

Phys 256 — Homework 1

Student Name _____

Instructions

- Write your solutions clearly and show all steps.
- Code should be included in a `python` listing block similar to listing 1 and listing 2
- Listings should be labeled as in examples provided in listing 1 and listing 2
- you should mention listings and figures in the text unless they appear exactly in the context of the sentence, i.e. “have a look at listing 2” is good and “have a look at listing below” is bad (especially when there are several possible listings to look at). If you use L^AT_EX, it can place a listing or a figure at the arbitrary location.
- Submit PDF file along with your source files (if it is required).

Extra information

We are basically learning to use Python as a calculator. Because math functionality was afterthought in Python, many math functions are implemented in additional modules. The standard way to get access to them would be through loading `math` module with `import` command. See how to calculate an exponential function in listing 1.

```
1 >>> import math
2 >>> math.exp(2)
3 7.38905609893065
```

Listing 1: Example of `math` module use

i.e. you would have to prepped function name with `math.` to be able to use it. You can get similar result via use of `numpy` module (as shown in listing 2), but the outcome might look a bit cryptic.

```
1 >>> import numpy
2 >>> numpy.exp(2)
3 np.float64(7.38905609893065)
```

Listing 2: Example of `numpy` module use

Problem 1: (2 points)

Find the value of the expression

$$(3.2)^4 - 1 + \ln(3)$$

where $\ln$ is the natural logarithm (use `log` in Python).

Problem 2: (1 points)

Which units are expected by trigonometric functions (`sin`, `cos`, `tan`) in Python is it degree, radians, steradian, or gradian. Prove it with examples.

Problem 3: (1 points)

What variable name should you type to get numerical π representation?

Problem 4: (2 points)

Find the value of the expression

$$\sin(2\pi + \pi/3) + \tan(\pi/8)$$

Problem 5: (2 points)

Find the value of the expression

$$e^{\sin(\pi/4)} - \log_{10}(25)$$

Use `exp` for exponent function and `log10` for logarithm to the base of 10.

Problem 6: (2 points)

Find the value of the expression

$$\cos^2(\pi/3)$$

Notice that human/mathematical notation is quite different from what Python is expecting.

Problem 7: (4 points)

Find the largest number x (one significant digit is enough) such that the numerical evaluation of expression

$$(1 + x) - 1$$

equals to zero. The value of x gives you an estimate of the relative uncertainty of your calculations with Python, try to keep it in mind when you do calculations. Note that x is actually rather small.

Problem 8: (3 points)

Find the value of the expression

$$100 \times (1/7 + 10^{-22}) - 100/7$$

Algebraically you should get 10^{-20} , but outcome is much larger. Explain it.

Problem 9: (3 points)

Find the numerical value of the expression

$$10^{16} + 1 - 10^{16}$$

with Python. Algebraically you should get 1. If your result is not 1, please, explain.