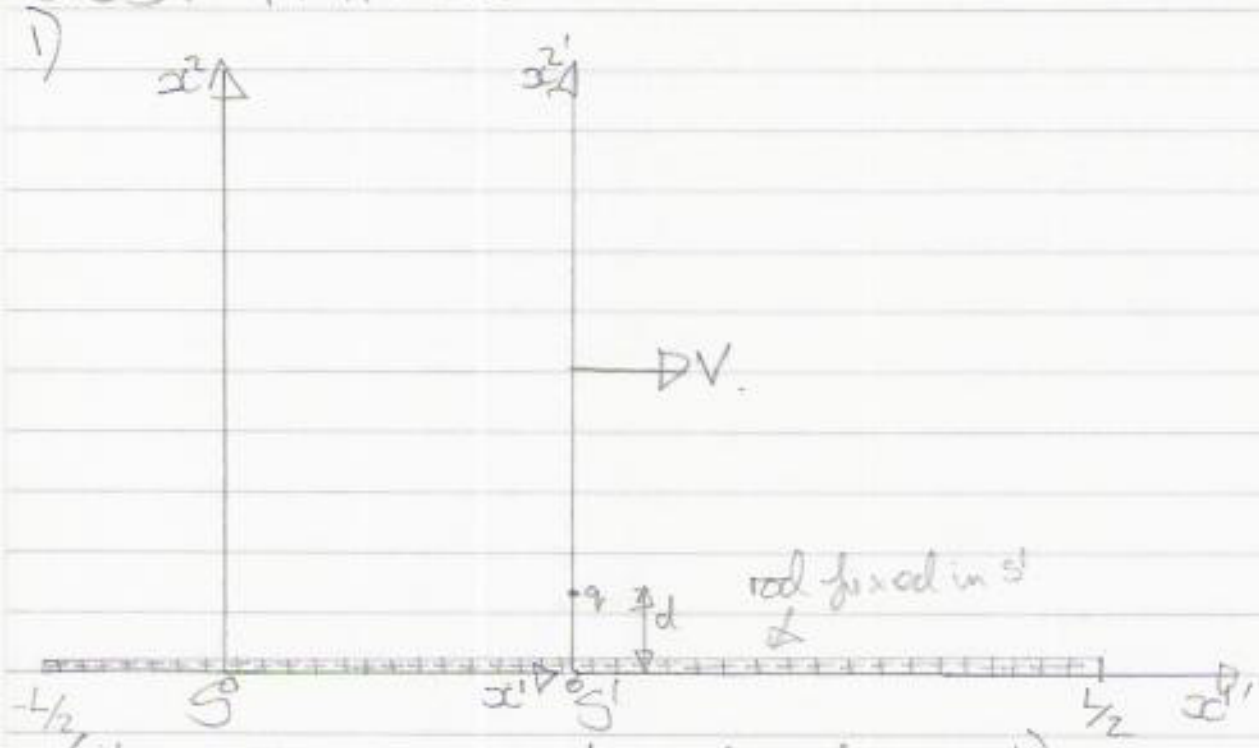
S357 TMA 02

1)



($-L/2$ and $L/2$ are x' coordinates in S')

i) Magnetic and Electric fields at a point in S include components perpendicular to the rod and parallel to the rod. Those components of the magnetic and electric fields parallel to the rod have their sources in charges in +ve and +ve x' directions, hence they will cancel out, ignoring end effects, and assuming that the rod is very long in both +ve and -ve x' directions in S. ?

Hence the magnetic and electric fields will vary in magnitude only as their distance from the rod is only on x^2 and x^3. If the distance from the rod has magnitude r, then $r=\sqrt{(x^2)^2+(x^3)^2}$ from Pythagoras Theorem. The direction of the electric and magnetic fields will vary with the values of x^2 and x^3. Indepen. of θ. $x^2 = r\sin\theta$, $x^3 = r\cos\theta$.

(Further x^2 and x^3 will take the same values for points in S' as in S, since only lengths in the direction of motion are changed under the Lorentz transformation)

3.