Ejercicio 3

a) $V(t) = V_p \cos(\omega t)$

$$V_c = \frac{R /\!/ \frac{1}{i\omega C}}{i\omega L + \left(R /\!/ \frac{1}{i\omega C}\right)} V_p$$

$$R /\!/ \frac{1}{i\omega C} = \left(\frac{1}{R} + i\omega C\right)^{-1} = \frac{R}{1 + i\omega RC}$$

$$\Rightarrow V_c = \frac{\frac{R}{(1+i\omega RC)}}{i\omega L + \frac{R}{1+i\omega RC}} V_p =$$

$$= \frac{R}{i\omega L - \omega^2 RLC + R} V_p =$$

$$= \frac{R}{i\omega L + R(1 - \omega^2 LC)} V_p$$

$$\Rightarrow \begin{cases} |V_c| = \dfrac{R}{\sqrt{\omega^2 L^2 + R^2 (1 - \omega^2 LC)^2}} V_p \\ \text{Arg}(V_c) = -\text{Arctg}\left[\dfrac{\omega L}{R(1 - \omega^2 LC)}\right] \end{cases}$$

$$\Rightarrow \boxed{V_c(t) = |V_c| \cos(\omega t + Arg(V_c))}$$

b)

$$|V_c|_{max} \quad si \quad (1 - \omega^2 LC) = 0$$

$$\Rightarrow LC = \frac{1}{\omega^2} \Rightarrow \boxed{C = \frac{1}{L\omega^2}}$$

c) Si $C = \frac{1}{L\omega^2} \Rightarrow V_c = \frac{R}{i\omega L} V_p$ $\Rightarrow$

$$I_L = \frac{V_p - V_c}{i\omega L}$$

$$\Rightarrow I_L = \frac{V_p \left(1 - \frac{R}{i\omega L}\right)}{i\omega L} = \frac{V_p (i\omega L - R)}{-\omega^2 L}$$

$$\Rightarrow |I_L| = \frac{V_p \sqrt{(\omega^2 L^2 + R^2)}}{\omega^2 L}$$

$$\mathrm{Arg}(I_L) = \mathrm{Arctg}\left(\frac{\omega L}{-R}\right) - \pi$$

$$\Rightarrow \boxed{i_L = |I_L| \cos(\omega t + \mathrm{Arg}(I_L))}$$