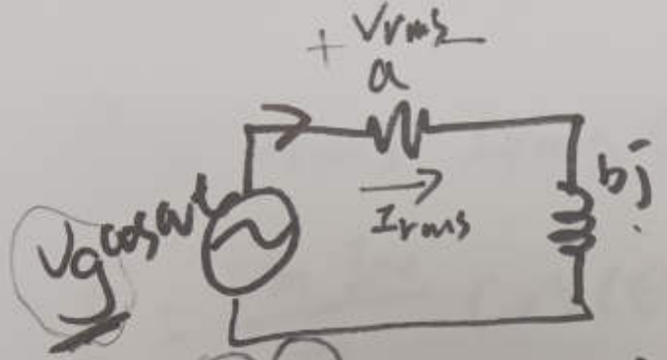
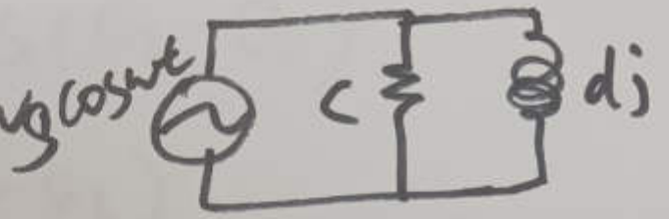




$$P = \frac{V_m I_m}{2}\cos(\theta_V - \theta_I)$$

$=$ real power / average power

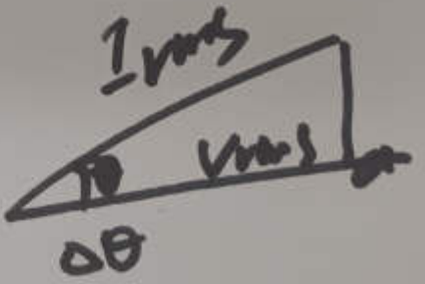
$$\frac{V\angle\theta_V}{I\angle\theta_I} = \frac{V}{I}\angle(\theta_V - \theta_I)$$

$$= Z\angle = \sqrt{a^2+b^2}\,\angle \arctan\frac{b}{a}$$

$a+bj$

$$= \frac{V_g \cdot \frac{V_g}{\sqrt{a^2+b^2}}}{2}\cos(\quad \rightarrow \frac{a}{\sqrt{a^2+b^2}}$$

$$= \frac{V_g^2\, a}{2(a^2+b^2)}$$



(1)

$$P = V_{rms} \cdot I_{rms} \cos(\theta_V - \theta_I)$$

$$P = \frac{V_m \cdot I_m}{2} \cos(\theta_V - \theta_I)$$

$$= \left(\frac{V_m}{\sqrt{2}} \cdot \frac{I_m}{\sqrt{2}}\right) \cdot \cos(\theta_V - \theta_I)$$

$$= V_{rms} \cdot I_{rms} \cos(\theta_V - \theta_I)$$

(2)

