Section B. Electricity and Magnetism

1. **Field Transformations**

(a) Let a current I circulate in a square of wire of side d lying in the x-y plane, with center at the origin. What is the vector potential $\vec{A}$ at a position x_o, where $x_o >> d$ (ie, Taylor expand the denominator)? (b) What is the magnetic field B at x_o?.

(c) At x_o lies a charge q_o at rest. Calculate the force acting on the charge, and the force actiing on the loop.

(d) Now boost to a frame where the charge q_o and the loop are both moving with speed $+v_o\hat{x}$. What is the electric field $\vec{E}'$ due to the loop acting on the charge (I need magnitude and direction). For this, you don't need the answer for part (b), just call the field B but you need the direction.

(e) What is the total force $\vec{F}_{tot}$ acting on the charge q_o in this frame?