

## Practice Problems Related to Radiation Fields

1. The electric and magnetic fields are not, of course, actually complex; they are real numbers, and we only represent them as complex numbers for ease of mathematical manipulation. With that in mind, how would we rewrite

$$\begin{aligned}\mathbf{E} &= \hat{\mathbf{a}}_1 E_0 \exp i(\mathbf{k} \cdot \mathbf{r} - \omega t) \\ \mathbf{B} &= \hat{\mathbf{a}}_2 B_0 \exp i(\mathbf{k} \cdot \mathbf{r} - \omega t)\end{aligned}\tag{1}$$

in terms of functions that are strictly real?

2. Plug your real-only expressions for  $\mathbf{E}$  and  $\mathbf{B}$  into the vacuum Maxwell equations

$$\begin{aligned}\nabla \cdot \mathbf{E} &= 0 & \nabla \cdot \mathbf{B} &= 0 \\ \nabla \times \mathbf{E} &= -\frac{1}{c} \partial \mathbf{B} / \partial t & \nabla \times \mathbf{B} &= \frac{1}{c} \partial \mathbf{E} / \partial t.\end{aligned}\tag{2}$$

What do you get? Do you find the same answers as you did when you used the complex expressions?