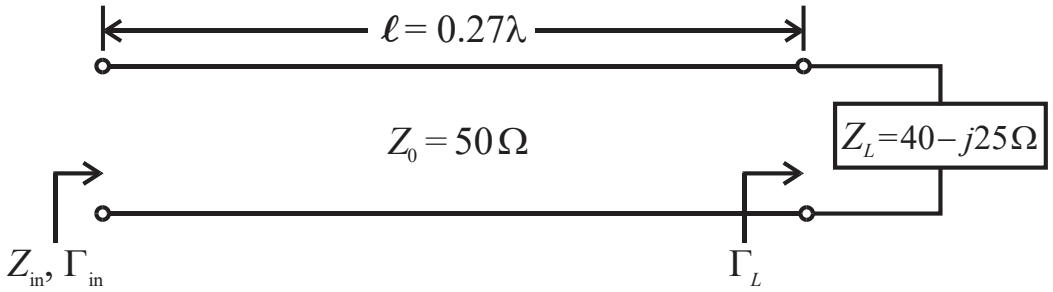
11.40 A lossless transmission line, with characteristic impedance of 50 Ω and electrical length of $\ell = 0.27\lambda$, is terminated by a load impedance $40 - j25\ \Omega$. Determine Γ_L, s, and Z_{in}.

- Use Smith chart. Also, determine input reflection coefficient.



1) Normalize Z_L. $z_L = Z_L/Z_0 = (40 - j25)/50 \Rightarrow z_L = 0.8 - j0.5\ \Omega/\Omega$ & plot on Smith chart.

2) Set compass to distance between center of Smith chart and z_L. Use compass to draw circle, centered on Smith chart, through z_L.

3) Next, use compass to mark the "REFL. COEFF. V or I" scale below Smith chart on right side to find $|\Gamma_{in}| = |\Gamma_L| = 0.288$.

4) Also, use compass to mark SWR (VSWR) scale below Smith chart on left side. Read standing wave ratio to be **$s = SWR = 1.81$**.

5) Use a straight edge to draw radial line from center of Smith chart through z_L and outer rings of Smith chart. Use the "ANGLE OF REFLECTION COEFFICIENT IN DEGREES" scale to read $\angle\,\Gamma_L = -96.3°$.

6) Put magnitude & angle of the load reflection coefficient together **$\Gamma_L = 0.288\angle -96.3°$**.

7) Given $\ell = 0.27\,\lambda$. For radial line through z_L read 0.116 on "WAVELENGTHS TOWARD LOAD" scale. Go to 0.27 - 0.116 = 0.154 on the "WAVELENGTHS TOWARD GENERATOR" scale and draw a radial from the center of Smith chart.

8) At intersection of this radial line and the $|\Gamma| = 0.288$ circle, read normalized input impedance to be $z_{in} = 1.04 + j0.61\ \Omega/\Omega$.

9) Calculate input impedance to be $Z_{in} = z_{in} Z_0 = (1.04 + j0.61)50 \Rightarrow$ **$Z_{in} = 52 + j30.5\ \Omega$**.

10) For radial line through z_{in}, use the "ANGLE OF REFLECTION COEFFICIENT IN DEGREES" scale to read $\angle\,\Gamma_{in} = 69.3°$.

11) Put magnitude & angle of the input reflection coefficient together **$\Gamma_{in} = 0.288\angle 69.3°$**.

Simple Smith Chart