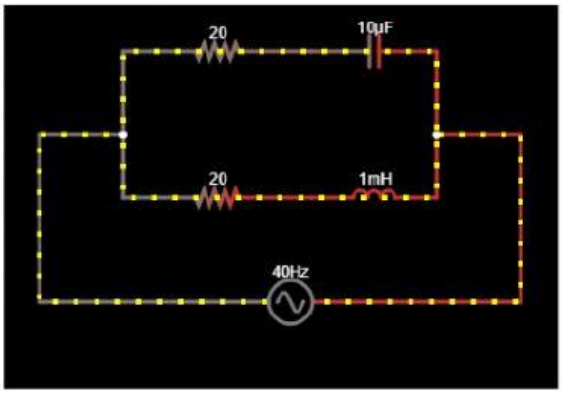
Using Complex numbers to solve RLC Circuits – M2 Worksheet



Step 1: Calculate angular velocity of this circuit:

W=2πf=

Step 2: Calculate individual impedances for each component:

XL=(W×L) j =

XC=$\frac{-j}{WC}$ =

Step 3: Calculate the impedance in the upper branch:

ZA=----------+ ---------- j

Step 4: Convert ZA to the polar form:

$ZA = \mathrm{r}1 < \Theta 1$

Step 5: Calculate the impedance in the lower branch:

ZB=----------+ ---------- j

Step 6: Convert ZB to the polar form:

$ZB = \mathrm{r}2 < \Theta 2$

Step 7: Calculate the total impedance:

$\frac{1}{Z} = \frac{1}{ZA} + \frac{1}{ZB} = \frac{1}{r1}<-\Theta 1 + \frac{1}{r2}<-\Theta 2$ =---------- + ----------

Step 8: Write each part of $\frac{1}{Z}$ in Cartesian form that you can add them up:

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Hint: convert $\frac{1}{r1}<-\Theta 1$ and $\frac{1}{r2}<-\Theta 2$ to the Cartesian form:

$\frac{1}{r1}<-\Theta 1$ =----------+---------- j

$\frac{1}{r2}<-\Theta 2$ =----------+---------- j

Then add them up together and find $\frac{1}{Z}$ in Cartesian:

$\frac{1}{Z}$ = ---------- + ---------- j

Step 9: Convert the Cartesian above to polar form to flip it and find Z:

$\frac{1}{Z} = r < \Theta$ = ----------

Step 10: invert $\frac{1}{Z}$ to get Z:

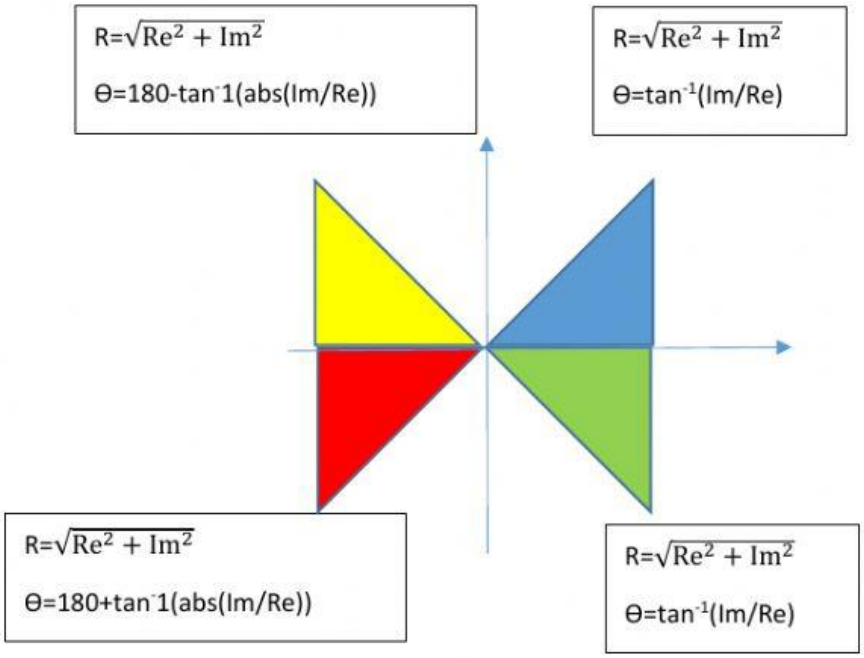
Z= $\frac{1}{r}<-\Theta$ = ----------

Step 11: write Z in Cartesian form:

----=r×Cos(Θ)

-----= r×Sin(Θ)

Z= ---------- + ---------- j



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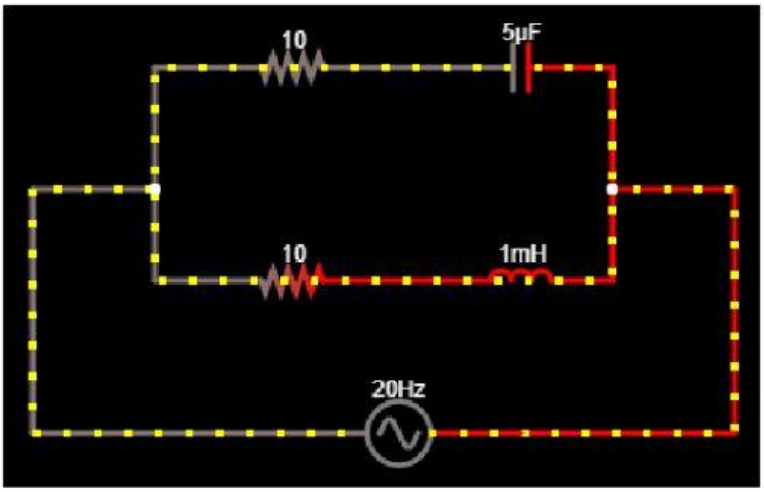

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Hint: convert $\frac{1}{r1}<-\theta 1$ and $\frac{1}{r2}<-\theta 2$ to the Cartesian form:

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$\frac{1}{Z} = r < \theta$ = ----------

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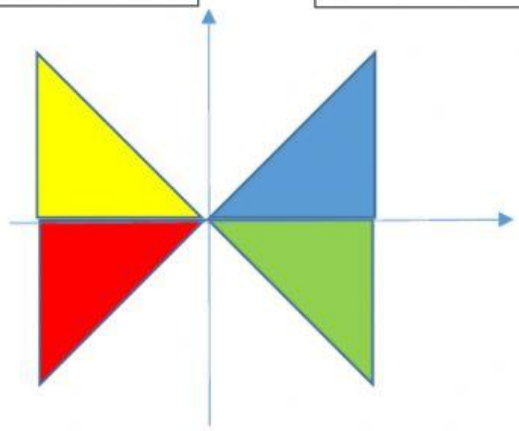
Z= $\frac{1}{r}<-\theta$ = ----------

Step 11: write Z in Cartesian form:

----=r×Cos(Θ)

-----= r×Sin(Θ)

Z= ---------- + ---------- j

R=$\sqrt{Re^2 + Im^2}$
Θ=180-tan-1(abs(Im/Re))

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Θ=$\tan^{-1}$(Im/Re)