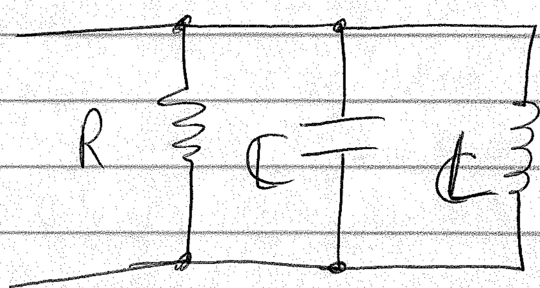
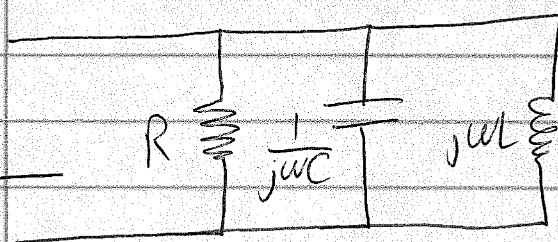
Let's try:



$\omega =$ ___



$$\tilde{Z}_{eq} = \frac{1}{\frac{1}{R} + \frac{1}{1/j\omega C} + \frac{1}{j\omega L}} = \frac{1}{\frac{1}{R} + j\omega C + \frac{1}{j\omega L}}$$

$$\tilde{Z}_{eq} = \frac{1}{\frac{j\omega L + R}{(R)(j\omega L)} + j\omega C} = \frac{1}{\frac{R + j\omega L}{j\omega RL} + j\omega C}$$

$$\tilde{Z}_{eq} = \frac{1}{\frac{R + j\omega L + (j\omega C)(j\omega RL)}{j\omega RL}} = \frac{1}{\frac{R + j\omega L - \omega^2 RLC}{j\omega RL}}$$

$$\tilde{Z}_{eq} = \frac{1}{\frac{(R - \omega^2 RLC) + j\omega L}{j\omega RL}} = \frac{j\omega RL}{(R - \omega^2 RLC) + j\omega L}$$

$$\tilde{Z}_{eq} = \frac{j\omega \cancel{R} L}{\cancel{R}\left[(1-\omega^2 LC) + j\omega \frac{L}{R}\right]} = \frac{j\omega L}{(1-\omega^2 LC) + j\omega L/R}$$

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complex conjugate = itself

"Rationalize the denominator!"

$$\tilde{Z}_{eq} = \frac{j\omega L}{(1-\omega^2 LC)+j\omega L/R} \cdot \frac{(1-\omega^2 LC)-j\omega L/R}{(1-\omega^2 LC)-j\omega L/R} = j\omega L \frac{(1-\omega^2 LC)-j\omega L/R}{(1-\omega^2 LC)^2+(\omega L/R)^2}$$

this now looks like $(a+jb)(a-jb) = a^2 - (jb)^2 = a^2+b^2$

$$\tilde{Z}_{eq} = \frac{(j\omega L)(1-\omega^2 LC)-(j\omega L)(j\omega L/R)}{(1-\omega^2 LC)^2 - j^2(\omega L/R)^2}$$

$$\tilde{Z}_{eq} = \frac{\omega^2 L^2/R + j\omega L(1-\omega^2 LC)}{(1-\omega^2 LC)^2+(\omega L/R)^2}$$

$$= \frac{\omega L\left[\omega L/R + j(1-\omega^2 LC)\right]}{(1-\omega^2 LC)^2+(\omega L/R)^2}$$

$$= \frac{\omega L}{(\omega L/R)^2+(1-\omega^2 LC)^2}\left[(\omega L/R) + j(1-\omega^2 LC)\right]$$

$$\tilde{Z}_{eq} = \frac{\omega L}{(\omega L/R)^2+(1-\omega^2 LC)^2}\left[\sqrt{(\omega L/R)^2+(1-\omega^2 LC)^2} \angle \tan^{-1}\left(\frac{1-\omega^2 LC}{\omega L/R}\right)\right]$$

$$= \frac{\omega L}{\sqrt{(\omega L/R)^2+(1-\omega^2 LC)^2}} \angle \tan^{-1}\left(\frac{(1-\omega^2 LC)R}{\omega L}\right)$$

on resonance at the frequency for which $\phi = 0$, or

$$\tan^{-1}\left(\frac{(1-\omega_0^2 LC)R}{\omega_0 L}\right) = 0$$

$$(1-\omega_0^2 LC)R = 0$$

$$(1-\omega_0^2 LC) = 0$$

or $\omega_0 = \frac{1}{\sqrt{LC}}$

as before