Homework 3.1–3.7

AST 422 Spring 2007

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(3.1) Show equation 3.19 of Ryden starting from eq 3.16.
(and with definition: $x \equiv S_\kappa(R)$, given in eq 3.18.)

(3.2) Starting from eq 4.3, show Ryden equation 4.4 and hence 4.5

(3.3) Prove and show "Equation of Motion" (Ryden eq 4.11)
(start from eq 4.5)
i) Show Ryden eq 4.11.
ii) Show (prove) that for special case of $U = 0$, that $a \propto t^{2/3}$.
iii) (Optional) Solve for $a(t)$ for $U \neq 0$, ($U > 0$ and $U < 0$).

(3.4) Show Ryden eq 4.21
What is the special meaning for $\kappa = 0$?

(3.5) Show and discuss Ryden eq 4.31, (History of $\Omega(t)$
See Longair 7.34 as well.

(3.6) Show and discuss Ryden eq 4.54 and 4.55
(Start from ideal gas law)
Discuss why:
i) $\omega < 1$
ii) $\omega \sim 0$ for non-relativistic
iii) $\omega = \frac{1}{3}$ for photons
iv) $\omega < -\frac{1}{3}$ for accell. universe
v) $\omega \equiv -1$ for Λ

(3.7) Show and discuss Ryden eq 4.58, 4.59, and 4.60
(You can start from the gravitational potential of $\Phi \sim \frac{GM}{r}$)
and hecne for the static universe, $\Lambda = 4\pi G\rho$