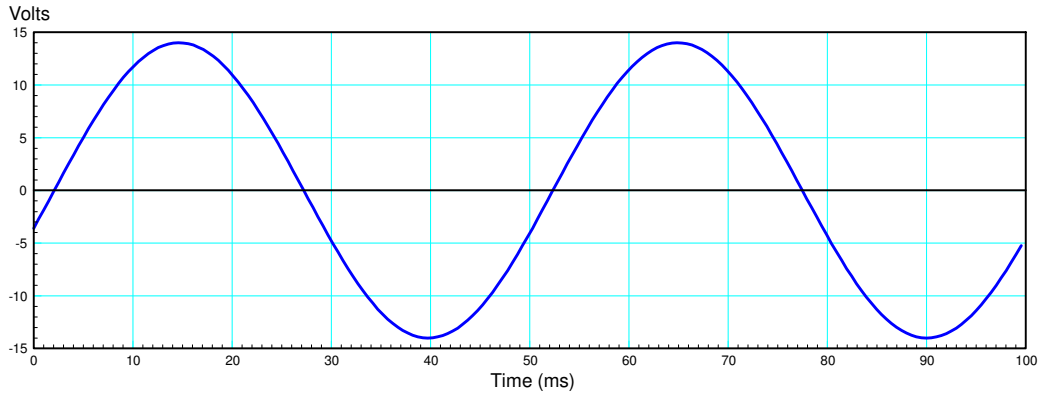
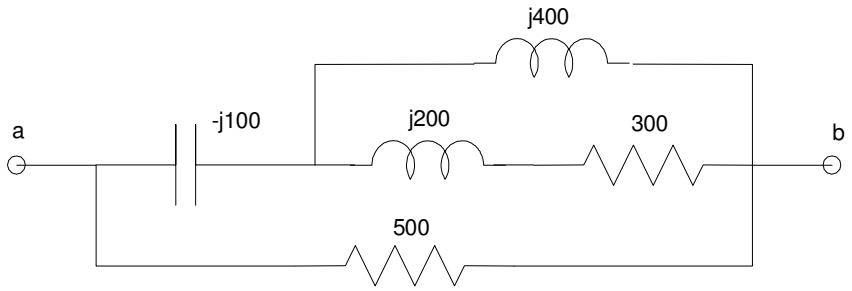
ECE 320: Handout #2

Complex Numbers and Phasors

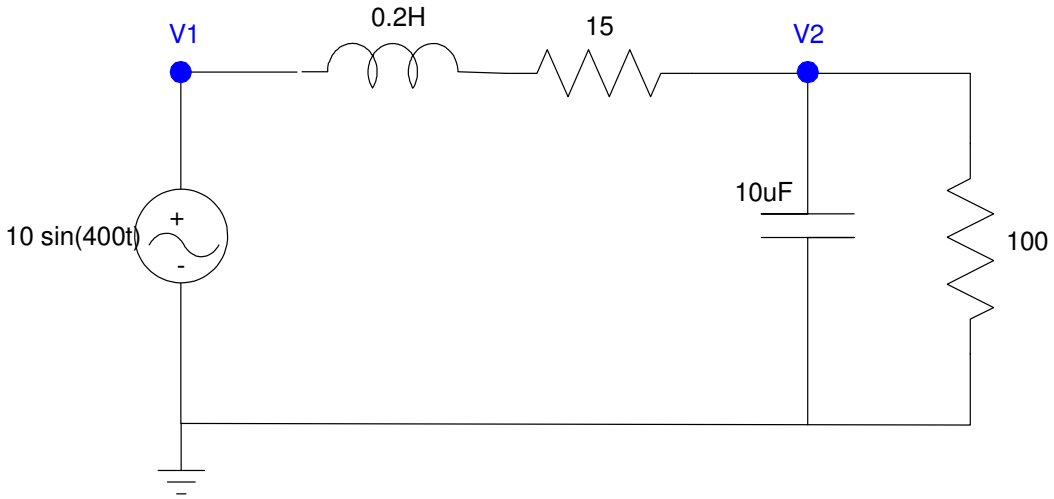
1) Find the frequency of V1 and express V1 in phasor form



2) Determine Zab

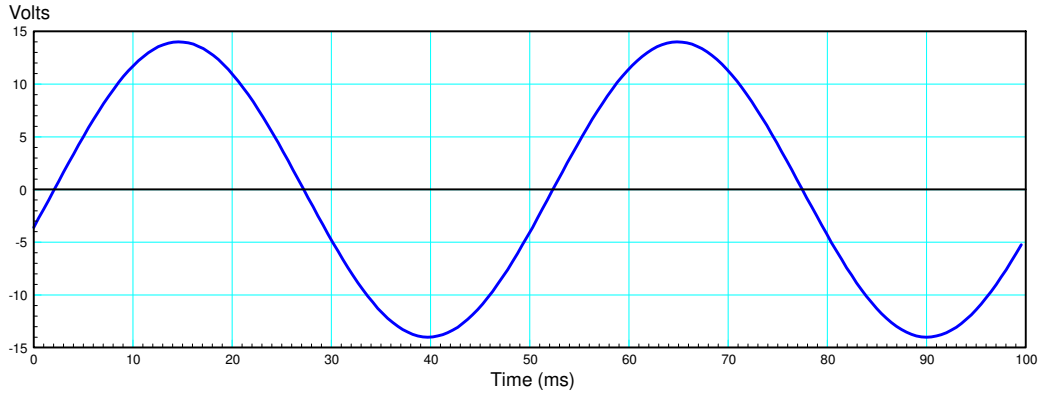


3) Find V2(t)



