

1. Compute the Einstein tensor for the Robertson-Walker line element

$$ds^2 = -dt^2 + a(t)^2 \left(\frac{dr^2}{1 - kr^2} + r^2 d\theta^2 + r^2 \sin^2 \theta d\phi^2 \right)$$

with $k = -1, 0, 1$ depending on whether the spatial cross-sections are hyperbolic, flat, or spherical, respectively.

You may use any method you wish. A complete (and correct) but otherwise undocumented computer printout will receive full credit. You can check your answers in Example 22.8 on page 484 of the text.

2.

- (a) Using the relationship

$$G^i_j = R^i_j - \frac{1}{2} \delta^i_j R$$

find an expression for the “Einstein scalar” $G = G^i_i$ in terms of the Ricci scalar R .

- (b) Determine the Ricci scalar for the spacetime given in the previous problem.