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AST 10: Homework 12

1. Is the “big bang theory” a genuinely new theory or is it derived from other, more fundamental theories? What are those theories? What are the observational successes of the big bang theory?
2. Roughly how old is the Universe according to the big bang theory?
3. What is the horizon problem? Who pointed it out? If the Universe were infinitely old in its present form, would there still be a horizon problem?

4. We have seen before that the \diamond equation can be written in terms of the Hubble constant H_0 as

$$3H_0^2 + \frac{3k}{a^2(t)} = \frac{8\pi G}{c^4} \rho.$$

Solve this equation for H_0 .

5. What is the flatness problem? Who pointed it out?
6. What problem in particle physics was Alan Guth trying to solve when he discovered cosmic inflation?
7. What is the basic idea of cosmic inflation? Why is it called “inflation”?
8. We have seen that if $P = -\rho$, the \heartsuit equation becomes

$$\frac{3\ddot{a}(t)}{a(t)} = \frac{8\pi G\rho}{c^4}$$

. Solve this for $\ddot{a}(t)$.

9. Using the formulas on the slides in class, if a cylinder of dough is originally 50 cm long and 1 cm in radius, what would its length and radius be after 16 “pulls” (as described in class).
10. How does inflation solve the horizon and flatness problems?