A lossless twin-lead transmission line ($Z_0 = 200\,\Omega$, $u = 2.4\times10^8$ m/s) of length $l = 0.7\lambda$ is terminated with a load $Z_L = 80 + j60\ \Omega$. The transmission line is connected to a signal generator operating at 360 MHz. Find (a) the inductance per-unit-length $L$ and capacitance-per-unit-length $C$, (b) phase constant $\beta$, wavelength $\lambda$, & length $l$ of the transmission line, and (c) input impedance $Z_{in}$.

a) $Z_0 = \sqrt{L/C}$ & $u = \frac{1}{\sqrt{LC}}$ from (11.21c) & (11.21b)

$$L = \frac{Z_0}{u} = \frac{200}{2.4\times10^8} = 0.8\overline{3}\ \mu H/m = 833.\overline{3}\ nH/m$$

$$C = \frac{1}{Z_0 u} = \frac{1}{200(2.4\times10^8)} = 20.8\overline{3}\ pF/m$$

b) $$\beta = \frac{\omega}{u} = \frac{2\pi \times 360\times10^6}{2.4\times10^8} = 9.425\ rad/m$$

$$\lambda = u/f = \frac{2.4\times10^8}{360\times10^6} = 0.\overline{66}\ m$$

$$l = 0.7\lambda = 0.7(0.\overline{66}) = 0.4\overline{6}\ m$$

c) (11.34) $Z_{in} = Z_0\left[\frac{Z_L + jZ_0\tan(\beta l)}{Z_0 + jZ_L\tan(\beta l)}\right]$ where $\beta l = \frac{2\pi}{\lambda}(0.7\lambda) = 1.4\pi$

$$Z_{in} = 200\left[\frac{(80+j60) + j200\tan(1.4\pi)}{200 + j(80+j60)\tan(1.4\pi)}\right]$$

$$Z_{in} = 550.649 - j30.679\ \Omega$$