1. Lorentz Transformation of Electric and Magnetic Fields.
Show that $E \cdot B$ is an invariant quantity under a Lorentz transformation, and that therefore if the electric and magnetic fields are perpendicular to one another in one inertial frame, they are perpendicular in all frames. (HINT: Look on p. 129 in Rybicki and Lightman).

2. Lorentz Transformations and invariants.
Show that $B^2 - E^2$ is an invariant quantity under a Lorentz transformation.

3. Maxwell’s Equations and Tensor Notation. Show that Maxwell’s equations may be written
$$ F_{\mu\nu} \equiv (4\pi/c) j_{\mu} $$
and
$$ F_{[\mu\nu,\sigma]} = 0 $$