PHYS 200: Problem Set V

Due: 4:30 pm March 8, 2005

1. [6] As seen in the S' coordinate system, a light pulse travels in the $x'y'$-plane at an angle of 45° with respect to the x'-axis. The S'-frame is moving at $0.600c$ parallel to the x-axis of a second frame of reference S. The x- and x'-axis are parallel in the standard configuration. Calculate the velocity components, the speed, and the angle of the light pulse as observed from the S-frame.

2. [6] A particle is travelling at $0.400c$.

   (a) By what factor does its momentum increase if its speed doubles?

   (b) By what factor does its speed increase for its momentum to double?

3. [4] Starting from rest, two skaters "push off" against each other on smooth level ice, where friction is negligible. One is a woman and one is man. The woman moves away with a velocity of +2.5 m/s relative to the ice. The mass of the woman is 54 kg, and the mass of the man is 88 kg. Assuming that the speed of light is 3.0 m/s, so that relativistic momentum must be used, find the recoil velocity of the man relative to the ice.