Physics 20083 - Spring 2007 Exam #6a

Instructions:

1. Answer the following four questions in the space provided. If you need extra space, please use the back of the page and make an appropriate notation on the front of the page so that I will know where to look for your complete answer.

2. Each question is worth a total of 25 points.

3. Each question requires an answer that is typically no more than two or three sentences long or perhaps a diagram and 1-2 sentences. Some questions do not require explanations. This will always be explicitly stated.

4. You may **not** use your own paper, book, notes or a calculator for this exam.

5. You will have 30 minutes to complete the exam and turn it in.

Inverse Square Law: $L_{app} \alpha \frac{L_{abs}}{r^2}$ - X

Hubble's Law and Age: $\text{Age} = \frac{1000}{H_o}$ billion years

Density Equation: $\text{Density } (\rho) \quad \alpha \frac{\text{Mass (M)}}{R^3}$

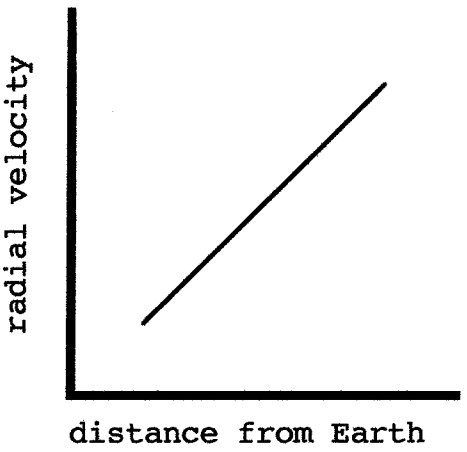
1. The constellation Hercules contains some of the most famous and well-studied globular clusters in the Milky Way galaxy.

a) (12 pts) Give the approximate altitude and azimuth of the constellation Hercules. Also, name the two brightest stars in this constellation.

b) (13 pts) Explain how we know that globular clusters are probably the oldest components of the Milky Way galaxy.

2. Below is a diagram showing Hubble's Law as measured by astronomers. We are assuming for this problem that there is no acceleration or deceleration experienced by galaxies in the expanding Universe. Instead, for simplicity, we will assume that the Universe is expanding at a constant rate (which is fairly close to the truth anyway).

On the graph below, sketch what the Hubble's Law graph will look like after another 7 billion years has passed (today, the Universe is about 14 billion years old). If you believe the graph will still look the same in 7 billion years, simply write "no change" on the graph. Either way, explain your answer in the space provided.



3. During the first billion years of the history of the Universe, things were very different than they were today.

a) (15 pts) Today, stars can form from collapsing gas clouds that have masses equal to or sometimes a little less than the mass of the Sun. Long ago, however, stars could only form from gas clouds that were 20 or more solar masses. Explain this difference.

b) (10 pts) We know that quasars only existed long ago because we only find quasars at large distances from the Earth. The Earth seems to be in the middle of a big "void" in which no quasars exist. Explain why this is not a violation of the Copernican Principle (it might help to state what the Copernican Principle is first so you can see how to explain this).

4. This problem deals with the Cosmological Constant (CC). First, (a) explain why Einstein first introduced the idea of a CC, then (b) explain the recent observational evidence that indicates perhaps a CC is indeed at work in the expansion of the Universe.