

1. Compute the Riemann curvature of the Schwarzschild geometry.

DO NOT TURN THIS IN! See me if you need help.

You may use any formalism you wish, and any coordinate system you wish. However, the results discussed in class will emphasize computations using differential forms in an orthonormal Schwarzschild (“shell”) basis. You **may** use computer algebra to compute the connection 1-forms (or the Christoffel symbols), but make sure you understand the conventions being used! You should **not** use computer algebra to compute the curvature 2-forms, although you are welcome to check your answers that way. Your answer should consist of all independent nonzero curvature 2-forms (or components of the Riemann tensor). You can check your answer in many textbooks, including mine, but again make sure you understand the conventions being used.

2. Compute the components R_{ij} of the Ricci curvature of the Schwarzschild geometry.

A reasonable starting point would be the curvature 2-forms computed above, and the relations

$$\Omega^i{}_j = \frac{1}{2} R^i{}_{jkl} \sigma^k \wedge \sigma^l$$
$$R_{ij} = R^m{}_{imj}$$

But again, you may use any formalism, and any coordinate system, so long as I can clearly follow your work. You may **not** use computer algebra for this computation, although you may certainly check your answers that way. How many independent computations do you need to do? What answer do you expect?