PC1 SOLUTIONS

1 $H = \frac{\dot{a}}{a}$ $\quad H = \frac{da}{dt} \cdot \frac{1}{a}$

$$H\,dt = \frac{da}{a}$$

$$H \int_{t=t_0}^{t_1} dt = \int_1^2 \frac{da}{a}$$

$$H\Delta t = [\ln a]_1^2$$

$$H\Delta t = \ln 2$$

$$\Delta t = \frac{\ln 2}{H}$$

$$\Delta t = \frac{\ln 2}{H \times 1000} \times 3\times10^{22}\ s$$

$$= \frac{\ln 2}{H \times 1000} \times \frac{3\times10^{22}}{3\times10^{7}}\ YR$$

$$= 10^{10}\ YR.$$

2 $$H = \frac{\dot{a}}{a}$$

$$= \frac{10^{-5}\ \text{Km/s}}{(20\times10^{-2}/3\times10^{22})\ \text{Mpc}}$$

$$= \frac{10^{-5}}{2\times10^{-1}} \times 3\times10^{22}\ \text{Km s}^{-1}\ \text{Mpc}^{-1}$$

$$= 1.5\times10^{18}\ \text{Km/s/Mpc}$$

3 $\dot{a}$ REMAINS CONSTANT, BUT A INCREASES, SO H DECREASES

4 $$H = \frac{\dot{a}}{a}$$ NOW $a = 30\,\text{cm}$

$$H(t=10s) = \frac{H(t=0)}{1.5}$$

$$= 10^{18}\ \text{Km/s/Mpc}$$

5 BECAUSE ONLY THESE SHAPES MEET THE CRITERIA OF HOMOGENOUS & ISOTROPIC

6 $$z+1 = \frac{1787.52}{1216} = 1.47$$

$$a(t_e) = \frac{1}{1+z} = 0.68$$