



$$V = H_0 d$$

$$H_0 = \frac{V}{d} = \frac{920 \text{ km/s}}{20 \text{ Mpc}}$$

$$= 46 \text{ km/s/Mpc}$$

a) see graph above

b) I got  $H_0 = \frac{920 \text{ km/s}}{20 \text{ Mpc}} = 46 \text{ (km/s)/Mpc}$

You might get anything from 30 to 60 depending on how you drew your line and which data points you considered "outliers".

c) See line labeled 72 (km/s)/Mpc above

d) Like the Pirate Code in "Pirates of the Caribbean", it's more like a guideline than a strict rule. You'd probably get a better line using Appendix 16 data

## 2. Galactic Halo:

$$a) \quad 85,841,504 \text{ days} \times \frac{1 \text{ yr}}{365.25 \text{ days}} = 235,021 \text{ yrs}$$

In that time, light would travel 235,021 light years

$$b) \quad 235,025 \text{ ly} \times \frac{1 \text{ kpc}}{3262 \text{ ly}} = 72 \text{ kpc}$$

c) The diameter of the galactic disk is about 40 kpc, so the answer to b) is almost twice the diameter of the Milky Way galaxy. (See Fig 22.28)

d) The game time is the sum of the time played by individuals who were playing concurrently, not consecutively, so it's mathematically meaningless to add the times that way

3. From Fig 24.4 a value of  $z = 0.4$  gives a lookback time of about 33%. The age of the Universe, so  $0.33 \times 13.7 \text{ Gyr} = 4.5 \text{ Gyr}$

about 4.5 Billion years ago