A solution to the wave equation is:

$f(z,t) = A\cos(kz - \omega t + \delta)$ $\qquad$ $(k > 0)$

What is the speed of this wave?

Which way is it moving?

If δ is small (and >0), is this wave "delayed" or "advanced"?

What is the frequency?

The angular frequency?

The wavelength?

The wave number?

The 3-D wave equation is $\nabla^2 f(x,y,z,t) = \frac{1}{v^2}\frac{\partial^2 f(x,y,z,t)}{\partial t^2}$

One particular "traveling wave" solution to this is often written

$$\tilde{f}_1(x,y,z,t) = \tilde{A}\, e^{\,i(\vec{k}\cdot\vec{r}-\omega t)}, \text{ where } \tilde{A} = A\, e^{\,i\delta}.$$

This wave travels in the **k** direction (do you see why?)

This wave has wavelength lambda= 2π/|**k**| (do you see why?)

This wave has period 2π/ω (do you see why?)

This wave has speed v = ω/|**k**| (do you see why?)

What is the real form of this wave?

A) $A\cos(kx-\omega t)$ B) $A\cos(kx-\omega t+\delta)$

C) $A\cos(\vec{\mathbf{k}}\cdot\vec{\mathbf{r}}-\omega t)$ D) $A\cos(\vec{\mathbf{k}}\cdot\vec{\mathbf{r}}-\omega t+\delta)$

E) More than one of these/other/???

The electric field for a plane wave is given by:

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

Suppose $\mathbf{E_0}$ points in the +x direction.
Which direction is this wave moving?

A) The x direction.

B) The radial (**r**) direction

C) A direction *perpendicular* to both **k** and **x**

D) The **k** direction

E) None of these/MORE than one of these/???