Electromagnetic field of the moving charge

Electric and magnetic fields of the moving charge are given by the following expressions (compare D.J.Griffiths “Introduction to electrodynamics”, Ch.10)

\[
E = \left( \frac{q}{4\pi\varepsilon_0} \right) \frac{R}{(\mathbf{R} \cdot \mathbf{U})^3} \left( 1 - \frac{v^2}{c^2} \right) \mathbf{U} + \frac{1}{c^2} \mathbf{R} \times \left( \mathbf{U} \times \mathbf{a} \right)
\]

\[\text{(1)}\]

\[
B = \frac{1}{c} \mathbf{n}_R \times \mathbf{E}
\]

\[\text{(2)}\]

Here \( \mathbf{R} \) is the radius vector from the charge to the observation point, \( \mathbf{n}_R = \mathbf{R} / R \) is the unit vector along \( \mathbf{R} \), \( \mathbf{U} = \mathbf{n}_R - \mathbf{v} / c \), \( \mathbf{a} = \partial \mathbf{v} / \partial t' \) is the acceleration, and all quantities in the right-hand sides of Eqs. (1),(2) should be taken at the moment of time \( t' = t - R / c \), which is the retardation time. Use these expressions to find

1. Electric and magnetic fields of a charge moving with the constant velocity. Find the non-relativistic and ultra-relativistic limits of \( \mathbf{E} \) and \( \mathbf{B} \) and comment on the results.
2. Force between two charges moving with equal constant velocities along the x-axis parallel to each other and separated by a distance \( l \) along the y-axes.
3. Electric and magnetic fields of the accelerated charge at large distance \( R \) (retain only the main term). Assume for simplicity zero instant velocity. Explain why the acceleration term decreases slower than the Coulomb field.