Name:_____ March 19, 2014

Algebra II: The Age of the Known Universe

1 Big Bang

We think that the universe began as a single point. That point has been expanding and expanding, with the space between objects getting larger as the universe gets bigger. We call this model of the universe the **big bang**.

In 1929, an astronomer named **Edwin Hubble** noticed that the other galaxies outside of the Milky Way appeared to be drifting away from us. He also noticed that the speed the galaxies were moving away was proportional to how far the galaxies are from us. He expressed this as **Hubble's Law**:

$$Speed = H_0 \times Distance \tag{1}$$

where the slope, H_0, is also called the **Hubble Constant**. It's expressing how fast the universe is expanding. If we can figure it out, we can estimate how old the universe is!

2 Other Galaxies

On the next page are the speed and distance of 20 galaxies outside the Milky Way. The distances are in MLy (millions of light years), and the speeds are in kilometers per second (km/s).

3 Problems

1. Look back at the Hubble Law, equation (1). We want it to be in slope intercept form, ($y = mx + b$). What are x and y in Hubble's Law?
2. Using the data in the Table as your x and y, determine H_0, the slope of the line.
3. Finally, compute the age of the universe, by inverting H_0 with some fancy unit conversions:

$$t_{universe} = \left(\frac{1}{H_0}\right) \times (3 \times 10^{11})\ years \tag{2}$$

   If you've done it right, you should have the current age of the universe in years.

Table 1: The distance and speed of 20 nearby galaxies, taken from the Nearby Galaxy Catalog.

Distances (MLy)	**Speeds** (km/s)
7.4	170
10.3	154
12.3	191
0.2	-22
0.2	28
14.9	247
13.3	264
13.0	327
13.7	189
8.0	139
2.9	73
16.3	339
16.0	279
18.1	408
16.7	401
11.7	438
19.2	498
17.0	399
6.4	73
0.3	-52