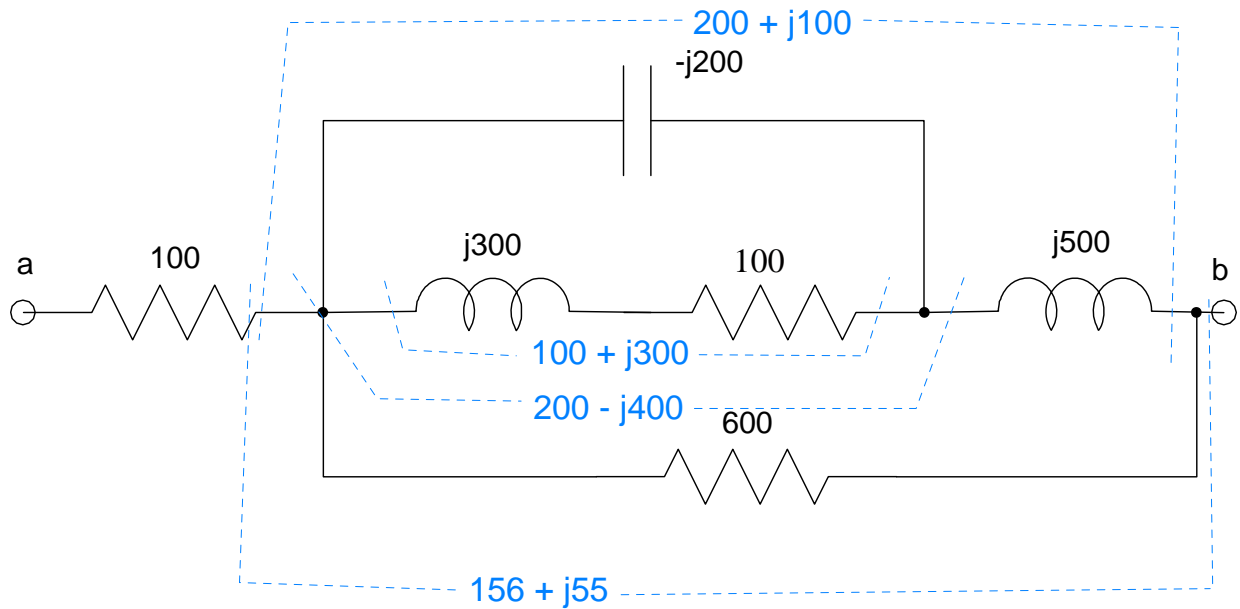


EE 206 Test #3 - Name _____

April 30 / May 1, 2019

1) Determine the impedance Z_{ab}

$$Z_{ab} = 256.9 + j55.4$$



$$(100 + j300) \parallel (-j200) = 200 - j400$$

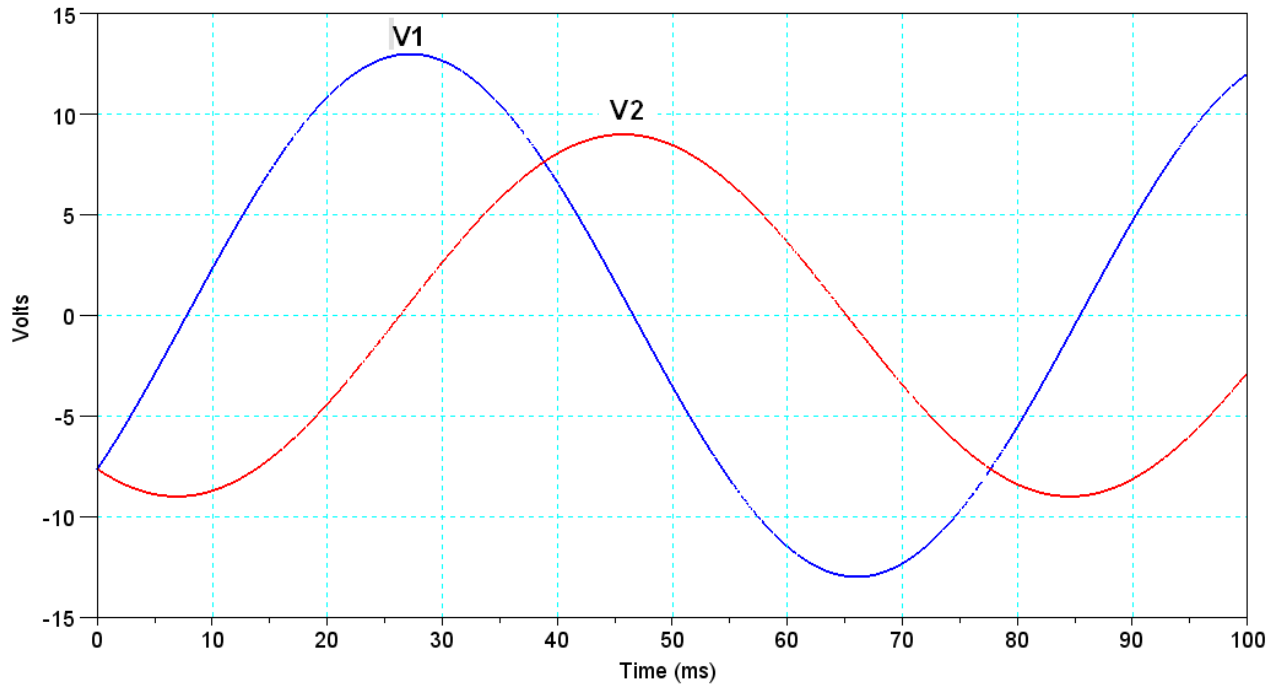
$$(200 - j400) + (j500) = 200 + j100$$

$$(200 + j100) \parallel (600) = 156 + j55$$

$$(156 + j55) + (100) = 256 + j55$$

2) Determine the frequency and phasor representation for V1 and V2

Frequency (Hz)	V1		V2	
	Amplitude (Vp)	Phase (degrees)	Amplitude (Vp)	Phase (degrees)
13.16 Hz	13V	-127 deg	9V	-217 deg



