

**Astrophysical Dynamics — HS 08-09**  
**Exercises Class 3 (15 Oct 2008)**

Consider three isothermal molecular clouds ( $T = 15$  K), with characteristic masses and radii of

- $10^5 M_\odot$  and 10 pc
- $2 \times 10^3 M_\odot$  and 1 pc
- $5 M_\odot$  and 0.1 pc

a) Analyse their stability against collapse according to the Jeans criteria (length and mass).

b) Evaluate the collapse timescale for those which are unstable.

c) Compute how their stability would change if one considered, instead of the thermal sound speed, an “effective sound speed” which is  $c_{\text{eff}}^2 = c_s^2 + V_{\text{turb}}^2$  where  $V_{\text{turb}}$  comes from Larson’s law.