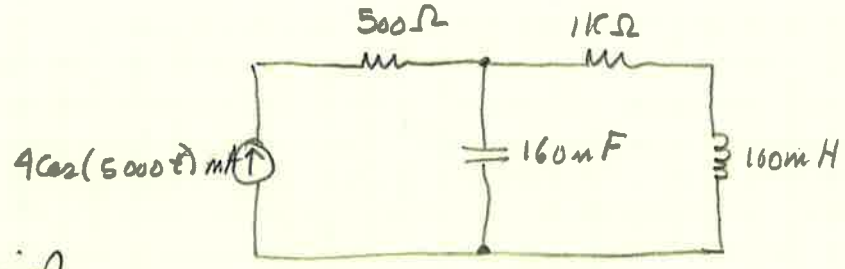


FIND P_{AVG} delivered by the current source.

$$Z_{cap} = \frac{1}{j\omega C} = -1250j$$

$$Z_{IND} = j\omega L = 500j\,\Omega$$

$$Z_{eq.} = 500 + \left[\frac{(-1250j)(1K+500j)}{-1250j + 500j + 1000}\right]$$

$$= 500 + (1000 - 500j)$$
$$= 1500 - 500j\,\Omega$$
$$= 1581.14\angle -18.435^\circ$$

$$V_z = I_z Z = 4\angle 0\,(1581.14\angle -18.435^\circ)\,mV$$
$$= 6.325\angle -18.435\,V$$

$$P_{load} = \frac{V_m I_m}{2}\cos(\theta_V - \theta_I)$$

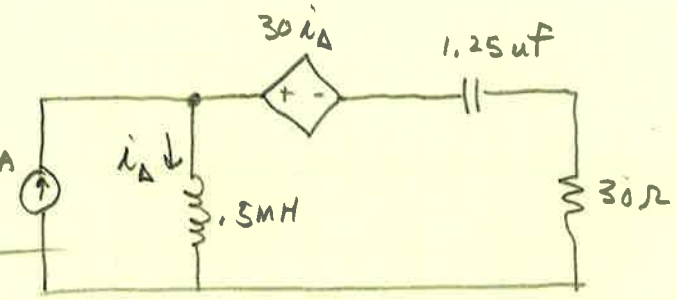
$$= \frac{(6.325)(.004)}{2}\cos(-18.435 - 0)$$

$$= 12\,mW$$

Therefore the current source generates 12mW of power or

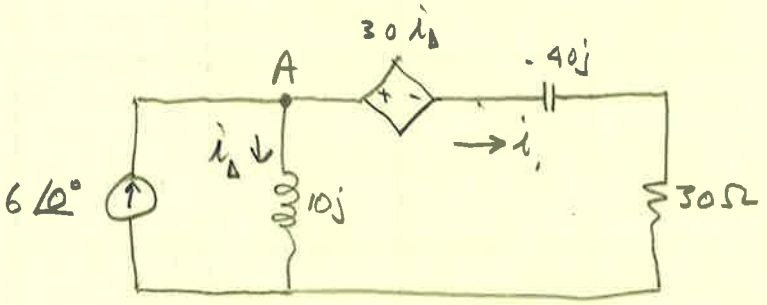
$$\boxed{P_{source} = -12\,mW}$$

FIND P_{Avg} dissipated in the 30Ω Resistor.



$\Sigma i_{NODE\,A} = 0$

$\Sigma i_{IN} = \Sigma i_{OUT}$



$$6\angle 0° = \frac{V_A}{10j} + \frac{V_A - 30 i_\Delta}{30 - 40j}$$

$$i_\Delta = \frac{V_A}{10j}$$

$$6\angle 0° = V_A\left[\frac{1}{10\angle 90°} + \frac{1}{30-40j} - \frac{30}{10j(30-40j)}\right]$$

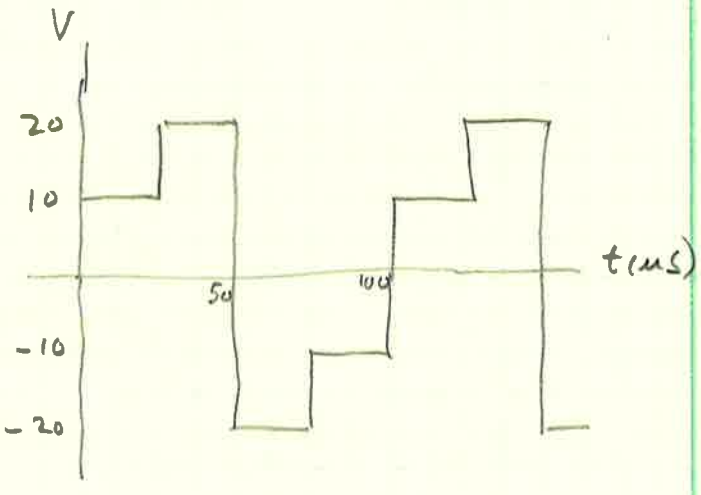
$$V_A = 100\angle 126.87° \text{ V}$$

$$i_\Delta = 10\angle 36.87° \text{ A}$$

$$i_1 = i - i_\Delta = 6\angle 0 - 10\angle 36.87° = 6.32\angle -108.43° \text{ A}$$

