

Exam Example  
 Phasor Voltage

Find  $V_1$

$$\text{Nose: } 24\angle 60^\circ = 24(\cos 60 + j \sin 60) = (12 + j12\sqrt{3})$$

Using Node Voltages:

$$\frac{V_1 - (12 + j12\sqrt{3})}{4} + \frac{V_1}{j6} + \frac{V_1}{8-j4} = 0$$

Remove  $j$  from denominator

$$\frac{V_1 - (12 + j12\sqrt{3})}{4} + \frac{V_1}{j6} \left( \frac{1}{j} \right) + \frac{V_1}{(8-j4)} \left( \frac{8+j4}{8+j4} \right) = 0$$

$$\frac{V_1 - (12 + j12\sqrt{3})}{4} - \frac{jV_1}{6} + \frac{V_1(8+j4)}{80} = 0$$

(Common Denominator:  
is 480)

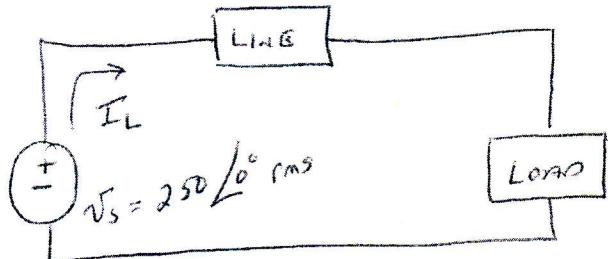
$$\frac{120 \left[ V_1 - (12 + j12\sqrt{3}) \right]}{480} + \frac{80 \left[ jV_1 \right]}{480} + \frac{6 \left[ V_1(8+j4) \right]}{480} = 0$$

Eqn Reduces to:  $120V_1 - 1440 - j1440\sqrt{3} - j80V_1 + 48V_1 + j24V_1 = 0$

$$168V_1 - j56V_1 = 1440 + j1440\sqrt{3}$$

$$V_1 = \frac{1440 + j1440\sqrt{3}}{168 - j56} = \frac{2879\angle 60^\circ}{177\angle -18.13^\circ}$$

$V_1 = 16.26\angle 18.13^\circ$



Exam Example  
Power

$$Z_{\text{LINE}} = 1 + j4$$

$$Z_{\text{LOAD}} = 39 + j26$$

Investigate Power.

$$I_L = \frac{V_L}{Z_{\text{eq}}} = \frac{250 \angle 10^\circ}{(1+j4) + (39+j26)} = \frac{250 \angle 10^\circ}{40 + j30} = \frac{250 \angle 10^\circ}{50 \angle 36.86^\circ} = 5 \angle -36.86^\circ \text{ rms}$$

$$V_{\text{LOAD}} = (Z_{\text{LOAD}})(I_L) = (39 + j26)(5 \angle -36.86^\circ) = (46.8 \angle 33.69^\circ)(5 \angle -36.86^\circ) = 234 \angle -3.16^\circ$$

(a) Power Delivered to Load:

$$P = V_{\text{rms}} I_{\text{rms}} \cos \theta = (234)(5) \cos(0^\circ - 36.86^\circ) = 975 \text{ W}$$

$$Q = V_{\text{rms}} I_{\text{rms}} \sin \theta = (234)(5) \sin(0^\circ - 36.86^\circ) = 650 \text{ VAR}$$

$S = 975 + j650$

(b) Power Delivered to Line:

$$P = I^2 R = (5)^2 (1) = 25 \text{ W}$$

$$Q = I^2 X = (5)^2 (4) = 100 \text{ VAR}$$

$S = 25 + j100$

Power Delivered By Source :

