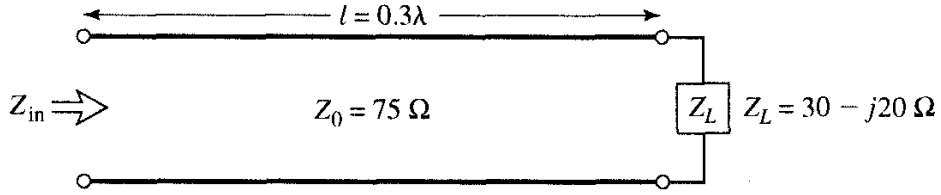
2.8 A lossless transmission line of electrical length $\ell = 0.3\lambda$ is terminated with a complex load impedance as shown in the accompanying figure. Find the reflection coefficient at the load, the SWR on the line, the reflection coefficient at the input of the line, and the input impedance to the line.



Per (2.35), $\Gamma = \Gamma_L = \dfrac{Z_L - Z_0}{Z_L + Z_0} = \dfrac{(30 - j20) - 75}{(30 - j20) + 75}$ $\Rightarrow$ **$\Gamma_L = 0.46071\angle -145.2532°$.**

Per (2.41), $\text{SWR} = \dfrac{1 + |\Gamma|}{1 - |\Gamma|} = \dfrac{1 + 0.46071}{1 - 0.46071}$ $\Rightarrow$ **SWR = 2.709.**

Using (2.10), $\beta = \dfrac{2\pi}{\lambda}$. Therefore, $\beta l = 2\pi(0.3) = 0.6\,\pi = 1.88496$ rad.

Per (2.42), $\Gamma(\ell) = \Gamma_{\text{in}} = \Gamma(0)e^{-2j\beta\ell} = \Gamma_L e^{-2j\beta\ell} = (0.46071\angle -145.2532°)e^{-2j1.88496}$

$\Rightarrow$ **$\Gamma_{\text{in}} = 0.46071\angle -1.2532°$.**

Per (2.43), $Z_{\text{in}} = \dfrac{1 + \Gamma e^{-2j\beta\ell}}{1 - \Gamma e^{-2j\beta\ell}} Z_0 = Z_0 \dfrac{1 + \Gamma_{\text{in}}}{1 - \Gamma_{\text{in}}} = 75\left(\dfrac{1 + 0.4607\angle -1.253°}{1 - 0.4607\angle -1.253°}\right)$

$\Rightarrow$ **$Z_{\text{in}} = 202.99 - j5.19\ \Omega$.**