c*. Be sure to use formatted output with an appropriate number of significant figures.

b) Now, write a second simple program that computes the surface area of the Earth assuming that the Earth is a perfect sphere with a radius of 6371 km.

c) Finally, compute the *relative error* between the two values you calculated in parts a) and b).