Section I Problems (due September 19)

Problem 1: Show that the spacetime coordinates of an event seen in two reference frames moving at a velocity $v$ relative to each other in the $z$-direction are related by the Lorentz transformation

$$x' = x$$
$$y' = y$$
$$z' = \gamma(z - vt)$$
$$t' = \gamma(t - vz/c^2)$$

where

$$\gamma = \frac{1}{\sqrt{1 - (v/c)^2}}$$

One way to do this is to begin with the general transformation $x'^\mu = a^\mu_{\nu} x^\nu$ and solve for the $a^\mu_{\nu}$ coefficients using properties of the metric, symmetries, etc.

Problem 2: Jackson 11.3

Problem 3: Jackson 11.5

Problem 4: Jackson 11.9

Problem 5: Jackson 11.10