1. Consider Hubble’s law with $\Omega_r = \Omega_\Lambda = 0$:

$$H_0a_o \int_0^{r_0} \frac{dr}{1 - kr^2} = \int_0^{z} \frac{dz}{(1 + z)\sqrt{1 + \Omega z}}$$

and show it leads to

$$DH_0 = \frac{zq_0 + (q_0 - 1)(\sqrt{2q_0z + 1} - 1)}{q_0^2},$$

where $D$ is luminosity distance.

2. Using the Taylor series find the approximation of the above calculated formula about $z = 0$ and up to $z^2$ term.

3. Express the luminosity distance as a function of the redshift in the Milne model.

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