Read Chapters 13 and 14 of d’Inverno for a more mathematical presentation of the material on the field equations and the Schwarzschild metric.

The point value for each question is given in brackets.

1. Find all the Killing vectors \( X^i \) of the three dimensional Euclidean line-element [20]:
\[
ds^2 = dx^2 + dy^2 + dz^2.\]

2. Show that the conservation equations for a perfect fluid in Minkowski space-time \( T^{ik}_{;k} = 0 \) lead to the equation of continuity and the equations of motion of a perfect fluid. [20]

3. Show that the Maxwell’s equations in Minkowski space we know and love can be explicitly obtained from \( F^{ik} = 4\pi j^k \) and \( F_{[ik;lm]} = 0 \). [25]

4. Find the non-zero components of \( R_{abcd} \) for the Schwarzschild solution. Show your work and don’t just write down the answers (which, however, you can check in the back of the book). [35]

Doing these questions should help you prepare for the Midterm Examination, which will be on October 11th. That will be a closed-book, closed-notes, exam for which you will have 110 minutes. I hope to have both the assignments and the midterms graded by October 13th, which is before the midpoint of the semester of October 15th (the last day on which you could withdraw and still get a grade of W).