EE301 Assignment 2: Smith Chart Problems

1. An impedance of 75 - j30 Ω is connected to a 100 Ω line. Find
    a. complex reflection coefficient at the load,
    b. the complex reflection coefficient and the impedance at a distance of 0.35 λ from the load.
    c. What is the VSWR measured on the line?
2. Mark following points on the smith chart.
    a. $\Gamma = 0.3\angle -45°$
    b. 2. $\Gamma = 0.2 + j0.5$
    c. 3. $\bar{z} = 3 + j2$
    d. 4. VSWR = 2 and $\angle\Gamma = 120°$

3. A long line with characteristic impedance $Z_o = 250\ \Omega$ operates at $1\ GHz$. The speed of propagation on the line is c and the load impedance is $Z = 75 + j100\Omega$. Find:
    a. The reflection coefficient at the load
    b. The reflection coefficient at a distance of 20m 2from the load towards the generator.
    c. Input impedance at 20 m from the load
    d. The standing wave ratio on the line
    e. Locations of the first voltage maximum and the first voltage minimum from the load.
4. An inductive reactance of 100 Ω is to be realized using an open circuited section of a 50 Ω line at 2 GHz. Find the length of section. If 10 % variation in the reactance is acceptable over what bandwidth the reactance realization is satisfactory?
5. On a line the maximum and minimum voltages measured are 25 V and 15 V respectively. The distance between adjacent maximum and minimum is 20 cm. If the voltage minimum occurs at a distance of 25 cm from the load, find the load admittance. The characteristic impedance of the line is 100 Ω.
6. A 1.25 λ long section of a 75 Ω line is short circuited at one end and open circuited at the other. The voltage measured at the midpoint of the line is 40 V. If the loss in the line is 0.2 dB per meter and the wavelength of the signal is 5 m, find the energy stored and energy dissipated on the line. Hence find the quality factor of the section of the line Assume that the line has a velocity factor 0.66. (velocity factor is the ratio of the velocity of a wave on the line to the velocity of the light in vacuum).
7. Two long cables with characteristic impedances 100 Ω and 200 Ω are to be joined through a quarter wavelength transform at 900 MHz. If the velocity factor for the transformer section is 0.8, find the length and the characteristic impedance of the transformer.
8. An impedance of 50 + j50 Ω is to be matched to 50 Ω using a quarter wavelength transformer. Find the location and the characteristic impedance of the quarter wavelength transformer.
9. If the single stub matching is employed for the previous question, what is the location and length of the stub? The stub is a short circuited section of 150 Ω line connected in parallel with the main line.
10. An antenna operates at a wavelength of 2m and is designed with an impedance of $75\ \Omega$. However, because of a mistake in design the antenna is badly mismatched. The measured impedance after installation is $15 + j60\ \Omega$. The antenna is connected to a $75\ \Omega$ single stub. Calculate:
    a. The required shorted stub length and its location on the line to match the antenna to the line.
    b. The shortest required open circuit stub that will accomplish the same purpose as the shorted stub.