Learning Objectives 3.5 and 3.6: I can identify the various quantities represented on the Smith Chart. I can use the Smith Chart to solve transmission line problems.

Show your work. Solve each part on a printed Smith chart, then check it with the formula. Write a **Documentation** line at the end (**None** if you did not collaborate). All lines are lossless with $Z_0 = 50\,\Omega$.

1. **Input impedance by rotation.** A load $Z_L = 25 - j25\,\Omega$ terminates a line 0.125λ long.

   (a) Find z_L and Γ_L in polar form.

   Γ_L =

   (b) Through what angle, and in which direction, does the point turn to reach the input? Find Γ_{in}.

   Γ_{in} =

   (c) Find Z_{in}, and check it with $z_{in} = \dfrac{z_L + j\tan\beta d}{1 + jz_L\tan\beta d}$.

   Z_{in} =

2. **Admittance and the quarter wave.** A load $Z_L = 100 + j50\,\Omega$.

   (a) Find y_L by reflecting Γ_L through the center, and check it with $1/z_L$.

   y_L =

   (b) The load sits at the end of a quarter-wavelength line. Find Z_{in}.

   Z_{in} =

3. **The wavelength scale.** A load has $\Gamma_L = 0.6\angle 60°$.

   (a) Find the load's reading on the wavelengths-toward-generator scale.

   WTG =

   (b) A point on the line reads 0.3λ on the same scale. How far is it from the load, and what is the angle of Γ there?

   d =

   θ =

4. **Voltage maxima and minima.** The load of Question 2, $z_L = 2 + j1$, has $\Gamma_L = 0.447\angle 26.6°$.

   (a) Find the distance from the load to the first voltage maximum, and z there.

   d_{max} =

   z =

   (b) Find the distance to the first voltage minimum, and z there.

   d_{min} =

   z =

   (c) A measurement finds a voltage minimum. Explain in one or two sentences why the impedance there is always real and less than one.

Documentation: _____