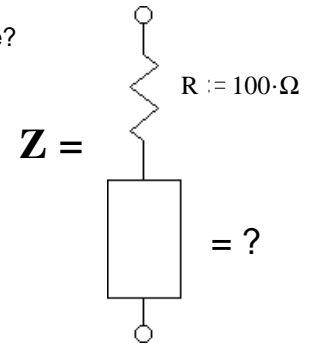1. $\mathbf{Z} = |\mathbf{Z}| \cdot e^{-j \cdot 30 \cdot deg}$ We don't know its magnitude, but its phase angle is -30°.

$\mathbf{Z}$ is made of a 100Ω resistor in series with one other part. What is the part? type and value?
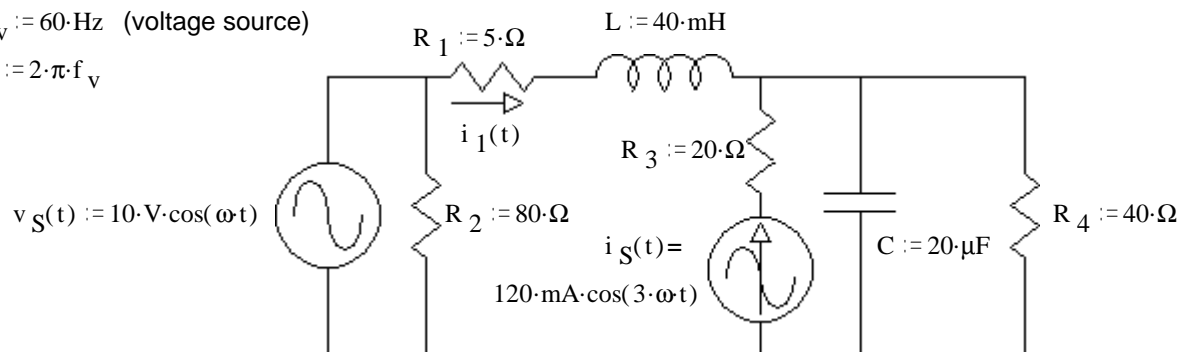
$f := 60 \cdot Hz$ $\omega := 2 \cdot \pi \cdot 60 \cdot Hz$

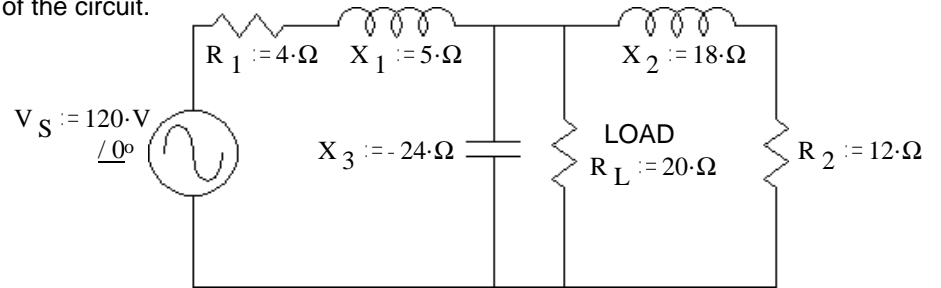$R := 100 \cdot \Omega$

$\mathbf{Z} =$

$= ?$

2. The circuit shown has two sources. The frequency of the current source is the third harmonic of the voltage source.
   Using superposition, find the current $i_1(t)$. Be sure to redraw the circuit twice as part of your solution. $i_1(t) = ?$

$f_v := 60 \cdot Hz$ (voltage source)

$\omega := 2 \cdot \pi \cdot f_v$

$R_1 := 5 \cdot \Omega$

$L := 40 \cdot mH$

$i_1(t)$

$R_3 := 20 \cdot \Omega$

$v_S(t) := 10 \cdot V \cdot \cos(\omega t)$

$R_2 := 80 \cdot \Omega$

$i_S(t) =$

$120 \cdot mA \cdot \cos(3 \cdot \omega t)$

$C := 20 \cdot \mu F$

$R_4 := 40 \cdot \Omega$

3. a) In the circuit below R_L is the load resistor. Find and
draw the Thevenin equivalent of the rest of the circuit.

$V_S := 120 \cdot V$
$\underline{/0°}$

$R_1 := 4 \cdot \Omega$ $X_1 := 5 \cdot \Omega$

$X_3 := -24 \cdot \Omega$

$X_2 := 18 \cdot \Omega$

LOAD
$R_L := 20 \cdot \Omega$

$R_2 := 12 \cdot \Omega$

b) Use the Thevenin equivalent to find the current through the load resistor and the voltage across the load resistor.

c) Find a replacement for R_L in order to maximize the power delivered to R_L.

d) Find the new current and voltage for the load resistor.

Answers

1. $45.9 \cdot \mu F$

2. $i_1(t) := 239 \cdot mA \cdot \cos(\omega \cdot t - 5.5 \cdot deg) + 96.1 \cdot mA \cdot \cos(3 \cdot \omega \cdot t + 94.7 \cdot deg)$

3. a)

$5.844 \: / \: \underline{43.95^o} \: \Omega$

$109.5 \: \underline{/-7.4^o} \: V$

b) $4.46 \: \underline{/-16.9^o} \: A$

$89.2 \: \underline{/-16.9^o} \: V$

c) $5.844 \: \Omega$

d) $10.1 \: \underline{/-29.4^o} \: A$

$59.1 \: \underline{/-29.4^o} \: V$