$$S = S_{\text{line}} + S_{\text{loss}}$$

$$= 975 + j650 + 25 + j100$$

$$\boxed{S = 1000 + j750}$$

Practice Note: Complex Power Problems

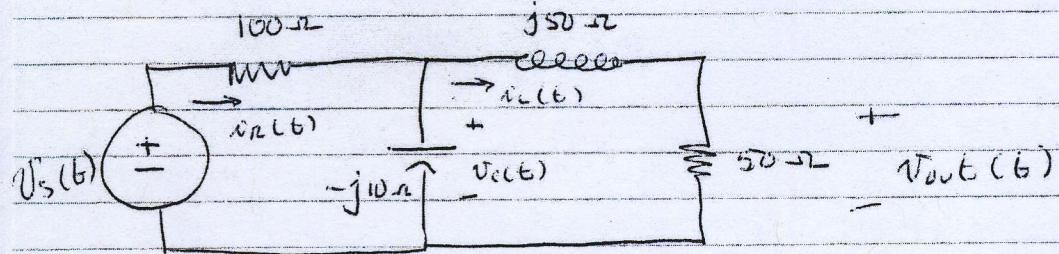
The "EQUATION FORM". Practice

Review and Become comfortable

With Equations Form in class

Problem #4

Find  $V_C(t)$  and  $V_S(t)$  for  
the following circuit



$$i_R(t) = 0.707 \sin(10t)$$

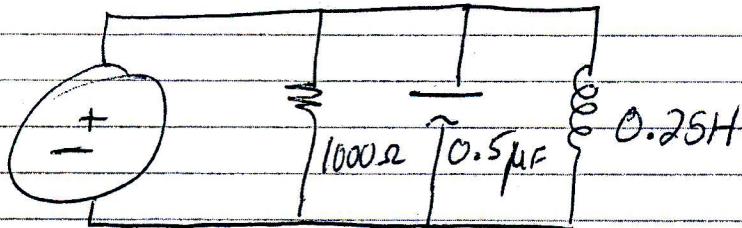
$$V_{out}(t) = 50 \sin(10t - 45^\circ)$$

Exam Example

Phasor Voltage

Problem # 5

For the following circuit find  
Real Power, Reactive Power, Apparent  
Power that would be delivered  
By the voltage source. Also  
Find the pf.



$$V_s = 100\text{V RMS}$$

$$\omega = 2000$$

Exam Example

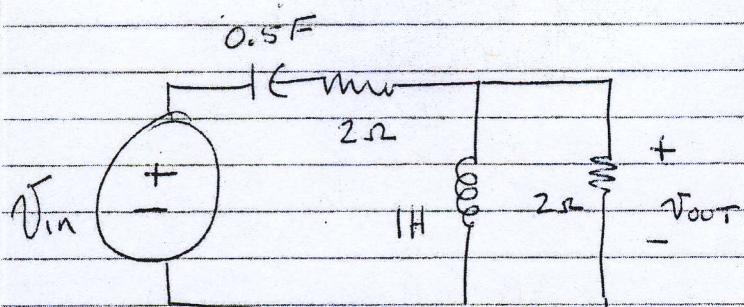
Complex Power

Problem # 6

Find the Transfer Function for  
the following Circuit. Note: let

$s = j\omega$  to Simplify Algebra and then  
resubstitute to get back form  $H(\omega)$

Note: Assume  $\omega = 1$

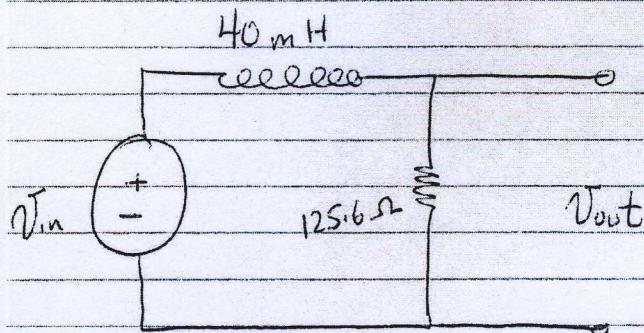


Exam Example

Transfer Function

Problem # 7

Find Your For The Following  
Circuit



$$V_{in}(t) = 3 + 60 \cos(20\pi t + 15^\circ) + 40 \sin(2000\pi t - 30^\circ)$$

Exam Examples

Fltoms