Physics 135-3-01, Winter 2017 **Name _____**
Quiz #4

1) (10 points) You are cruising above Evanston in your Ford Stratomobile at 85% lightspeed. Your Stratomobile is 4 meters long (according to the owner's manual), and you are looking for a place to land it. As you look down on Evanston, from your point of view, how long is the smallest parking space that would be suitable for your Stratomobile?

Solution
You need a four-meter-long spot for your Stratomobile. Such a spot will be relativistically contracted from your point of view to $L = L_o(1 - v^2/c^2)^{1/2}$, or $(4)(1 - 0.85^2)^{1/2} = 2.11$ m.

2) (10 points) You and your sister have identical watches. Then you board a spacecraft and zip away from the Earth at 0.9c. After you have been aboard the spacecraft for an hour, you look back at the Earth (never mind how – this is science fiction) and look at your sister's watch. How much time do you see has run off her watch?

Solution
We have $\Delta t_2 = \Delta t_1 / (1 - v^2/c^2)^{1/2}$. What we know in this case is $\Delta t_2 = 60$ minutes. We want to know Δt_1. So, $\Delta t_1 = \Delta t_2(1 - v^2/c^2)^{1/2} = (60 \text{ min})(1 - 0.9^2)^{1/2} = 26$ min, 9 sec.

In class (and also in a slide I posted), I indicated that the sister on Earth would be the *older* of the two siblings if and when you ever returned to Earth, which would seem to imply that her watch should run faster than yours, not slower. However, as I also pointed out in class, this situation can only come about if the spacecraft *stops*, *turns around*, and *comes back*. So long as the spacecraft moves in one direction, then the time as seen on Earth is dilated and moves more slowly than time aboard the spacecraft, and vice versa. The fact that both you and your sister see each other's time moving more slowly is just one of the paradoxes of relativity.