$v(t) = 80\cos(10t + 20°)$ V
$i(t) = 15\cos(10t + 60°)$ A

FIND the instantaneous and average Power

$$p_{INST} = v(t)\,i(t)$$

$$= \frac{V_m I_m}{2}\left\{\cos(\theta_v - \theta_i) + \cos(2\omega t + \theta_v + \theta_i)\right\}$$

$$= \frac{80(15)}{2}\left(\cos(-40°) + \cos(2\omega t + 80°)\right)$$

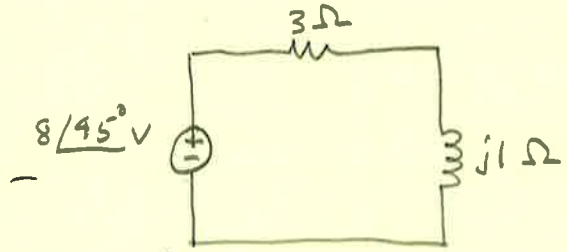
$$\boxed{p_{INST} = 459.6 + 600\cos(20t + 80°)\ W}$$

$$p_{AVG} = \frac{V_m I_m}{2}\cos(\theta_v - \theta_i)$$

$$= \frac{80(15)}{2}\cos(-40°)$$

$$\boxed{p_{AVG} = 459.6\ W}$$

Calculate the average power absorbed by the resistor and inductor + the power supplied by the source



$$P_{AVG} = \frac{1}{2} V_m I_m \cos(\theta_v - \theta_i)$$

$$i = \frac{8\angle 45^\circ}{3+j1} = \frac{8\angle 45}{3.162\angle 18.4^\circ} = 2.53\angle 26.6^\circ \text{ A}$$

$$V_R = i R = 7.59\angle 26.6^\circ$$
$$V_L = i Z_L = 2.53\angle 116.6^\circ$$

$$P_{AVG_R} = \frac{1}{2}(7.59)(2.53)\cos(26.6^\circ - 26.6^\circ) = \underline{9.6\,W}$$

$$P_{AVG_L} = \frac{1}{2}(2.53)(2.53)\cos(116.6^\circ - 26.6^\circ) = \underline{0\,W}$$

$$P_{source} = \frac{1}{2}(8)(2.53)\cos(45 - 26.6^\circ) = \underline{9.6\,W}$$

1) Calculate the average and reactive powers if:

$V = 100 \cos(\omega t + 15^\circ)$ V
$I = 4 \sin(\omega t - 15^\circ)$ A

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using the trig identity $\sin \omega t = \cos(\omega t - 90^\circ)$

$I = 4 \cos(\omega t - 105^\circ)$ A

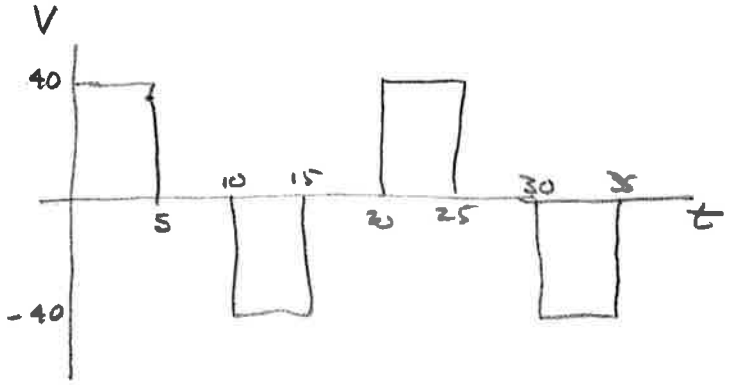
$P = \frac{1}{2} V_m I_m \cos(\theta_v - \theta_i) = \frac{1}{2}(100)(4)\cos(15 - (-105)) =$ **-100 W**

$Q = \frac{1}{2} V_m I_m \sin(\theta_v - \theta_i) = \frac{1}{2}(100)(4)\sin(15 + 105) =$ **173.21 VARS**

2) Is the circuit delivering or absorbing average + reactive power?

Since average Power is negative - Delivering.
" Reactive " " positive - absorbing

a) Find the RMS value of the periodic waveform.



$$V_{RMS} = \sqrt{\frac{1}{T}\int^{T} v^2\,dt}$$

$$= \left[\frac{1}{20}\left(\int_0^5 40^2\,dt + \int_{10}^{15} (-40)^2\,dt\right)\right]^{1/2}$$

$$= \left[\frac{1}{20}\left(1600(5) + 1600(15-10)\right)\right]^{1/2}$$

$$= 28.28\ V_{RMS}$$

b) $P_{Avg} = \frac{V^2}{R} =$ 20W