

Physics 262 Early Universe Cosmology

Homework 0

For the 2021 class, this is not an assigned HW. But it is a recommended starting point for students who want to warm up their programming skills and/or consider switching to Matlab for this class.

NOTES

CODING: This course will require you to write computer code. You will evaluate formulae, plot results, solve some simple differential equations and probably find the minimum of a multivariable function or two. This “HW0” was assigned in earlier years (but not in 2021) to make sure students had figured out how to start using these tools for the class. Also, following HW will build on the code you have written for this one (to do calculations that are actually relevant to cosmology). In 2021 problems on this sheet are not assigned, but they can still be useful for the above purposes.

LANGAGE: In the past I have required students to do their 262 HW using Matlab. This is the only language (besides Fortran!) I know well enough to help students learn. And some years ago problems arose when I let students stick to their language of choice. This year I have again dropped the requirement that the HW be done in Matlab. But PLEASE stick to Matlab if you are not confident you can do all of the abovementioned activities in your other language of choice. If you do not choose Matlab your options for assistance will be more limited. In addition to being able to help you during office hours with Matlab, I'll have extra “hand holding” for Matlab users built into the HW (as you see in this one). If you choose a language other than Matlab, if you become impossibly stuck with the coding aspects (which is the sort of problem I have seen in the past) you will be responsible digging yourself out with out my help.

For 2021, our TA, Arsalan Adil, has experience with Mathematica and Python. He does NOT recommend Python for the full range of calculations planned for this class (he is especially concerned about the quality of differential equation solving in Python), but he will be able to support you to some degree with these languages during his office hour, assuming you already have a good level of experience with them.

COMPUTERS: If you do not know what computer (such as your own laptop) you would use for 262 HW please let me know ASAP and we can investigate what is available on the departmental student computers.

- 1.1)** Download the files Sample262.m, f1.m, f2.m and fSin.m from the Matlab section of the course website ([here](#)). Practice running Sample262.m. Modify the sample program so that all the constants (in the “par” structure) are double their original values and produce the corresponding plot. (Alternatively, skip right to problem 1.2 and write code in your preferred language)
- 1.2)** Following the example of the sample program, write a new program that plots the following functions over the domain [0.1,1].

$$g_2(x) = \frac{A_2}{x^2}$$

$$g_3(x) = \frac{A_3}{x^3}$$

$$g_4(x) = \frac{A_4}{x^4}$$

with $A_2 = A_3 = A_4 = 1$

Please produce two plots. One with linear axes and one with both x and y axes logarithmic.

Hints for Matlab users:

- *Start Matlab by typing “Matlab” at the command prompt of the department teaching computers (in room 106).*
- *Click the “?” on the Matlab window to enter the extensive help system. When I originally learned Matlab I found the help system and especially the tutorials to be extremely helpful.*
- *You can also type “help ComandName” at the Matlab command prompt to learn more about a particular command.*
- *Probably everything you need to know for this assignment is modeled in the sample program.*
- *The Matlab command for log-log plots is “loglog”*