$$P = \left(\frac{\frac{V_g}{\sqrt{2}}}{\sqrt{a^2+b^2}} \right)^2 \cdot a$$

$$P = I^2 \cdot R$$

$$= \frac{V^2}{R}$$

$$= VI$$

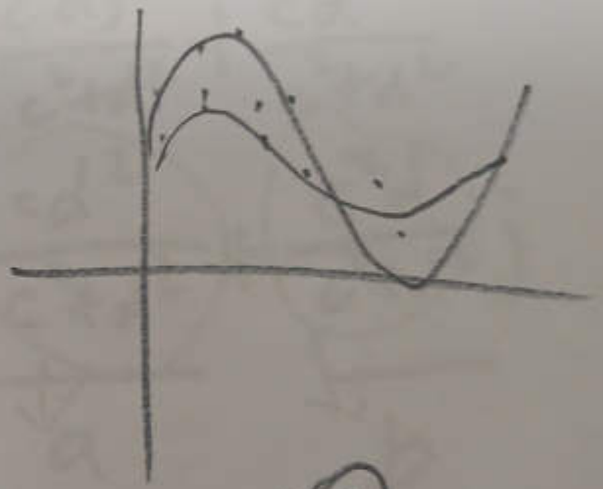
$$= \frac{V_g^2 \cdot a}{2(a^2+b^2)}$$

$$a = I_{rms}^2 \cdot a \cos\theta = I_{rms}^2 \cdot a \cdot 1$$

$\cos(\theta_V - \theta_I)$

$= \cos\theta$

$= 1$



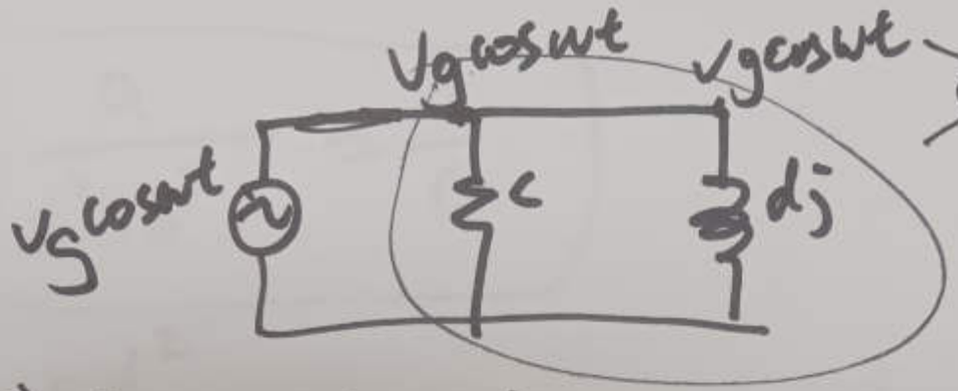
$V = I(R)$

$V_R = a+bj \Rightarrow \arctan\frac{b}{a}$

$R = R$

$I_R = \frac{a}{R} + \frac{b}{R}j \Rightarrow \arctan\frac{b}{a}$

(3)



~~c+dj~~

$$\frac{c\cdot dj}{c+dj} = \frac{c\cdot dj\,(c-dj)}{c^2+d^2}$$

$$= \frac{c^2 dj}{c^2+d^2} + \frac{cd^2}{c^2+d^2}$$

$$= \underbrace{\frac{cd^2}{c^2+d^2}}_{a} + \underbrace{\frac{c^2 d}{c^2+d^2}}_{b}\,j$$

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

$$= \frac{V_g}{2}\frac{V_g}{c}\cdot 1 = \frac{V_g^2}{2c}\cdot 1$$

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

$$= \frac{V_g}{2}\frac{V_g}{\sqrt{a^2+b^2}}\cos(\theta_v - \theta_i)$$

$$= \frac{V_g^2}{2}\frac{1}{\sqrt{a^2+b^2}}\cdot\frac{a}{\sqrt{a^2+b^2}} = \frac{V_g^2\cdot a}{2(a^2+b^2)}$$

(4)

$$\boxed{\frac{a}{a^2+b^2} = \frac{1}{c}}$$

$$\frac{\frac{cd^2}{c^2+d^2}}{\frac{c^2d^2}{(c^2+d^2)^2} + \frac{c^3}{(c^2+d^2)^2}} = \frac{1\cdot(c^2+d^2)}{c^3+cd^2}$$

$$= \frac{c^2+d^2}{c(c^2+d^2)} = \frac{1}{c}$$

(5)

$V = 120\cos(\omega t - 45^\circ)$ V

$I = 25\cos(\omega t + 15^\circ)$ A

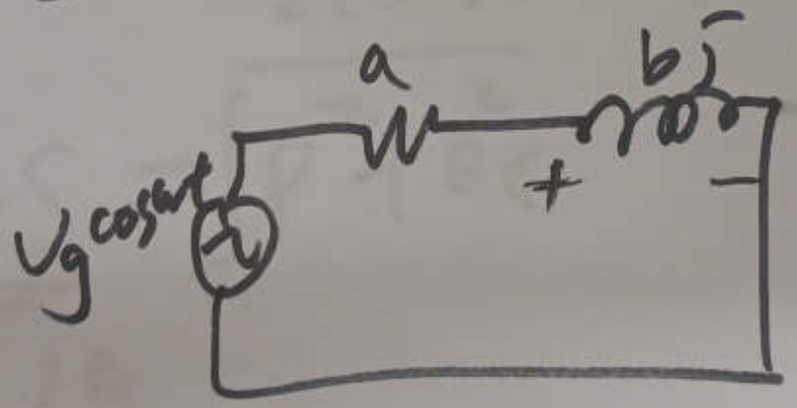
$P = \frac{120 \cdot 25}{2}\cos(-45^\circ - 15)$ W