$$P_{Avg} = \frac{1}{2} I^2 R = \frac{1}{2}(6.32)^2 30 = \boxed{600 \text{ W}}$$

a) Find the RMS value of the waveform shown.



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

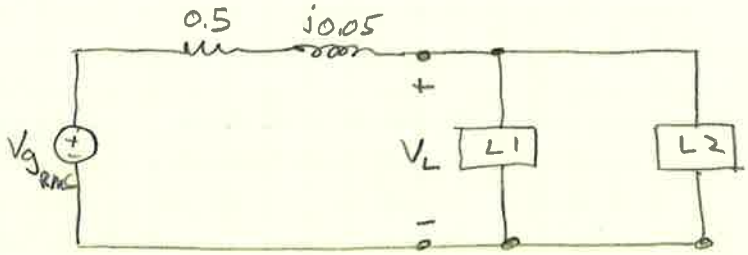
$$= \left[\frac{1}{100\,ms}\left[\int_0^{25ms} (10)^2\,dt + \int_{25ms}^{50ms} (20)^2\,dt + \int_{50ms}^{75ms} (-20)^2\,dt + \int_{75ms}^{100ms} (-10)^2\,dt\right]\right]^{1/2}$$

$$= \left[\frac{1}{100\,ms}\left[100(25ms)(2) + 400(25ms)(2)\right]\right]^{1/2}$$

$$\boxed{V_{RMS} = 15.81\,V}$$

b) If this value is applied to a 4Ω resistor, what is the average power dissipated?

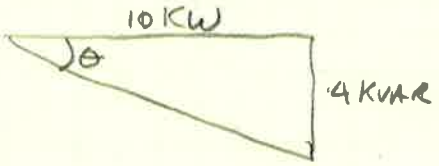
$$P = \frac{V^2}{R} = \boxed{62.5\,W}$$



L1: absorbs 10kW
delivers 4KVAR
L2: $Z = 60+j80$

$V_L = 1000\sqrt{2}\cos 100\pi t$ V
$= 1000\cos 100\pi t\ V_{RMS}$

a) Find V_g



$S_1 = 10{,}000 - j4000$
$= 10.77K\angle -21.8^\circ$ VA

$VI_1^* = S_1 = 10.77K\angle -21.8^\circ$ VA

$I_1^* = \frac{S_1}{V} = 10.77\angle -21.8^\circ$

$= 10 - 4j$ A

$I_{L1} = 10 + 4j$ A

$I_{L2} = \frac{V_{L2}}{Z_{L2}} = \frac{1000\angle 0^\circ}{60+j80} = 10\angle -53.13^\circ = 6 - 8j$ A

$I_{total} = I_{L1} + I_{L2} = 16 - 4j$ A $= 16.49\angle -14.04^\circ$

$V_g = V_L + I_{TOT}(.5 + j.05)$

$= 1000\angle 0 + (16.49)\angle -1404^\circ (.5025\angle 5.71^\circ)$

$= 1000 + 8.286\angle -8.33^\circ = 1000 + 8.12 - 1.2j$

$V_g = 1008.12 - 1.2j = 1008.2\angle -0.0682^\circ\ V_{RMS}$

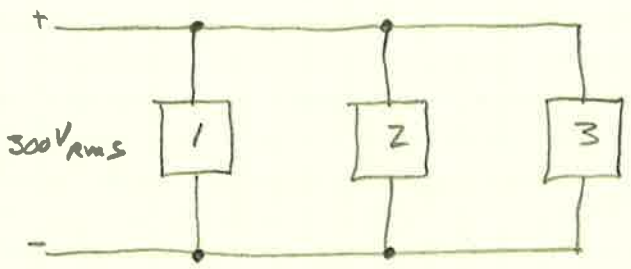
b) $T = \frac{1}{f} = \left(\frac{100\pi}{2\pi}\right)^{-1} = \frac{1}{50} = 20ms$

$\frac{-.0682^\circ}{360^\circ} = \frac{t}{20ms} \Rightarrow t = -3.79\mu s$

c) Does the load voltage lead or lag the source voltage?

