7. (15 points) A future experiment finds that the angular diameter distance to the CMB is .1% larger than it would be in a flat Universe:

$$\frac{d_A^{(\text{observed})} - d_A^{(\text{flat})}}{d_A^{(\text{flat})}} = .001. \tag{2}$$

Assume a Universe with only matter (and curvature) with a redshift to the CMB of $z_{\text{CMB}} = 1000$. [**Hint: In your calculations, you can neglect the correction to the comoving distance from curvature, and assume that $R_0 \gg r_{\text{CMB}}$, in which case $R_0 \sin(r/R_0) \simeq r - r^2/(6R_0^6)$ and $R_0 \sinh(r/R_0) \simeq r + r^2/(6R_0)$.**]

(a) Is the Universe positively or negatively curved.

(b) What is $1 - \Omega_0$?