ASTR 509: Physical Foundations of Astrophysics III: Stellar Dynamics

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Selected Problems for the Final Exam

1) "Derive" the colisionless Boltzmann equation and describe all the steps.

2) Given the colisionless Boltzmann equation, derive the Jeans equations in cylindrical geometry.

3) Derive the scalar virial theorem.

4) Derive the density as a function of height for an isothermal slab.

5) Describe the basic properties of King models.

6) Given expressions (5-7) to (5-10), derive and explain eq. 5-22

7) Given eq. (6-40), explain what it means/implies.

8) State and describe the Schwarzschild distribution function.

9) What are the similarities and differences between the Schwarzschild and Maxwell-Boltzmann distribution functions?

10) What do you know about disk instabilities such as bars and spiral arms?

11) Describe the steps leading to, and the meaning of the Chadrasekhar dynamical friction formula.

12) Define and discuss the two main regimes for galaxy encounters.

13) Given eq. 4-17, derive eqs. 4-29c and 4-38

14) If distance to a stellar tracer population is overestimated by a factor of f, what is the effect of this error on the application of eq. 4-38. What if the photometric survey used to select the tracer stars is incomplete at the level x?

15) Given $\Omega(R)$ and Ω_p, find R for LRs and CR. Or, given $\Omega(R)$, find Ω_p for which ILR does not exist.

16) Given the Milky Way rotation curve, find how far could 2-armed spiral extend.