V_L leads V_g by 0.0682°

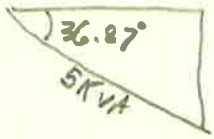
Load 1: absorbs 3 kW
PF = 1
load 2: absorbs 5 kVA
PF = 0.8 leading
load 3: absorbs 5 kW
delivers 6 kVars



a) find $\underline{Z}$ of combined load

$S_1 = 3 + 0j$ kVA
$S_2 = 4 - 3j$ kVA
$S_3 = 5 - j6$ kVA

S2:



$S_{TOTAL} = 12 - 9j$ kVA $= VI^*$

$I^* = 40 - 30j$
$I = 40 + 30j = 50 \angle 36.87^\circ$ A

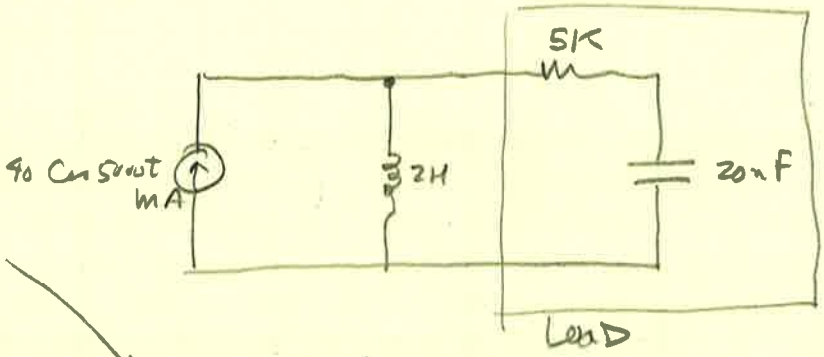
$\underline{Z} = \frac{V}{I} = \boxed{6 \angle -36.87^\circ \Omega = 4.8 - j3.6 \Omega = \underline{Z}}$

b) find power factor of combined load

$PF = \cos \angle \underline{Z}$

$\boxed{PF = 0.8 \text{ leading}}$

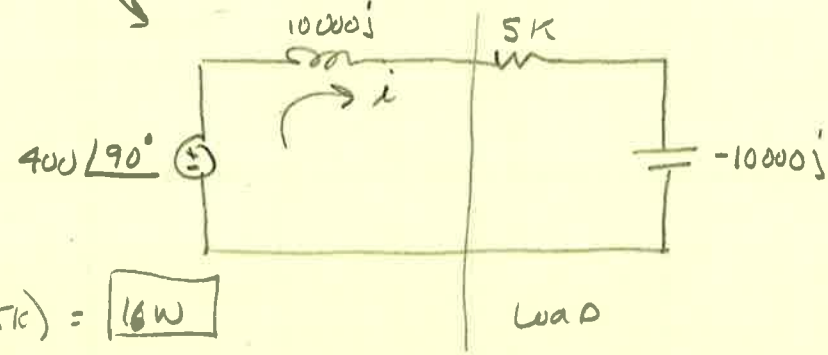
FIND P_{AVG}, P_{REAC}, P_{APP} absorbed by the load



DO source transform

$V = IZ$
$= 40\angle 0 \,(10{,}000\angle 90^\circ)$ mV
$= 400\angle 90^\circ$ V

$i = \frac{V}{Z}$
$= \frac{400\angle 90^\circ}{5K}$
$= 0.08\text{A}\angle 90^\circ$



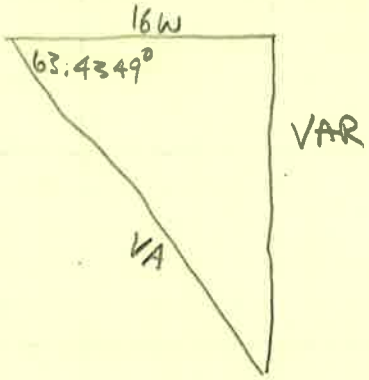
$P_{AVG} = \frac{1}{2}I^2R = \frac{1}{2}(.08)^2(5K) = \boxed{16\text{W}}$

$V_L = \frac{400\angle 90^\circ\,(5K - 10000j)}{5K} = 894.427\angle 26.565^\circ$

$PF_{load} = \cos(\theta_V - \theta_i) = \cos(26.565 - 90) = .4472$ (also PF_{Angle} = Angle Z $= \tan^{-1}\frac{(-10000)}{5000} = -63.435^\circ$)

$\cos 63.4349 = \frac{16}{P_{APP}}$

$\boxed{P_{APP} = 35.78\text{ VA}}$



$\sin 63.4349^\circ = \frac{VAR}{P_{APP}}$

$\boxed{VAR = \text{Reactive Power} = -32\text{ VAR}}$