Physics 3710 – Problem Set #4 *Relativistic kinematics, II*

1. In this problem (x,T) refers to the s-t coordinates (both measured in units of distance) of events according to an observer O. A rocket leaves Earth at $(0,0)$ (event A) and travels at constant speed to a distant star arriving at $(4,5)$ (event B). After a while a light signal is sent from the star at $(4,10)$ (event C) back to Earth, being received at event D. (a) Draw an s-t diagram of these events and the world lines connecting them. (b) What are the coordinates of event D? (c) Compare the elapsed time between A and D on Earth with the sum of proper times between A and B, B and C, and C and D.

2. Redo Problem 1, but now from the perspective of observer O′ traveling relative to O with velocity +0.8 in the x-direction. Assume that both observers agree that A occurs at $(0,0)$.

3. According to one observer, event A is at $(2,7)$ and event B is at $(3,10)$. Calculate the proper time interval between these events. A second observer records event A as occurring at $(-6,9)$ and B at $(-25/3,38/3)$. Calculate the proper time interval between *these* two events and compare with the previous value.

4. O′ travels relative to O with a constant (dimensionless) x-velocity +0.8. O records the velocity of a rocket to be +0.9 in the x-direction. What is the velocity of the rocket according to O′?

5. For the conditions in Problem 4, suppose O records the velocity of another rocket to be +0.8 in the y**-direction**. What is the velocity of the rocket according to O′?