NYU Physics I—Problem Set 14

Due Thursday 2016 December 15 at the beginning of lecture.

Problem 1: From the notes at `http://cosmo.nyu.edu/hogg/sr/`, Problem 4–8.

Problem 2: From the notes at `http://cosmo.nyu.edu/hogg/sr/`, Problem 4–11.

Problem 3: From the notes at `http://cosmo.nyu.edu/hogg/sr/`, Problem 6–10.

Extra Problem (will not be graded for credit): *(a)* Forgetting about Special Relativity, and assuming just Newtonian mechanics, compute how long you would have to accelerate at acceleration $g = 10\,\mathrm{m\,s^{-2}}$ in order to reach the speed of light.

(b) A relativistically correct contstant-acceleration trajectory on a space-time diagram is a hyperbola, where both asymptotes are 45-degree lines (null trajectories. Find a formula (position x as a function of time t) for this hyperbola, constrained to have acceleration g at small times.

(c) Show that this trajectory is unchanged under the Lorentz transformation. That is, show that if you boost in the x direction, the trajectory translates onto itself (except, possibly, for a small shift in the x or t direction).