Real Power

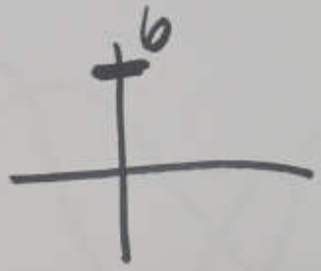
$Q = \frac{V_m \cdot I_m}{2}\sin(-45^\circ - 15)$ VAR

reactive power

volt Amp reactive



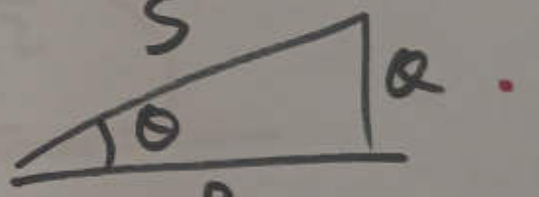
$$Q = \frac{V_m I_m}{2} \sin(\theta_V - \theta_I)$$

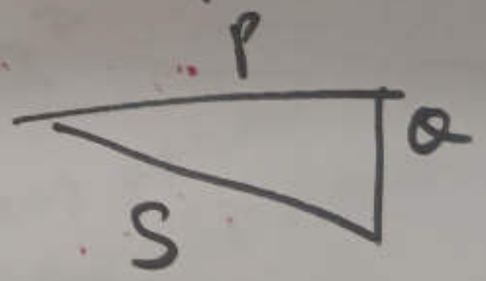


$$= \frac{\frac{V_S \cdot b}{\sqrt{a^2+b^2}}}{2} \cdot \frac{\frac{V_S \cdot b}{\sqrt{a^2+b^2}}}{b} \sin(90^\circ)$$

$$= \frac{V_S^2 \, b}{2(a^2+b^2)} \cdot 1$$

apparent power $\leftarrow S = \sqrt{P^2 + Q^2}$



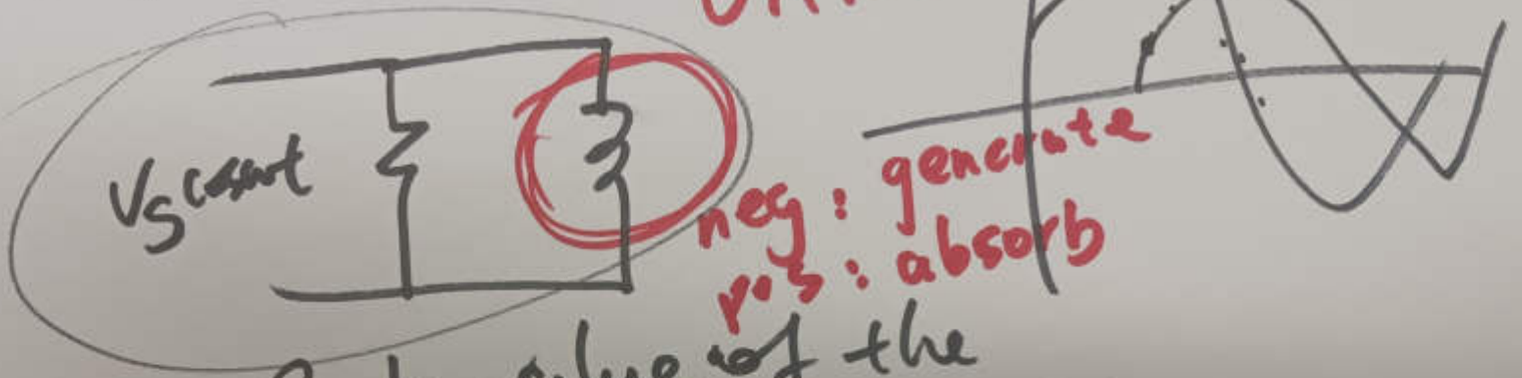


VA

Volts Amp

10.7.

VARS?



neg: generate
pos: absorb

Peak value of the instantaneous power delivered by the source

$$P_{max} = P + \sqrt{P^2 + Q^2}$$

$$P_{min} = P - \sqrt{P^2 + Q^2}$$

Power B. Peak instantaneous power absorbed by the source

(2)