

75. From the problem statement $2\pi f_0 = (LC)^{-1/2} = 6000 \text{ Hz}$, $Z = \sqrt{R^2 + (2\pi f_1 L - 1/2\pi f_1 C)^2} = 1000 \Omega$ where $f_1 = 8000 \text{ Hz}$, and $\cos \phi = R/Z = \cos 45^\circ$. We solve these equations for the unknowns.

(a) $R = Z \cos \phi = (1000 \Omega) \cos 45^\circ = 707 \Omega$

(b) The self-inductance is

$$L = \frac{\sqrt{Z^2 - R^2}}{2\pi(f_1 - f_0^2/f_1)} = \frac{\sqrt{(1000 \Omega)^2 - (707 \Omega)^2}}{2\pi[8000 \text{ Hz} - (6000 \text{ Hz})^2/8000 \text{ Hz}]} = 3.22 \times 10^{-2} \text{ H} .$$

(c) The capacitance is

$$C = \frac{1}{4\pi^2 f_0^2 L} = \frac{1}{4\pi^2 (6000 \text{ Hz})^2 (3.22 \times 10^{-2} \text{ H})} = 2.19 \times 10^{-8} \text{ F} .$$