ASTR367 - HW4
September 29, 2023, Due October 9, 2023

Use a spreadsheet to build a model star! You will be computing its properties as a function of radius. I suggest 100 steps of $0.01R_\odot$, but it's up to you. You will submit the spreadsheet over email, and write out any relevant expressions you use on the turned-in assignment. Graphs can be printed out or included in the spreadsheet.

You can use the central conditions of the Sun in Table 11.1.

Additionally,

- Assume the temperature decreases linearly as the radius increases.
- Assume the density follows a function, $\rho(r) = \rho_c(1 - r/R_\odot)^{6.69}$, where ρ_c is the central density.

Hints:

- Use mass conservation to compute the mass interior to each radius, M_r. Use Wolfram Alpha if you need to solve integrals.
- Use the ideal gas law to compute the pressure at each radius.
- Also, use hydrostatic equilibrium to compute the pressure at each radius.
- Compute $d \ln P / d \ln T$ for the hydrostatic equilibrium method.

Graph T, ρ, M_r, P (both versions), and $d \ln P / d \ln T$ as a function of r. For each graph, indicate whether your plot agrees with the one in the text.

And finally, answer these questions:
1) Do you find a convective zone?
2) Why do you think there are differences between the two pressure values?
3) What assumptions in the model do you think are most suspect?