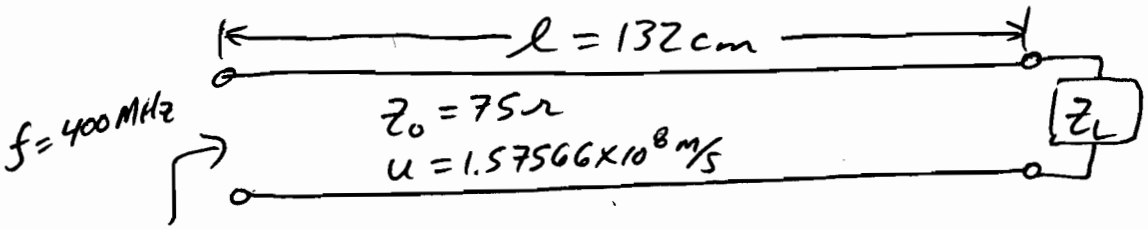
11.37 A 75 Ω lossless transmission line is 132 cm long, with a dielectric constant $\varepsilon_r = 3.62$. If the line operates at 400 MHz with an input impedance of $Z_{in} = 40 + j65\ \Omega$, use the Smith chart to determine the terminating load.

$$u = \frac{c}{\sqrt{\varepsilon_r}} = \frac{2.9979 \times 10^8\ m/s}{\sqrt{3.62}} = 1.57566 \times 10^8\ m/s$$

$$\lambda = \frac{u}{f} = \frac{1.57566 \times 10^8}{400 \times 10^6} = 0.39391535\ m$$

$$\frac{\ell}{\lambda} = \frac{132 \times 10^{-2}}{0.3939} = 3.351 \rightarrow \underline{0.351\lambda = \ell}$$



$Z_{in} = 40 + j65\ \Omega$

* Normalize Z_{in} to 75Ω line $z_{in} = \frac{40 + j65}{75} = 0.5\bar{3} + j0.86\bar{6}\ \Omega/\Omega$ and plot on Smith Chart

* Move $\ell = 3.351\lambda$ or 0.351λ from z_{in} "WAVELENGTHS TOWARD LOAD" on circle of constant $|\Gamma|$ to arrive at $z_L = 2.75 - j1.4\ \Omega/\Omega$

$$Z_L = z_L Z_0 = (2.75 - j1.4)75$$

$$\underline{\underline{Z_L = 206.25 - j105\ \Omega}}$$

(Analytic soln $Z_L = 204.6 - j105.3\ \Omega$)

Problem 11.37

$z_0 = 75\,\Omega$

$f = 400\,MHz$

$u = c/\sqrt{3.62}$

$l = 3.351\lambda$

$z_{in} = 0.53 + j0.867\ \Omega$

$z_L = 2.75 - j1.4\ \Omega$