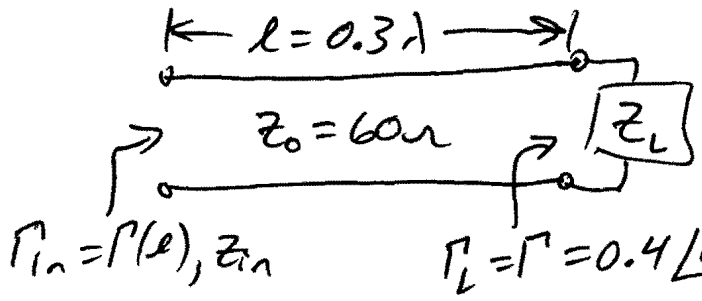
2.10 A terminated transmission line with $Z_0 = 60\ \Omega$ has a reflection coefficient at the load of $\Gamma = 0.4\angle 60°$. (a) What is the load impedance? (b) What is the reflection coefficient 0.3λ away from the load? (c) What is the input impedance at this point?



a) Per (2.35), re-arranged,

$$Z_L = Z_0\left(\frac{1+\Gamma}{1-\Gamma}\right) = 60\left(\frac{1+0.4\angle 60°}{1-0.4\angle 60°}\right)$$

$$\underline{\underline{Z_L = 66.316 + j\,54.696\ \Omega}}$$

b) Per (2.42)

$$\Gamma_{in} = \Gamma(\ell = 0.3\lambda) = \Gamma(0)\,e^{-j2\beta\ell}$$

($\Gamma(0) = \Gamma_L$)

$$= (0.4\angle 60°)\,e^{-j2\frac{2\pi}{\lambda}0.3\lambda}$$

$$\underline{\underline{\Gamma_{in} = 0.4\angle -156°}}$$

c) Per (2.43)

$$Z_{in} = \frac{1+\Gamma_{in}}{1-\Gamma_{in}}Z_0 = \left(\frac{1+0.4\angle -156°}{1-0.4\angle -156°}\right)60$$

$$\underline{\underline{Z_{in} = 26.655 - j\,10.325\ \Omega}}$$