



Homework 5

Instructions

- (1) Write the answers clearly and show the necessary mathematics.
 - (2) Doing homeworks is essential to understand the subject.
 - (3) For your own good, do not copy.
 - (4) Submission due date: 12 November 2014
 - (5) Assignment problems are not an exhaustive list of problems. You are encouraged to do more problems presented in standard books.
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- H5.1 Consider two inertial frames I and I' with I' moving at velocity v relative to I in the x direction. The spacetime coordinates of a particle from I and I' are (x, y, z, t) and (x', y', z', t') , respectively.
- (a) Write down the Lorentz transformation equations from (x, y, z, t) to (x', y', z', t') .
 - (b) Using these equations, express (x, y, z, t) in terms of (x', y', z', t') .
- H5.2 Using Lorentz equations for pair of events, justify relativity of simultaneity principle.
- H5.3 How does the speed gun work? (This is used by authorities to measure speed of a car, for example.)
- H5.4 (a) An observer on earth sees a spaceship at an altitude of 4350 km moving downward toward earth with a speed of $0.97c$. What is the distance between the spaceship to earth as measured by the spaceship's captain? (b) After firing his engines, the captain measures her ship's altitude as 267 km, while the observer on earth measures it to be 625 km. What is the speed of the spaceship at this instant?



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- H5.5 Compare the non-relativistic and relativistic momentum of an electron travelling at a speed of $0.75c$.
- H5.6 An electron moves at a speed of $0.85c$. Find its total energy and kinetic energy. Compare the latter with the classical kinetic energy.