

## Physics 201, Fall 2008

### Problem Set 3

Due Wednesday, September 24.

#### Problems from Taylor, Zafiratos and Dubson:

1.44, 1.46, 1.51

#### Additional Problems

##### 1. *Time Dilation Due to Earth's Rotation*

Assume the Earth is an inertial sphere which rotates on a fixed axis once a day. The circumference of the Earth at the equator is about 40,000 km. Compared to a clock at the center of the Earth, how much time (in seconds) is lost each day on a clock located at the equator, as a result of relativistic time dilation?

##### 2. *Invariant Interval*

In a certain inertial frame, two events occur 600m and  $1\mu\text{s}$  apart.

- a) What is the invariant interval  $(\Delta s)^2$  between these events?
- b) Is there another reference frame in which the time ordering of the two events is interchanged? How do you know?
- c) Suppose in another inertial frame moving with respect to the first in the direction between the two events, the two events are also separated by 600m. (This is the same as in problem 1.40 in the text.) Using the fact that the invariant interval is the same in all inertial frames, show that in the new frame the events are separated by  $-1\mu\text{s}$ .