5. (60 points) Now make the assumption that both the **E** field and the **B** field are time-harmonic, that each can be written as

$$\mathbf{E} = \mathbf{E}_0 \, e^{i(\mathbf{k}\cdot\mathbf{r} - \omega t)}$$
$$\mathbf{B} = \mathbf{B}_0 \, e^{i(\mathbf{k}\cdot\mathbf{r} - \omega t)}$$

The time and spatial derivatives can then be written as

$$\frac{\partial \mathbf{E}}{\partial t} = -i\omega\mathbf{E}$$
$$\frac{\partial \mathbf{B}}{\partial t} = -i\omega\mathbf{B}$$
$$\nabla \cdot \mathbf{E} = i\mathbf{k}\cdot\mathbf{E}$$
$$\nabla \times \mathbf{E} = i\mathbf{k}\times\mathbf{E}$$
$$\nabla \times \mathbf{B} = i\mathbf{k}\times\mathbf{B}$$

The divergence of **B**, as always, is zero. Now rewrite Maxwell's equations componentwise, using the derivatives of the time-harmonic form.