ICP 1 - Series RC Circuit

- Consider the series RC circuit in Fig. 15.33, analyze the circuit similar to the RL circuit.
  1. Write the current $\mathbf{I}$ in phasor form.
  2. Calculate the total impedance $\boldsymbol{Z_T}$ of the circuit
  3. Find the voltage across the current source, $\mathbf{Vin}$ and the voltages $\boldsymbol{V_R}$ and $\boldsymbol{V_C}$
  4. Find the power delivered to the loads and the total power delivered

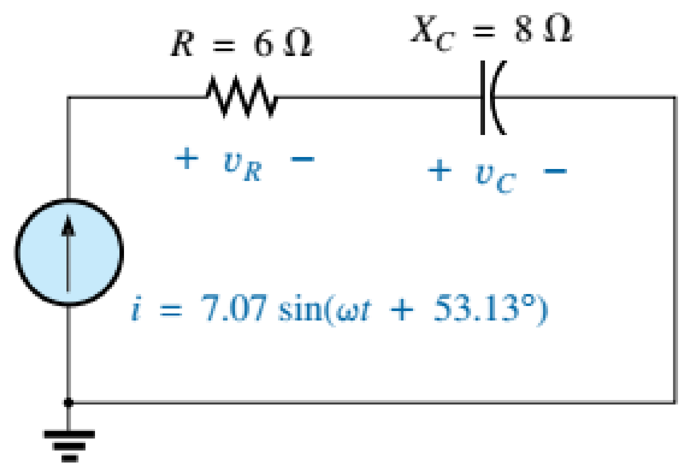

FIG. 15.33
Series R-C ac circuit.

Use the table below to check your analysis of the series RC circuit

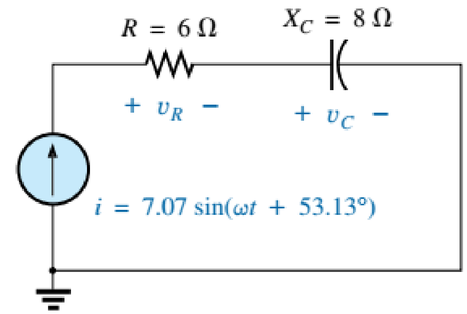

FIG. 15.33
Series R-C ac circuit.

		R	C	Total	
E	Polar	$30\ \angle 53.13°$	$40\angle - 36.87°$	$50\ \angle 0°$	V_rms
	Rectangular	$18 + j24$	$32\ - j24$	$50\ + j0$	
I	Polar	$5\ \angle 53.13°$	$5\ \angle 53.13°$	$5\ \angle 53.13°$	A_rms
	Rectangular	$3\ + j4$	$3\ + j4$	$3\ + j4$	
Z	Polar	$6\ \angle 0°$	$8\angle - 90°$	$10\ \angle - 53.13°$	Ohms
	Rectangular	$6\ + j0$	$0\ - j8$	$6 - j8$	
P		150	0	150	Watts

$$F_P = \cos\theta_T = \frac{R}{Z_T} \qquad = \cos(53.13) = \frac{6\Omega}{10\Omega} = 0.6 \text{ leading}$$

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ICP 2 – Voltage Divider Rule

- Using the voltage divider rule, find the unknown voltages V_R, V_L, V_C, and V_1 for the circuit shown below.

