Name _____   Date _____

Quiz 1: Relativity

$$\Delta t' = \gamma \Delta t_p \quad L' = \frac{L_p}{\gamma} \quad c = 3 \cdot 10^8 \,\mathrm{m/s} \quad \gamma = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}} \quad v_{\mathrm{obj}} = \frac{v + v'_{\mathrm{obj}}}{1 + \frac{v v'_{\mathrm{obj}}}{c^2}}$$

$$v'_{\mathrm{obj}} = \frac{v_{\mathrm{obj}} - v}{1 - \frac{v v_{\mathrm{obj}}}{c^2}} \quad x' = \gamma \left(x - vt\right) \quad t' = \gamma \left(t - \frac{vx}{c^2}\right)$$

1. An airplane 10.0 m long is flying at 300 m/s. How much shorter will this airplane appear to be to an observer on the ground?

- ☐ 5×10^{-6} m
- ☐ 2×10^{-3} m
- ☐ 0.1 m
- ☐ 5 m

2. A crew watches a movie that is two hours long in a space-craft that is moving at high speed through space. Will an Earthbound observer, who is watching the movie through a powerful telescope, measure the duration of the movie to be:

- ☐ Longer than two hours.
- ☐ Shorter than two hours.
- ☐ Equal to two hours.
- ☐ I'd tell you, but that would violate the temporal prime directive.

3. Which one of these things can two observers in different frames **not** agree on?

- ☐ Their relative speed of motion with respect to each other.
- ☐ The speed of light c.
- ☐ The simultaneity of two events taking place at the same position and same time in some frame.
- ☐ The distance between two points that remain fixed in one of their frames.

4. The period of a pendulum is measured to be 3.00 in its own reference frame. What is the period as measured by an observer moving at a speed of $0.950c$ with respect to the pendulum?

- ☐ 6.00 sec
- ☐ 13.4 sec
- ☐ 0.938 sec
- ☐ 9.61 sec