

## Physics 836: Problem Set 3

Due Wednesday, April 27 by 5PM

1. Write out the components of Jackson, eq. (11.144) explicitly, and show that they give the Lorentz force equation and the corresponding power equation as discussed in class.
2. Jackson, problem 11.22 (a).
3. Jackson, problem 12.3
4. Verify that the Lagrange equations of motion, applied to the Lagrangian (12.12), do indeed lead to the Lorentz force equation. Note: you may need to use the relation  $d/dt = \partial/\partial t + \mathbf{v} \cdot \nabla$  (which comes from the chain rule).
5. FOR EDIFICATION ONLY; NOT TO BE TURNED IN.  
Jackson, problem 12.5(b).
6. FOR EDIFICATION ONLY; NOT TO BE TURNED IN.
  - (a) Verify the matrix relations  $[S_x, S_y] = S_z$ ,  $[S_y, S_z] = S_x$  and  $[S_z, S_x] = S_y$  for the  $S$  matrices defined in Jackson, eq. (11.91).
  - (b). By using the relations for  $K_1$  and  $K_1^2$  given in eqs. (11.91) and (11.92) of Jackson, and using the Taylor series for the sinh and cosh functions, verify explicitly that for a boost in the x direction the matrix  $A$  has the form (11.95).