

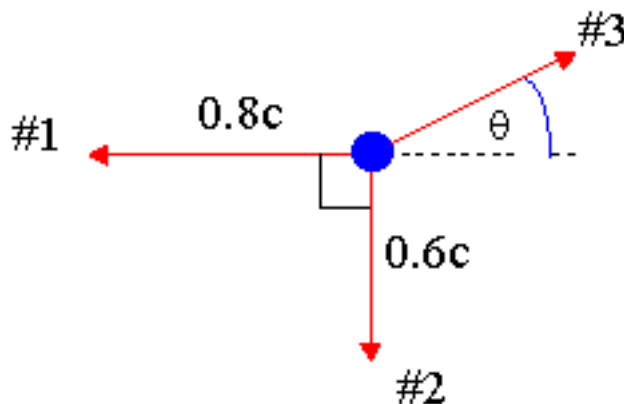
Written Examination Special Relativity MFN 1313
Academic Year 2011–2012: 27 June 2012, 2.30-4.30 PM

Please read the following INSTRUCTIONS

A. Answer at most TWO questions. You may answer in english or in italian. A pass is obtained for one complete answer.

B. You may not use notes or textbooks, but the course notes are available for consultation at the front desk.

1. A particle of rest mass M is at rest in the laboratory when it decays into three identical particles of rest mass m . Two of the particles have velocities and directions as shown.



Find the speed and direction of the third. What is the ratio M/m ?

2. What is the velocity of the centre of mass for a system consisting of a photon of energy E and a stationary atom of rest mass M ?

i) Would this velocity change (and if so, how) if instead of a photon, there was a particle of rest mass m and the same energy E ?

ii) What is the ratio between the photon frequencies in the centre-of-mass and laboratory frames?

3. Prove that if a two-tensor is symmetric (antisymmetric) in one frame, then it is symmetric (antisymmetric) in all frames. Give two examples of each type of tensor (four in all).