LC and driven RLC circuits

1. Consider an LC circuit with $L = 10\,mH$, $C = 0.7\,mF$ and capacitor initially charged to $10\,V$.

   (a) find the resonant frequency ω_0 in rad/s

   (b) derive explicit formulas for the charge $q(t)$ and the electric energy $U_C(t)$ in the capacitor

   (c) derive explicit formulas for the current $I(t)$ and the magnetic energy $U_M(t)$ in the inductor

   (d) verify $U_M(t) + U_E(t) = const$ (and determine the $const$)

2. A series RLC circuit is driven by an external AC source with $V_{RMS} = 120\,volt$ and variable frequency f. Use $L = 10\,mH$, $C = 0.7\,mF$, $R = 0.1\,\Omega$.

   (a) Find the resonant frequency f_0 (in Hz)

   (b) Plot I_{RMS} as a function of f. (Select the horizontal scale $f_0 \pm 40\,Hz$ for a good plot).