Assignment 9; Phys 191 Name _____

1. (40 points) You have two events (ct_1, x_1) and (ct_2, x_2). In the frame of reference where $x_1 = x_2$, call the time separating these events $\Delta t_p = t_2 - t_1$. (Δt_p is the "proper time" interval.) You then measure the time interval $\Delta t' = t'_2 - t'_1$ in another frame of reference moving at $v = \beta c$ relative to the proper time frame. Find the relationship between Δt_p and $\Delta t'$.

2. (60 points) You measure the length of an object in a frame where it is at rest: Get the location of one end at (ct_1, x_1) and the other end at (ct_2, x_2). Since the object is at rest, what ct_1 and ct_2 are doesn't matter. The "proper length" $\Delta x_p = x_2 - x_1$ will not change, since x_2 and x_1 do not change. Then, an observer measures the length $\Delta x' = x'_2 - x'_1$ in another frame of reference moving at $v = \beta c$ relative to the proper length frame. However, since the object is moving in that frame, they have to obtain (ct'_1, x'_1) and (ct'_2, x'_2) while making sure that $t'_1 = t'_2$. Find the relationship between Δx_p and $\Delta x'$.