1. Using Maxwell’s curl equations (1.50a and 1.50b in the textbook) derive the expression for the complex propagation constant, \( \gamma \), given in equation 1.55, assuming that the medium is a perfect insulator (\( \sigma = 0 \)) and that the material has a complex permittivity, \( \varepsilon = \varepsilon' - j\varepsilon'' \).

2. An electromagnetic wave, propagating in the z direction, with an electric field given by

\[
\mathcal{E}_x = 10 \cos(\omega t - kz)
\]  

at a frequency of 3 GHz is incident upon a body of distilled water (see appendix G for the relative dielectric constant and loss tangent of distilled water). What fraction of the incident power is reflected? Find the transmission coefficient, T. Write an expression for the transmitted wave into the water as a function of distance, \( z \). Using Matlab, or Excel or an equivalent software tool, plot the electric field intensity versus depth (\( z \)), for \( t=0 \) from \( z=0 \) to \( z=1 \) m. This should look like a highly damped sinusoid. Change the frequency to 300 MHz and plot the results, assuming that the permittivity remains unchanged. How many dB is the wave attenuated at 1 m depth at 300 MHz? At 3 GHz?