PHYS 200: Problem Set II

Due: 4:30 pm February 1, 2005

1. [3] An astronaut travels to a distant star with a speed of $0.45c$ relative to Earth. From the astronaut's point of view, the star is 7.5 ly from Earth. On the return trip, the astronaut travels with a speed of $0.88c$ relative to Earth. What is the distance covered on the return trip, as measured by the astronaut? Give you answer in light-years. [Note: ly is the unit of a light-year. A light year is the distance light travels in one year.]

2. [4] When travelling past an observer with a relative speed v, a rocket is measured to be 8.00 m long. When the rocket moves with a relative speed $2v$, its length is measured to be 5.00 m.

   (a) What is the speed v?

   (b) What is the proper length of the rocket?

3. [3] A spaceship and an asteroid are moving in the same direction away from Earth with speeds of $0.77c$ and $0.41c$, respectively. What is the relative speed between the spaceship and the asteroid?