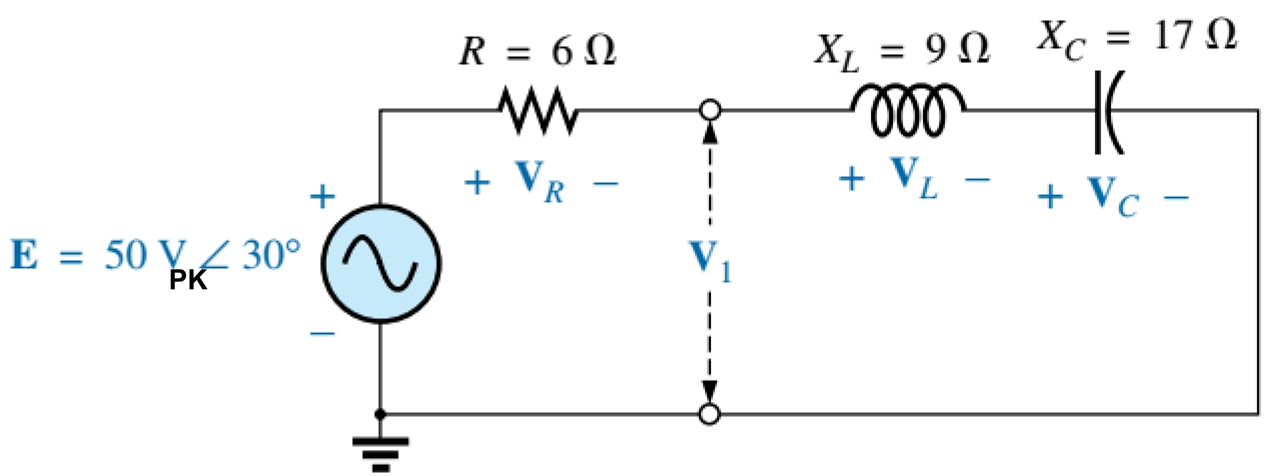

FIG. 15.44
Example 15.12.

ICP 2 – Voltage Divider Rule

- Using the voltage divider rule, find the unknown voltages $\boldsymbol{V_R}$, $\boldsymbol{V_L}$, $\boldsymbol{V_C}$, and $\boldsymbol{V_1}$ for the circuit shown below.

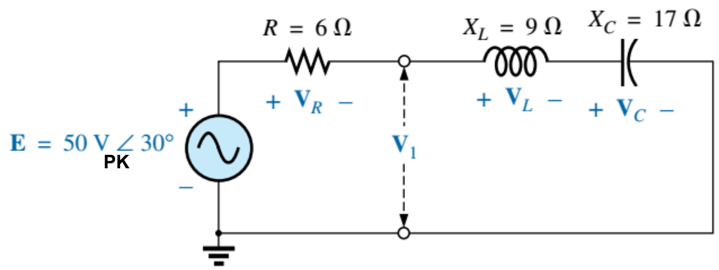

FIG. 15.44
Example 15.12.

$$\boldsymbol{V_R} = \frac{\boldsymbol{Z_R E}}{\boldsymbol{Z_R + Z_L + Z_C}} = \frac{(6\Omega\angle 0°)(50Vpk\angle 30°)}{(6\Omega\angle 0°)+(9\Omega\angle 90°)+(17\Omega\angle -90°)}$$

$$\boldsymbol{V_R} = 30V_{pk}\angle 83.13°$$

$$\boldsymbol{V_L} = \frac{\boldsymbol{Z_L E}}{\boldsymbol{Z_T}} = \frac{(9\Omega\angle 90°)(50V_{pk}\angle 30°)}{10\Omega\angle -53.13°}$$

$$\boldsymbol{V_L} = 45V_{pk}\angle 173.13°$$

$$\boldsymbol{V_C} = \frac{\boldsymbol{Z_C E}}{\boldsymbol{Z_T}} = \frac{(17\Omega\angle -90°)(50V_{pk}\angle 30°)}{10\Omega\angle -53.13°}$$

$$\boldsymbol{V_C} = 85V_{pk}\angle - 6.87°$$

- ❑ **Check: Sum VR, VL and Vc = E, KVL**

NP

ICP 2 – Voltage Divider Rule

- Using the voltage divider rule, find the unknown voltages V_R, V_L, V_C, and V_1 for the circuit shown below.

$$\boldsymbol{V_1} = \frac{(\boldsymbol{Z_L}+\boldsymbol{Z_c})\boldsymbol{E}}{\boldsymbol{Z_T}} = \frac{(9\Omega\angle 90° + 17\Omega\angle -90°)(50V_{pk}\angle 30°)}{(10\Omega\angle -53.13°)}$$

$$\boldsymbol{V_1} = \frac{(8\Omega\angle -90°)(50V_{pk}\angle 30°)}{(10\Omega\angle -53.13°)}$$

$$\boldsymbol{V_1} = 40V_{pk}\angle - 6.87°$$

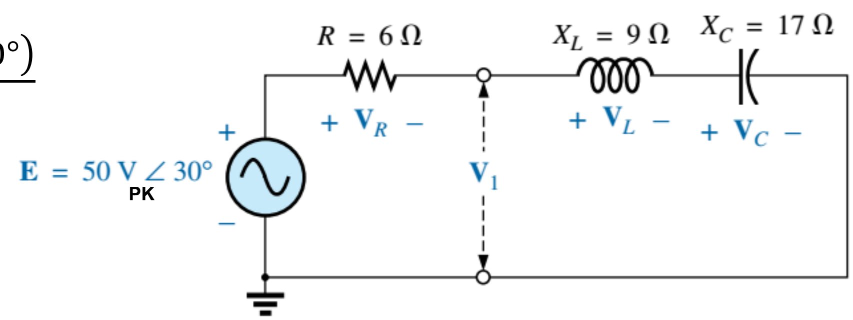

FIG. 15.44
Example 15.12.