

Cosmology: Quiz 4
IUCAA-NCRA Graduate School
January - February 2014

- All the necessary steps must be shown. Include explanations where required.
 - The answers should be brief and to the point. Irrelevant and unnecessary statements will be penalized.
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1. Write the Friedmann equations.
2. Suppose the universe is filled with a fluid having equation of state $P = w\rho$. What is the condition on w for having $\ddot{a} > 0$?
3. Starting from the Friedmann equations, obtain the expressions for a'^2/a^2 and a''/a in terms of ρ and P for a *spatially flat universe*. Here $'$ denotes differentiation with respect to the conformal time coordinate η .
4. Suppose the universe is filled with a fluid having equation of state $P = w\rho$. What is the condition on w for having $a'' > 0$ in a spatially flat universe?

[1+1+6+2]