PY3726 Assignment 2

Due: Feb 25

1. Obtain the exact luminosity-distance relationship for a matter dominated universe.

2. Verify that the cosmological constant does not appear in the energy conservation equation $d(\rho a^3) = -pd(a^3)$. Use the field equations to obtain this result.

3. Show that the previous result follows from $T^{\mu\nu}_{;\nu} = 0$.

4. Prove that

$$t_0 = \frac{2}{3H_0}\frac{1}{\sqrt{\Omega_\Lambda}}\log\left(\frac{1+\sqrt{\Omega_\Lambda}}{\sqrt{1-\Omega_\Lambda}}\right)$$

if $\Omega_\Lambda + \Omega_M = 1$ and $\Omega_R = 0$.