PHY312- Homework 1

Take the speed of light to be 3×10^8 m/s.

1. At 9:00 pm Pacific daylight time on August 14 1989, the planetary probe Voyager II passed by the planet Neptune. Images of the planet were coded and sent back to Earth my microwave relay. It took four hours and 6 minutes for this signal to reach Earth. Microwaves, like sunlight travel at light speed through vacuum. Calculate the distance between Earth and Neptune.

2. A man is riding a bicycle along a straight road. His speed relative to the road is 2 m/s. A train traveling along a track which parallels the road is moving at 10 m/s in the same direction. What is the velocity of the bicycle relative to the train ?. What is its direction ?

3. Replace the man on the bicycle in the previous question by a pulse of light traveling at speed c. Assume the train is moving at speed $v < c$. What according to Newton would be the observed speed of the light pulse as seen from the train ? What is its direction ? What happens if $v = c$?

4. If in some FOR the space separattion between 2 events is 1m and the time separation is 1 sec what is the size of the spacetime interval separating these events ? What is the proper time between these events ? Suppose I observe these same events from a spaceship speeding by at 1/2 speed of light. What would be the spacetime interval measured by the spaceship ?

5. What would be the spacetime interval and proper time if the time separation were 1.0×10^{-8} secs ? If the two events in question correspond to the emission, free propagation and later absorption of a high energy particle what is the speed of the particle as observed from the original FOR?