Quiz #1, 02/12/2018

Name:_____Signature:_____

A wave with the frequency of 1-MHz travels in the -z direction in air. Assume the wave travels at the speed of light (c = $3.0\text{x}10^8$m/s in air). If the wave reaches a peak value of 1.2 π at z =50 m when t=0. Find:

1) (10 points) Wavelength in air

2) (10 points) Expression for the instantaneous of the wave (time domain)

3) (10 points) Expression for the wave in the phasor domain

4) (extra 10 points) If the wave reflects at z =50 m with 100% reflection and 0^0 phase shift, what's the time domain expression of the reflection wave?

Solution:

1). $\lambda f = c, \lambda = \frac{c}{f} = \frac{3\times10^8 m/s}{10^6 Hz} = 300m$

2). $y(z,t) = 1.2\pi\cos\left(\omega t + \frac{2\pi}{\lambda}z + \varphi_0\right)$

$1.2\pi = 1.2\pi\cos\left(\frac{2\pi}{300}50 + \varphi_0\right)\ \varphi_0 = -\frac{\pi}{3}$

$y(z,t) = 1.2\pi\cos\left(\omega t + \frac{2\pi}{\lambda}z - \frac{\pi}{3}\right)$

3) $\tilde{y}(z) = 1.2\pi e^{j\left(\frac{2\pi}{\lambda}z - \frac{\pi}{3}\right)}$

4) $\tilde{y}(z) = 1.2\pi e^{j\left(-\frac{2\pi}{\lambda}z + \frac{\pi}{3}\right)}$