PHYS160 Spring 2009

Problem Set #1: Due in class on Wed. 4/8

Problems from Chapter 2 of Thornton & Rex:

10. This problem involves verifying the steps in the derivation on pp. 30-31. Pay special attention to filling in the missing steps near the bottom of p. 31.

13. Write the Lorentz transformation equations in terms of differences in time and space between a pair of events, Δx, Δt, $\Delta x'$, $\Delta t'$, and find the relative velocity of K' with respect to K for which $\Delta t'=0$.

14 & 15: These problems are fairly straightforward applications of the Lorentz transformation equations.

20. Realize that the travelers experience the proper time interval between departure from earth and arrival at distant star. Also realize that the 20 l.y. distance between the earth and the distant star is observed in the earth-star frame (not the rocket frame).

23 & 24: These problems are fairly straightforward applications of the time dilation and length contraction effects respectively.

31 & 35: Straightforward relativistic velocity addition problems.

95. A twin paradox problem.

Additional Problems:

A. Show that the spatial distance between two points is invariant under Galilean transformation (Eqs. 2.1).

B. Given the speed of light is $3.00\text{x}10^8$ m/s, calculate its value in mph, and in ft/ns.

C. When you are watching a physics demonstration from the back row of Youngchild 041, how far in the past do you experience the things you see? Consider only the finite speed of light and neglect the opto-bio-chemical-neurological time delays involved in the visual perception process. Repeat the calculation for the things you see on the field when you are watching a football game from the upper deck of the stadium.