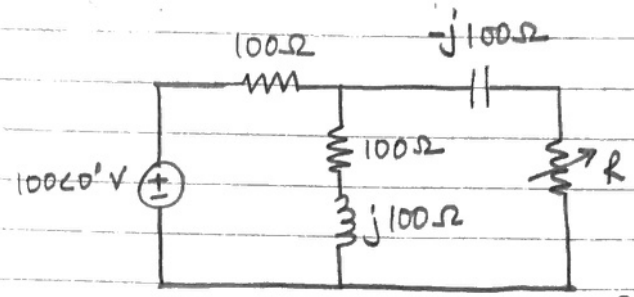
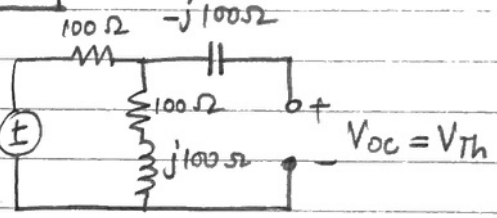
11.19



1) Find V_{Th}:



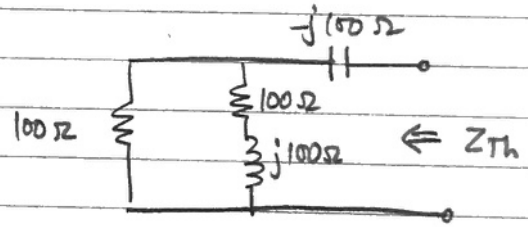
By vltg divider:

$$V_{Th} = \frac{100(1+j)}{100(2+j)} \; 100\angle 0^\circ$$

(1) $= 60 + 20j \; V$

$= 63.25 \angle 18.43^\circ \; V$

2) Find Z_{Th}:



$$Z_{Th} = (100 \,\|\, (100 + j100)) \; -j100$$

$= 60 - 80j \; \Omega$

(1) $= 100 \angle -53.13 \; \Omega$

3) $\therefore R_L = 100 \; \Omega$

$$|I_L| = \frac{|V_{Th}|}{|R_L + Z_{Th}|} = \frac{63.25}{178.89} = 0.354 \text{ A}$$

(1) $$P_{max} = \frac{1}{2} |I_L|^2 R_L = 6.25 \text{ W}.$$

11.27 $T = 5$ and $i(t) = t$, $0 < t < 5$

$$I^2_{rms} = \frac{1}{5}\int_0^5 i(t)^2\, dt$$

$$= \frac{1}{5}\left[\frac{t^3}{3}\right]_0^5 \quad (1/2)$$

$$= \frac{125}{15} = 8.33\ A^2$$

$$\therefore I_{rms} = 2.89\ A \quad (1/2)$$

11.46

(b) $S = VI^* = (250\angle -10^\circ)(6.2\angle 25^\circ)$

$= 1550\angle 15^\circ$

$= [1497.2 + 401.2j]$ V.A

(½) Apparent power = $|S| = 1550$ V.A

(½) Real power = 1497.2 W

(½) Reactive power = 401.2 VAR

(½) pf : lagging

(d) $S = VI^* = (160\angle 45^\circ) \times (8.5\angle -90^\circ)$

$= 1360\angle -45^\circ$

$= [961.67 - 961.67j]$ VA

(½) Apparent power = $|S| = 1360$ VA

(½) Real power = 961.67 W

(½) Reactive power = −961.67 VAR

(½) pf : leading

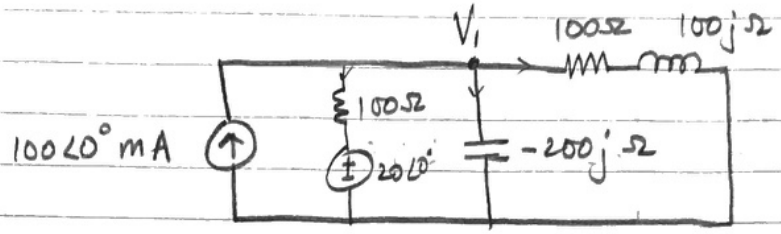
11.48

(a) P: real power = 269 W
Q: reactive power = 150 VAR.

(1) ∴ $S = P - jQ = [269 - j150]$ VA
(½) (∵ load is capacitive)

(c) $|S| = 600$ VA ∴ (Apparent power)
(½) $= \sqrt{P^2 + Q^2}$
∴ $P^2 = S^2 - Q^2$
(½) $= 157500$
∴ $P = 396.86$ W
(½) ∴ $S = [396.86 + 450j]$ VA
(∵ load is inductive)

11.59



at node 1:

$$0.1 = \frac{V_1 - 20}{100} + \frac{V_1}{-200j} + \frac{V_1}{100(1+j)}$$

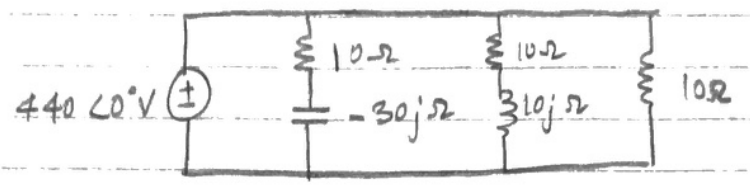
$$\Rightarrow 0.3 = \frac{3}{200} V_1$$

$$\Rightarrow V_1 = 20\,V$$

$\therefore$ Reactive power in capacitor $= \frac{1}{2} \cdot \frac{|V_1|^2}{200} = 1\,VAR.$

Reactive power in inductor $= \frac{1}{2} \left| \frac{V_1}{100 - 100j} \right|^2 100 = 1\,VAR$

11.75



(a) Total Complex Power :

(½) $S = S_1 + S_2 + S_3$

(½) $= \frac{1}{2} \times 440 \times \left[\frac{440}{10 - 30j\,\Omega} + \frac{440}{10 + 10j\,\Omega} + \frac{440}{10\,\Omega} \right]^*$

(½) $= [15488 + 1936j]$ VA

(b) (½) $pf = \frac{P}{|S|} = 0.992$

(1)

(c) For unity power factor:

(½) $|S|_{new} = P_{old}$

$= 15488$

$\therefore Q_{new} = 0$

or $Q_{old} + Q_C = 0$

(1) $\therefore Q_C = -1936j$

$= \frac{(440)^2}{2 \cdot X_C^*}$

(½) $\Rightarrow X_C = -50j\,\Omega$

Assuming $\omega = 2\pi \times 60 = 377$

(½) $\therefore C = \frac{1}{j\omega X_C} = 53.05\ \mu F$