(10 pts) Consider a monochromatic electromagnetic plane wave moving along the $z$-axis in vacuum and described by electric and magnetic fields

$$\vec{E} = \hat{x} E_0 \cos(kz - \omega t)$$
$$\vec{B} = \hat{y} B_0 \cos(kz - \omega t),$$

where $\omega = ck$ and $c$ is the speed of light.

(a). Show explicitly that these fields satisfy Maxwell equations in vacuum for a particular value of $E_0/B_0$, and find that value.

(b). Calculate the energy density and momentum density in the wave.

(c). Calculate the time-averaged Poynting vector. Show that its magnitude is related to the time-averaged energy density in the wave and interpret. (Time averaging should be done over the times greater than or equal to the period of the wave $T = 2\pi/\omega$.)

(d). Calculate the components of the time-averaged Maxwell stress tensor, and show that the non-zero component is again related to the time-averaged energy density, and interpret.