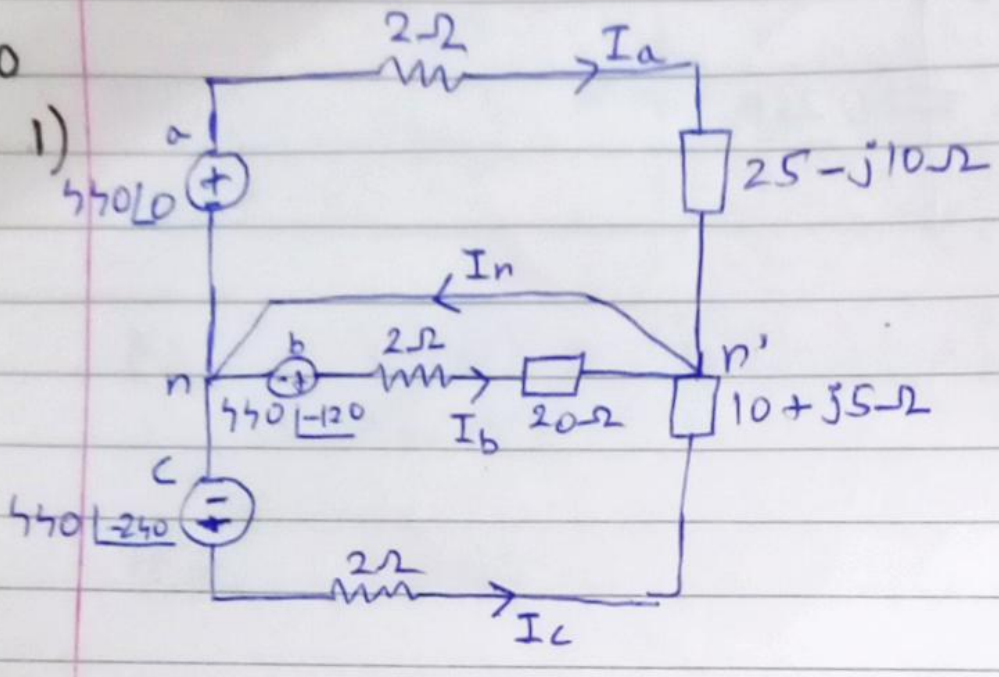
Q20

1)



$$I_a = \frac{V_{an}}{Z_{net}} = \frac{440\angle 0}{27-10j} = 15.28\angle 20.32\ A$$

$$I_b = \frac{V_{bn}}{Z_{net}} = \frac{440\angle -120}{22} = 20\angle -120\ A$$

$$I_c = \frac{V_{cn}}{Z_{net}} = \frac{440\angle -240}{12+j5} = 33.85\angle 97.38\ A$$

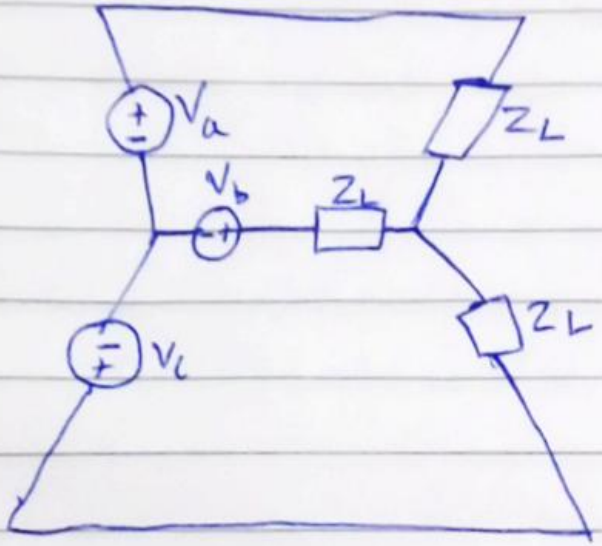
Applying KCL at n we get:

$$I_a + I_b + I_c = I_n$$

$$\therefore I_n = 15.28\angle 20.32 + 20\angle -120 + 33.85\angle 97.38$$

$$\Rightarrow \boxed{I_n = 21.56\angle 90.05\ A}$$

2)



$Z_L = 30\angle 45°$

$V_{ab_{RMS}} = 208V \Rightarrow V_{ab} = 294.16V$

$\Rightarrow V_{an} = 169.83V$

$$I_a = \frac{V_{an}}{Z_{net}} = \frac{169.83\angle 0}{30\angle 45} = 5.66\angle -45$$

$\Rightarrow I_{a_{RMS}} = 4.002$

Avg. Power delivered to load:

$$P_L = \sqrt{3} \times V_{L_{RMS}} \times I_{L_{RMS}} \cos\theta$$

$$= \sqrt{3} \times 208 \times 4.002 \cos 45°$$

$$\boxed{P_L = 1019.50\ W}$$