# Homework 3
### Due Tuesday, February 7th at 5pm

Finish chapter 5 and read chapter 6 of Hartle's *Gravity*.

1. Consider twins, Stella and Terrance. Stella goes off in a straight line traveling at a speed of $\sqrt{\frac{3}{4}}c$ for 5 years as measured on *her* clock then reverses and returns at the same speed. Terrance remains at home on earth. Make a spacetime diagram showing the motion of Stella and Terrance from Terrance's point of view. When they return, what is the difference in ages between Stella and Terrance? (This is similar to Hartle 4.9, which you've already done.)

2. Same setup as the last problem. It can be confusing that the situation between the two twins is not symmetrical. To address this issue consider the following method for analyzing the problem: Consider the problem from Stella's perspective, she sees Terrance head off in the opposite direction at the same speed.

   a) Thus during the outgoing trip how much does she calculate him as aging?

   b) Same question for the incoming trip?

   This indicates that she thinks that Terrance is younger at the end of the trip. However, it neglects the fact that she was the one who had to do the turning around!

   c) Make another copy of your spacetime diagram from Problem 1. On this spacetime diagram draw the lines of constant time for Stella's outgoing trip.

   d) Using a different color (or dashing your lines) draw the lines of constant time for Stella's incoming trip.

   e) At the turnaround event, do these two sets of lines agree?

   f) Explain how your answer to e) resolves the fact that Stella is truly the younger twin upon returning to earth.

3. Hartle 6.6, p132

4. Hartle 6.7, p132

5. Hartle 6.13, p133