Problem 1. A star 1000 light years away explodes at $t = 0$ (as described in our earth coordinate system). Write out the event vector.

Problem 2. A spaceship is passing earth at $t = 0$. The spaceship is moving with velocity of 0.5c in the direction of the star, which is situated at distance of 1000 light year. If the spaceship observers also agree that $t = 0$ when the spaceship passes earth, what is the event vector for the star explosion in the spaceship's coordinate system?

Problem 3. An electron passes at 0.98c through an accelerator tube. The tube has length L_2 according to the electron. In the electron frame what are the event vectors for:
i) the event where the electron enters the tube.
ii) the event where the electron leaves the tube. Note that x component is measured from the electron (i.e., with the vector in the electron frame).

Problem 4. A particle of mass m moving relativistically with momentum p is projected at a second stationary particle also of mass m.
i) Find the total 4-momentum (i.e., momentum-energy 4-vector) of the system.
ii) Find the coordinate frame in which the total 3-mom (i.e., 3 space-like components which are the momentum) is zero.

Problem 5. Two particles leave a collision point at 90° to the initial direction in the C.M. frame. If the velocity of the C.M. frame is c what are the angles in the lab frame? What is the magnitude of the momentum in the lab frame?

Problem 6. An event is displayed in S_1 to be at the spacetime point (10.0 m, 0, 0, tc), where $t = 1.0 \times 10^{-6}$ s. At what spacetime point is this event in S_2, which is moving at 0.6c (in y-direction) with respect to S_1?