

**GR - HOMEWORK 6**

1. Prove that, in a two-dimensional space, the Riemann curvature tensor has only one independent component. Then show how this component is related to the Gaussian curvature.

2. Using the conservation law  $D_\mu T^{\mu\nu} = 0$  together with the identity  $D_\mu(R^{\mu\nu} - \frac{1}{2}g^{\mu\nu}R) = 0$ , one is led to the gravitational field equation

$$R^{\mu\nu} - \frac{1}{2}g^{\mu\nu}R = \alpha T^{\mu\nu},$$

where  $\alpha$  is a constant. Now determine the value of  $\alpha$  by comparing the weak-field, non-relativistic limit of this equation with Newtonian gravity.