The period is 76ms

$$f = \frac{1}{T} = \frac{1}{76ms} = 13.16Hz$$

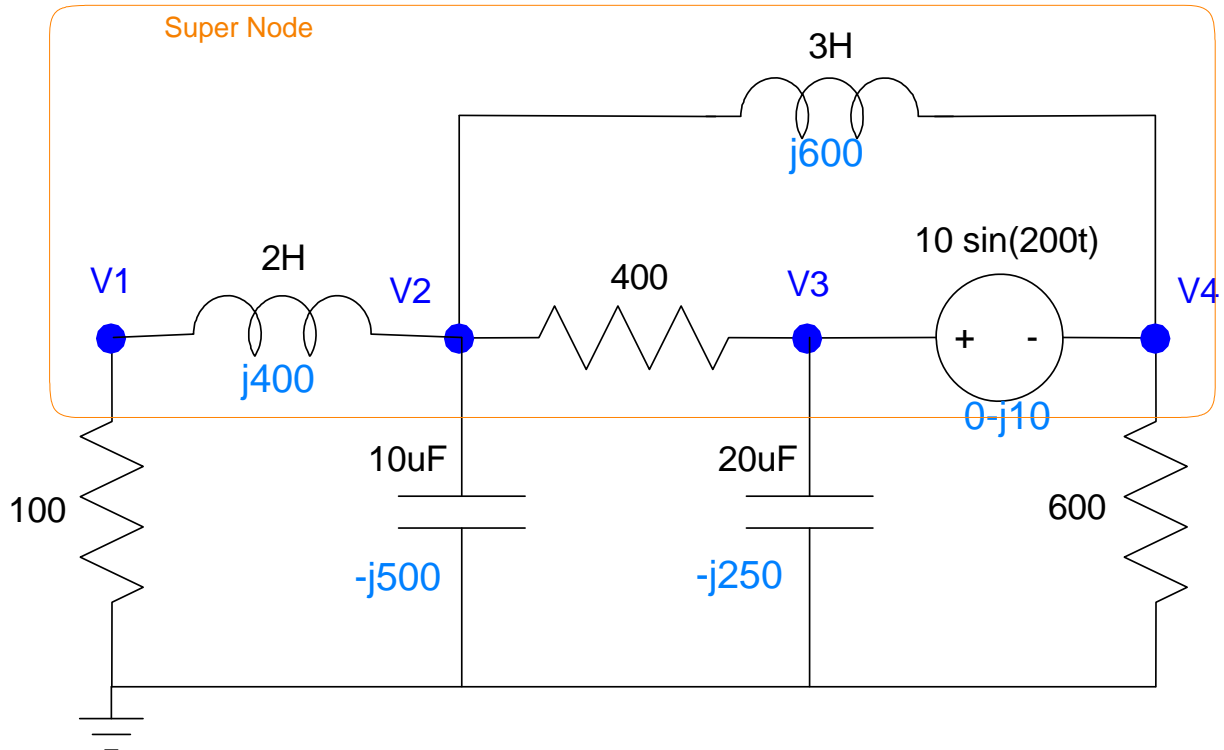
The delay on V1 is 27ms

$$\phi_1 = -\left(\frac{\text{delay}}{\text{period}}\right) \cdot 360^\circ = -\left(\frac{27ms}{76ms}\right) 360^\circ = -127^\circ$$

The delay on V2 is 46ms

$$\phi_2 = -\left(\frac{\text{delay}}{\text{period}}\right) \cdot 360^\circ = -\left(\frac{46ms}{76ms}\right) 360^\circ = -217^\circ$$

3) Write N equations to allow you to solve for the N unknown voltages



Convert V, L, and C to phasors (shown in blue)

