

Physics 721 Homework 11

Assigned: Mon. 4/04/05

Due: Mon. 4/11/05

1. Jackson 7.2
2. Jackson 7.4
3. Jackson 7.13
4. The electric and magnetic fields in vacuum at $t = 0$ are

$$\vec{E} = E_0 f(z) \hat{x}$$

$$\vec{B} = B_0 f(z) \hat{y}$$

where $f(z) = e^{-az^2}$ for a given constant a .

- a) Find the electromagnetic energy density, momentum density, and their ratio.
- b) Show that at $t > 0$, there are two wavepackets travelling in the direction \hat{z} and $-\hat{z}$.
For what ratio $\frac{E_0}{B_0}$ is there just one wavepacket? How much of the initial energy of the field is carried in the \hat{z} and $-\hat{z}$ direction?
- c) What are the group velocities of the two wave packets? What are their phase velocities? Should their magnitudes be different?