The electric field of an E/M wave is described by:

$$\mathbf{E} = E_0 \sin(kx - \omega t)\hat{\mathbf{y}}$$

What is the direction of the magnetic field?

A. $+x$
B. $+y$
C. $-x$
D. $+z$
E. $-z$

You have this solution to Maxwell's equations in vacuum:

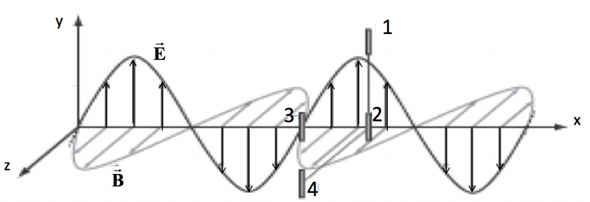
$$\widetilde{\mathbf{E}}(x, y, z, t) = \widetilde{\mathbf{E}}_0 \exp[i(\mathbf{k} \cdot \mathbf{r} - \omega t)]$$

If this wave travels in the y direction, is polarized in the x direction, and has a complex phase of 0, what is the x component of the physical wave?

A. $E_x = E_0\ cos\,(kx - \omega t)$
B. $E_x = E_0\ cos\,(ky - \omega t)$
C. $E_x = E_0\ cos\,(kz - \omega t)$
D. $E_x = E_0\ cos\left(k_x x + k_y y - \omega t\right)$
E. Something else

An electromagnetic plane wave propagates to the right. Four vertical antennas are labeled 1-4. 1, 2, and 3 lie in the $x-y$ plane. 1, 2, and 4 have the same x-coordinate, but antenna 4 is located further out in the z-direction. Rank the time-averaged signals received by each antenna.

A. 1=2=3>4
B. 3>2>1=4
C. 1=2=4>3
D. 1=2=3=4
E. 3>1=2=4



A point source of radiation emits power P_0 isotropically (uniformly in all directions). A detector of area a_d is located a distance R away from the source. What is the power P_d received by the detector?

A. $\frac{P_0}{4\pi R^2} a_d$
B. $P_0 \frac{a_d^2}{R^2}$
C. $P_0 \frac{a_d}{R}$
D. $\frac{P_0}{\pi R^2} a_d$
E. None of these