

Physics 515, Spring Quarter 2018

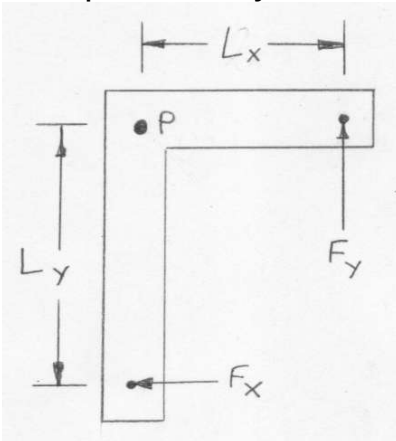
Electrodynamics: Homework Assignment 3

Due April 20, either 11:00am in class or 10:45am in the instructor's mailbox.

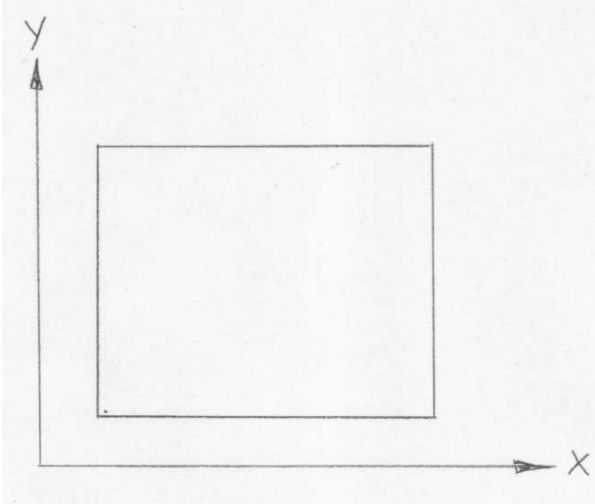
1. Fill in the missing step in lecture on conservation of momentum. Show by direct differentiation that the time derivative of the “time” component of the momentum can be written in the sensible form:

$$\frac{dP^4}{dt} = \vec{v} \cdot \frac{d}{dt} \left(\frac{m_0 \vec{v}}{\sqrt{1 - v^2/c^2}} \right)$$

2. The Minkowski right-angle lever consists of two rigid arms, as shown, allowed to pivot about the point P . Forces F_x and F_y are applied, as shown, and in this frame the lever is at rest in rotational and longitudinal equilibrium. Now suppose this system is viewed by an observer moving in the x -direction at speed v .
- What is the torque according to the moving observer?
 - Explain the principle that forbids the system from undergoing rotation in one inertial frame and not undergoing rotation in a second inertial frame.
 - Explain how you can reconcile the result of part a and part b.



3. A rectangular neutral current loop at rest in the X-Y plane has magnetic dipole moment \mathbf{m} . Now suppose this system is viewed by an observer moving in the x-direction at velocity \mathbf{v} . What is the electric dipole moment \mathbf{p} according to the moving observer? You can ignore terms quadratic in v .



4. Show that the velocity-addition formula (Jackson eqn 11.33) is sensible by showing that two parallel boosts, one after another, is equivalent to a single boost at a velocity given by the addition formula. This is an exercise in several texts.