Learning Objective 3.6: 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 stub formulas. Write a **Documentation** line at the end (**None** if you did not collaborate). All lines and stubs are lossless with $Z_0 = 50\,\Omega$ and $v_p = 2 \times 10^8$ m/s.

1. **Stub reactance.**

   (a) Find the input impedance of a shorted stub $\lambda/8$ long, and the lumped element it acts like.

   Z_{sc} =

   (b) Find the input impedance of an open stub $\lambda/8$ long.

   Z_{oc} =

   (c) Find the shortest shorted stub and the shortest open stub that add a normalized susceptance of $+j1$ in shunt.

   short =

   open =

   (d) Repeat part (c) for a susceptance of $-j1$.

   short =

   open =

2. **Single-stub tuner.** The load $Z_L = 100 + j50\,\Omega$ from the Lesson 12 practice set must be matched at 500 MHz with a single shunt stub. Lesson 12 found that $d = 0.1988\lambda$ puts the admittance at $y = 1 + j1$.

   (a) Find the wavelength on the line and the distance d in centimeters.

   $d =$ ____

   (b) The tuner is built in coaxial cable. Choose the stub type and find its length in centimeters.

   $\ell =$ ____

   (c) Find the second solution: d, y there, and the open-stub length.

   $d =$ ____

   $\ell_{oc} =$ ____

   (d) Explain in one or two sentences why a tuner is usually a shunt stub rather than a series stub.

Documentation: _____