1. Express the wave function for one-dimensional harmonic waves in terms of the following parameters:
   - Frequency and wavelength
   - Period and wavelength
   - Angular frequency and wave vector

starting place?

$y(x) = A\cos(k(x - vt) + \phi)$

or

$y(x) = A\cos(kx - \omega t + \phi)$

1) $y(x) = A\cos\left(\frac{2\pi x}{\lambda} - 2\pi\nu t + \phi\right)$

2) $y(x) = A\cos\left(\frac{2\pi x}{\lambda} - \frac{2\pi}{T}t + \phi\right)$

3)

$\omega\left(t - \frac{x}{c}\right) = \omega t - \frac{\omega x}{c}$, with $\frac{\omega}{c} = k$

2. Consider the plane electromagnetic wave in vacuum (in SI units) given by the expressions:
   $E_x = 0$
   $E_y = 4\cos[2p * 10^{14}(t - x/c) + p/2]$
   $E_z = 0$

   - Calculate the frequency, wavelength, direction of motion, amplitude, initial phase angle, and polarization of the wave.
   - Write an expression for the magnetic flux density.

4 ← amplitude; initial phase angle → $\pi/2$; polarization → y-direction

not sure about $p$ → $\pi$?

but $k \cdot v = \omega$

and $v = \frac{\omega}{k} = \lambda \cdot \nu$

so since $\omega = 2\pi \cdot 10^{14}$ $\quad \omega = 2\pi\nu$

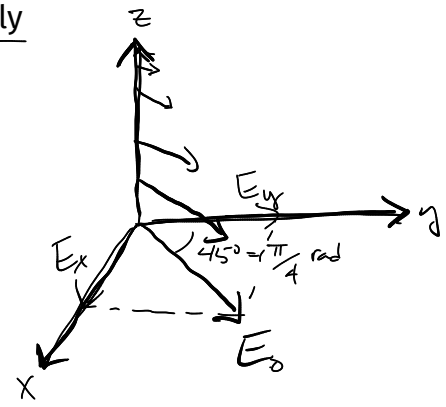
then $\nu = 10^{14}$ Hz

$\lambda = \frac{2\pi}{k} = \frac{2\pi c}{\omega}$

but also $\lambda = \frac{v}{\nu}$

so $\lambda = \frac{c}{10^{14}} = \frac{3 \cdot 10^8}{10^{14}} = 3 \cdot 10^{-6} = 3\,\mu m$

3. Write an expression for the $\vec{E}$ and $\vec{B}$ fields that constitute a plane harmonic wave traveling in the $+z$-direction. The wave is linearly polarized with its plane of vibration at 45° to the $yz$-plane.




$$\vec{k} = k_z \hat{z}$$

$$E_x = \frac{E_0\sqrt{2}}{2}\cos(k_z z - \omega t)$$

$$E_y = \frac{E_0\sqrt{2}}{2}\cos(k_z z - \omega t)$$

$$E_z = 0$$

$$\vec{B} = \frac{\vec{k}\times\vec{E}}{\omega} = \begin{vmatrix} \hat{x} & \hat{y} & \hat{z} \\ 0 & 0 & k_z \\ E_x & E_y & 0 \end{vmatrix}$$

4. A 500-nm harmonic EM wave, whose electric field is in the z-direction, is traveling in the y-direction in vacuum.
   - What is the frequency of the wave?
   - Determine both v and k for this wave.
   - If the electric field amplitude is 700 V/m, what is the amplitude of the magnetic field?
   - Write an expression for both $E(t)$ and $B(t)$ given that each is zero at $x = 0$ and $t = 0$. Put in all the appropriate units.

5. Consider a linearly polarized plane electromagnetic wave traveling in the $+x$-direction in free space having as its plane of vibration the $xy$-plane. Given that its frequency is 5 MHz and its amplitude is $E_0 = 0.05\,\mathrm{V/m}$

   - Find the period and wavelength of the wave.
   - Write an expression for $E(t)$ and $B(t)$.
   - Find the flux density, $< S >$, of the wave.

6. A light wave travels from point A to point B in vacuum. Suppose we introduce into its path a flat glass plate ($n = 1.50$) of thickness $L = 1.00$ mm. If the vacuum wavelength is 500 nm, how many waves span the space from A to B with and without the glass in place? What phase shift is introduced with the insertion of the plate?