Write the node equations

- $V_3 - V_4 = 0 - j10$

Node V1

- $\left(\frac{V_1}{100}\right) + \left(\frac{V_1 - V_2}{j400}\right) = 0$

Node V2

- $\left(\frac{V_2 - V_1}{j400}\right) + \left(\frac{V_2}{-j500}\right) + \left(\frac{V_2 - V_3}{400}\right) + \left(\frac{V_2 - V_4}{j600}\right) = 0$

Super Node

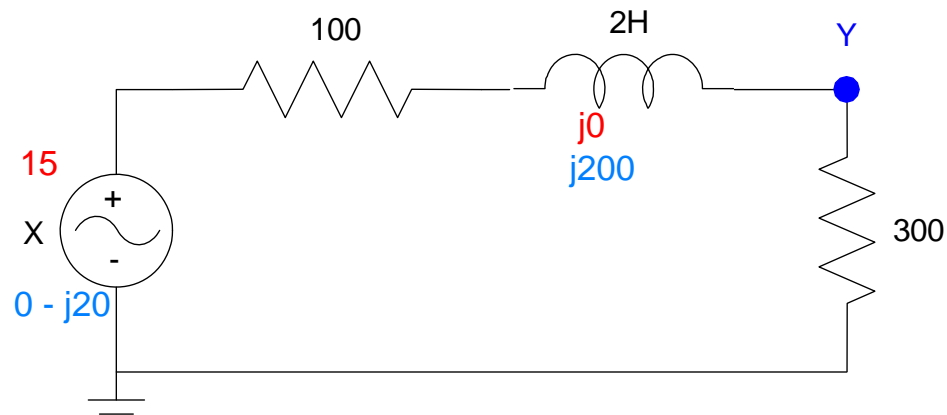
- $\left(\frac{V_1}{100}\right) + \left(\frac{V_2}{-j500}\right) + \left(\frac{V_3}{-j250}\right) + \left(\frac{V_4}{600}\right) = 0$

4) Assume

$$x(t) = 15 + 20 \sin(100t)$$

Determine the voltage, $y(t)$

$$y(t) = 11.25 - 6 \cos(100t) + 12 \sin(100t)$$



DC (orange)

$$Y = \left(\frac{300}{300+100} \right) 15$$

$$Y = 11.25$$

AC (blue)

$$Y = \left(\frac{300}{300+100+j200} \right) (0 - j20)$$

$$Y = -6 - j12$$

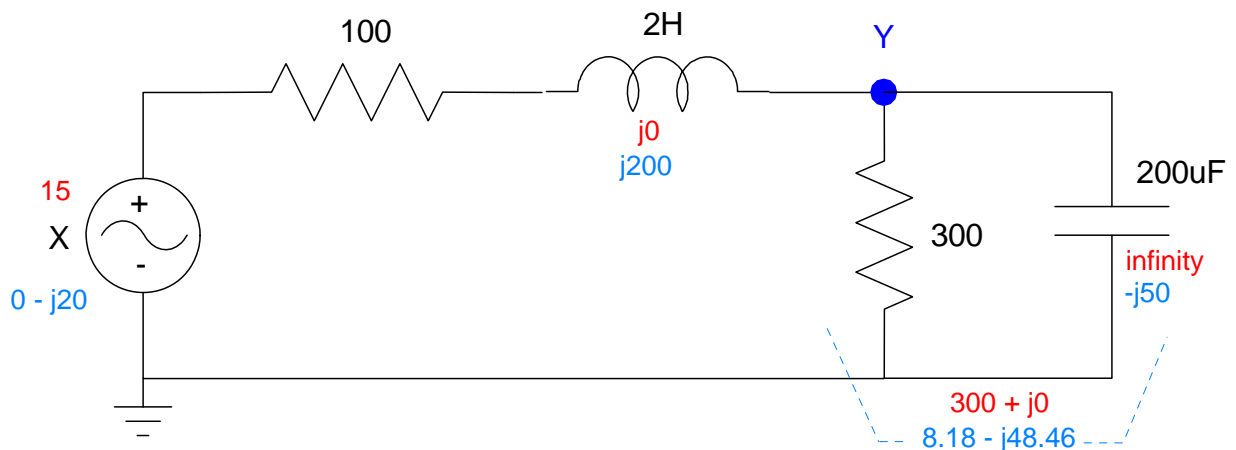
$$y(t) = -6 \cos(100t) + 12 \sin(100t)$$

5) Assume

$$x(t) = 15 + 20 \sin(100t)$$

Determine the voltage, $y(t)$

$$y(t) = 11.25 - 3.75 \cos(100t) - 3.75 \sin(100t)$$



DC (red)

$$Y = \left(\frac{300}{300+100} \right) 15$$

$$Y = 11.25$$

AC (blue)

$$Y = \left(\frac{(8.18-j48.46)}{(8.18-j48.46)+(100+j200)} \right) (0 - j20)$$

$$Y = -3.75 + j3.75$$

$$y(t) = -3.75 \cos(100t) - 3.75 \sin(100t)$$

Bonus! Suggest one thing that the U.S. government could do to reduce income inequality