HW4

Reading assignment: Feynman chapter 4.1 and 4.2. Einstein chapters 10 - 14 and (optionally) 15-17.

By Monday please make sure you have finished homeworks 1, 2, 3, and 4. If you are working on an optional problem you can turn this in whenever you'd like (before next Thursday though). There will be one final assignment for general relativity on Monday.

For the problems below, please show all work! You only need to do 2 of these, but feel free to do more for extra credit.

1. A rocket is flying towards Earth at a speed $v = .9c$. The observer on Earth measures the rocket to be $1000km$ above ground. (a) Draw a diagram of this situation. (b) What is the distance to Earth as measured by someone on the rocket?

2. A muon has a half-life of about $10^{-6}s$. Suppose you start with 100 muons. (a) Draw a graph showing number of muons vs time. (b) Now draw a similar figure for 100 muons moving at $v = .999c$.

3. (NO MATH, BUT COULD BE CHALLENGING) A farmer has a ladder which is too big for his barn. So one day he ran with the ladder as fast as he could - the ladder having Lorentz contracted to a size the barn could easily accommodate, and once the back end of the ladder was fully inside the barn a friend would slam the door behind him. However, the friend points out that in the farmers reference frame the barn, not the ladder, will contract and so the fit will be even worse. Who is right? Both, neither? Explain this paradox as you wish, spacetime diagrams and the notion of relative simultaneity could be useful.