

PHYS 402: Electricity & Magnetism II  
Due date: Thursday, December 2, 2010

### Problem set #12

#### 1. 4-vector transformations

For a frame  $S'$  moving relative to your rest frame  $S$  with a velocity  $v$  in the  $x$  direction, use the definition of the 4-velocity and the appropriate Lorentz transformation to derive Griffiths equations 12.45 that describe how the classical 3-velocity transforms.

#### 2. Tensor inner ("scalar") product

Compute the scalar  $F^{\mu\nu}F_{\mu\nu}$ .

#### 3. 4-tensor transformations

For a frame  $S'$  moving relative to your rest frame  $S$  with a velocity  $v$  in the  $x$  direction, derive the electric and magnetic field transformation equations given by Griffiths equations 12.108 starting from the definition of  $F^{\mu\nu}$  and the appropriate Lorentz transformations.