

1. Length of a spaceship is measured to be exactly half of its proper length. What is the speed of the spaceship relative to the observer's frame? What is the ratio of times noted in the spaceship and observer's frames?
2. A muon has lifetime of 2×10^{-6} s in its rest frame. It is created 100 km above the earth and moves towards it at a speed 2.97×10^8 m/s. At what altitude does it decay? According to the muon, how far did it travel in its brief life?
3. The earth and sun are 8.3 light-minutes apart. Ignore their relative motion for this problem and assume they live in a single inertial frame, the Earth-Sun frame. Events A and B occur at $t = 0$ on the earth and at 2 minutes on the sun respectively. Find the time difference between the events according to an observer moving at $u = 0.8c$ from Earth to Sun. Repeat if observer is moving in the opposite direction at $u = 0.8c$.
4. A light beam is emitted at an angle θ_0 with respect to x' axis in S' frame. Find the angle θ that the beam makes with respect to x-axis in S. Let v be the relative velocity of the two frames.
5. Problem **K&K 12.6**
6. Problem **K&K 12.9**