(a) Show that surfaces of constant phase are normal to $\vec{n}_1$ and that surfaces of constant amplitude are normal to $\vec{n}_2$

(b) Show that, in all operations involving $\vec{\nabla}$, this operator can be replaced by $-j\vec{k}$.

(c) Rewrite Maxwell's equations utilizing this fact.

5. 15% (a) Suppose that two observers O and O′ are in uniform relation motion with velocity $\vec{v}$. Show that if O′ measures an electric field E′ and a magnetic field B′, the electric field and the magnetic field measured by O are given by (O and O′ have common X-axis, i.e. $\vec{v} = v\hat{a}_x$)

$$E_x = E_x', \quad E_y = \frac{E_y' + vB_z'}{\sqrt{1-v^2/c^2}}, \quad E_z = \frac{E_z' - vB_y'}{\sqrt{1-v^2/c^2}}$$

$$B_x = B_x', \quad B_y = \frac{B_y' - vE_z'/c^2}{\sqrt{1-v^2/c^2}}, \quad B_z = \frac{B_z' + vE_y'/c^2}{\sqrt{1-v^2/c^2}}$$

Hint: The Lorentz transformations of force are

$$F_x' = F_x, \quad F_y' = \frac{F_y}{\sqrt{1-v^2/c^2}}, \quad F_z' = \frac{F_z}{\sqrt{1-v^2/c^2}}$$

15% (b) Consider an infinite row of equally spaced charges moving along the X-axis with velocity $\vec{v}$ relative to observer O. Derive the magnetic field measured by O by means of the relativistic transformation for the electromagnetic field.