Homwork 17

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a) With a non-dispersive medium we get that for a given wavelength, the velocity doesn't change. So k, ω and v are all constant.

b) $$E(x,z,t) = E_0 e^{i(k_1 x - \omega_1 t)} + E_0 e^{i(k_2 z - \omega_2 t)}$$

$$\Rightarrow E_0 \left(e^{i(kx-\omega t)} + e^{i(k z - \omega t)}\right]$$

Who said these were EM waves? :)

$$= E_0 e^{i\omega t}\left(e^{ikx} + e^{ikz}\right)$$

$$I = \frac{1}{c\mu_0}\left(|E|\right)^2 = \frac{1}{c\mu_0}\left(E_0 e^{i\omega t}\left(e^{ikx}+e^{ikz}\right)\right)^2 = 0$$

The modulus squared is not the same as the simple square of the number.

$$\left(e^{ikx} + e^{ikz}\right)^2 = 0$$

$$e^{ikx} + e^{ikz} = 0$$

$$\cos(kx) + i\sin(kx) = -\cos(kz) - i\sin(kz)$$

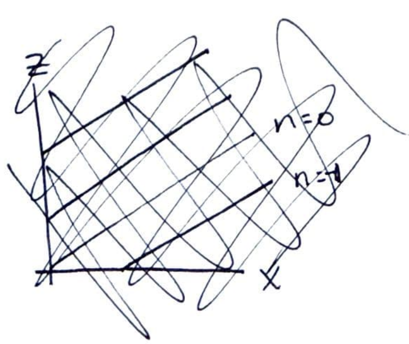
$$\cos(kx) = -\cos(kz)$$

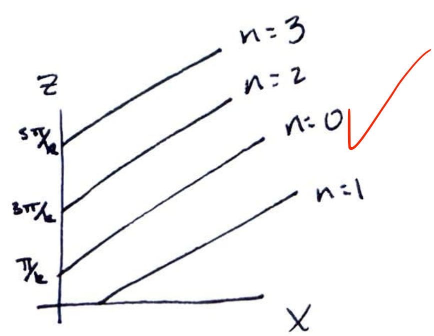
$$i\sin(kx) = -i\sin(kz)$$

$$kz = kx + \pi\underbrace{(2n+1)}_{\text{odd int}} \qquad n \in \mathbb{Z}$$

$$z = x + \frac{\pi(2n+1)}{k}$$

Originally this is what I wrote down by just thinking of interference, so this meets the expectation.





c)

i) only the quantity of k would change, but the idea stays the same.

ii) Unless the frequencies are specific multiples of V and 2π, the Intensity will also depend on t, as it can't be factored out like we did [since ω is different for x and z].