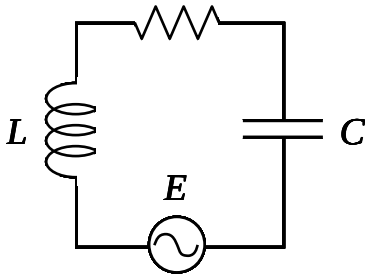
Discussion Question 11D
P212, Week 11
RLC Circuits

(a) Calculate the maximum EMF $\mathcal{E}_m$ and the maximum current I_m in the RLC circuit described at right.

The "rms" = root-mean-square value of anything oscillating sinusoidally is its peak value divided by √2.



$R = 200\ \Omega$
$L = 40$ mH
$C = 0.20\ \mu$F
$E_{\text{rms}} = 120$ V
$\omega = 10^4$ rad/sec

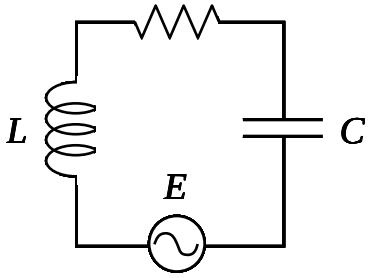
(b) Find the magnitude and sign of the phase ϕ by which the driving EMF leads the current.

A negative phase means that the driving EMF *lags* the current … which is the case here? Does your answer make sense given the reactances you calculated earlier?

(c) Draw the <u>phasor diagram</u> for this circuit, giving <u>numerical values</u> for the lengths of each phasor ($\mathcal{E}$, V_R, V_C, V_L).

Be sure to draw your diagram carefully: use longer phasors for larger peak voltages.

(d) What is the resonant frequency ω_0 of this circuit?



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(e) Calculate the maximum energies $U_{L,max}$ and $U_{C,max}$ stored in the inductor and capacitor.

(f) Assume that the angular frequency ω of the generator is variable. For what ω is the total impedance Z equal to $2R$? *Hint- you will get a quadratic equation.*