EEL 3472, Spring 2013 Quiz 1 (2 points for each correct answer)

Closed-note, closed book

Using a calculator is a hindrance!

The time-domain expression for the current on a transmission line is given by:

\[ i(z,t) = \frac{3\cos(2\pi \times 10^6 t + \frac{2}{3} \pi \times 10^{-2} z)e^{0.01z}}{i_1(z,t)} + \frac{2\cos(2\pi \times 10^6 t + \frac{2}{3} \pi \times 10^{-2} z)e^{-0.01z}}{i_2(z,t)} \]

a. Which of the two terms, \( i_1(z,t) \) or \( i_2(z,t) \) represents a wave traveling in the positive \( z \)-direction? 

b. What is the propagation constant \( \beta \)?

(c. What are the units for the propagation constant \( \beta \)?)

d. What is the frequency \( f \)?

\[ \frac{\omega}{2\pi} = \frac{10^6}{2\pi} \rightarrow f = \frac{10^6}{2\pi} \text{ rad/s} = 3 \times 10^8 \text{ m/s} \]
e. What is the phase velocity \( v_p \) of the wave? 

\[ v_p = \frac{\omega}{\beta} = \frac{2\pi \times 10^{-2}}{\frac{2}{3} \pi \times 10^{-2}} = 3 \times 10^8 \text{ m/s} \]

Bonus (2 points – no partial credit)

f. If the characteristic impedance of the line is 50 \( \Omega \), write the expression for the line current in phasor form:

\[ V(z) = \frac{100}{e^{-j\frac{2}{3} \pi \times 10^{-2} z} - j0.018 e^{-j\frac{2}{3} \pi \times 10^{-2} z}} \]