

Problem Set #2: Due in class on Wed. 4/15**Problems from Chapter 2 of Thornton & Rex:** 67, 70, 76, 84, 87**Problems from Chapter 3 of Thornton & Rex:** 18, 19, 20, 34, 35, 39, 47, 52**Additional Problems:**

- A. Reproduce the spacetime diagram for the outbound leg of the Twin Paradox handout. Use it to visualize the length contraction effect. To do so complete the following steps:
- Use the Lorentz transformation equations to show that the x' axis has slope of v/c .
 - Show that the distance scale is marked as shown in the handout.
 - Consider a 10 l.y. long meter stick (proper length) that is stationary in Tom's frame, observed from Emily's frame. If Emily measures the length of the meter stick by determining the position of both ends of the meter stick *simultaneously* at $t=0$, what length does she obtain? How is it displayed on the spacetime diagram?
- B. Fill in the missing steps in the derivation of the relativistic kinetic energy on p. 64, between equations 2.57 and 2.58.
- C. Relativistic freefall: Determine the velocity versus time for a particle, initially at rest, subjected to a constant force. Recall that Newton's second law can be written $F = dp/dt$ as long as you use the relativistic momentum. First find the relativistic momentum as a function of time. Then solve for the velocity versus time and compare it to the "old" result where momentum has the form $p = mu$.