Solutions:

1) Find the frequency of V1 and express V1 in phasor form



The frequency is 1 / period

Period = 50ms

$$f = \frac{1}{T} = \frac{1}{50ms} = 20.00Hz$$

The amplitude is aboug 14V

cos(t) is a maximum at t = 0.

This is a maximum at t = 15ms

The delay (phase shift) is

$$\theta = -\left(\frac{\text{delay}}{\text{period}}\right)360^0$$

$$\theta = -\left(\frac{15ms}{50ms}\right)360^0 = -108^0$$

The phasor form for V1 is

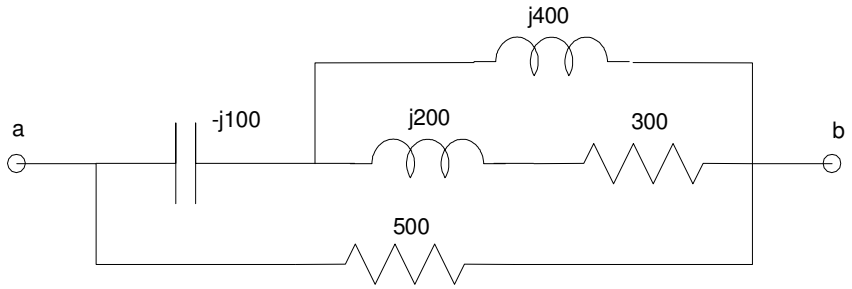
$$V_1 = 14\angle -108^0$$

or

$$V_1 = -4.326 - j13.315$$

Either answer is correct

2) Determine Zab



(300) + (j200) = 300 + j200

(300 + j200) || (j400) = 106.667 + j186.667

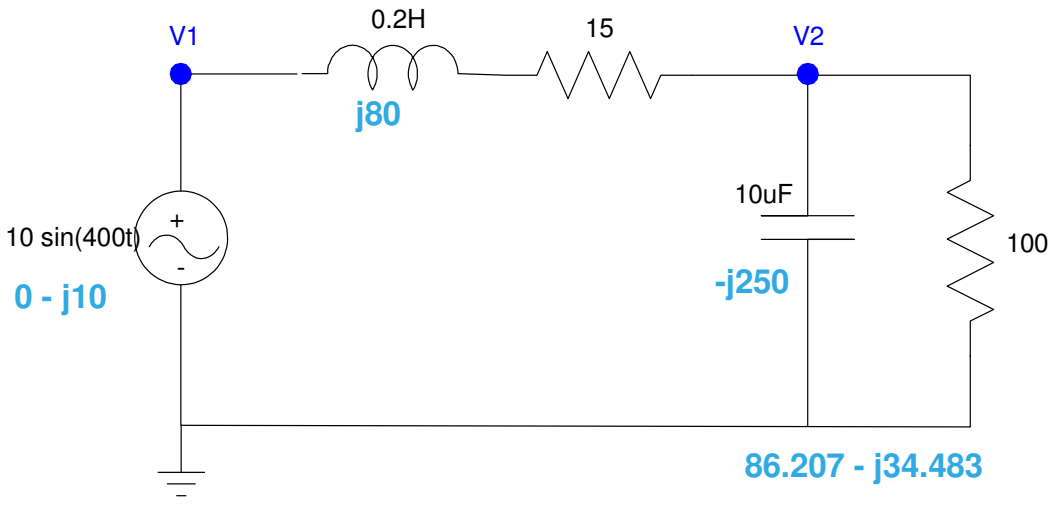
(106.667 + j186.667) + (0 - j100) = 106.667 + j86.667

(106.667 + j86.667) || 500 = 96.154 + j57.692

Free42 commands

```
300
enter
200
complex          300 - j200
1/x
0
enter
400
complex
1/x
+
1/x              (300 - j200) || (j400)
0
enter
-100
complex
+                add -j100 in series
1/x
500
1/x
+
1/x              add 500 in parallel
```

3) Find V2(t)



Convert to phasors

$$\omega = 400$$

$$L \rightarrow j\omega L = j80$$

$$C \rightarrow \frac{1}{j\omega C} = -j250$$

$$V \rightarrow 0 - j10$$

Add the 100 Ohm and -j250 Ohms in parallel

$$Z = \left(\frac{1}{100} + \frac{1}{-j250}\right)^{-1} = 86.207 - j34.483$$

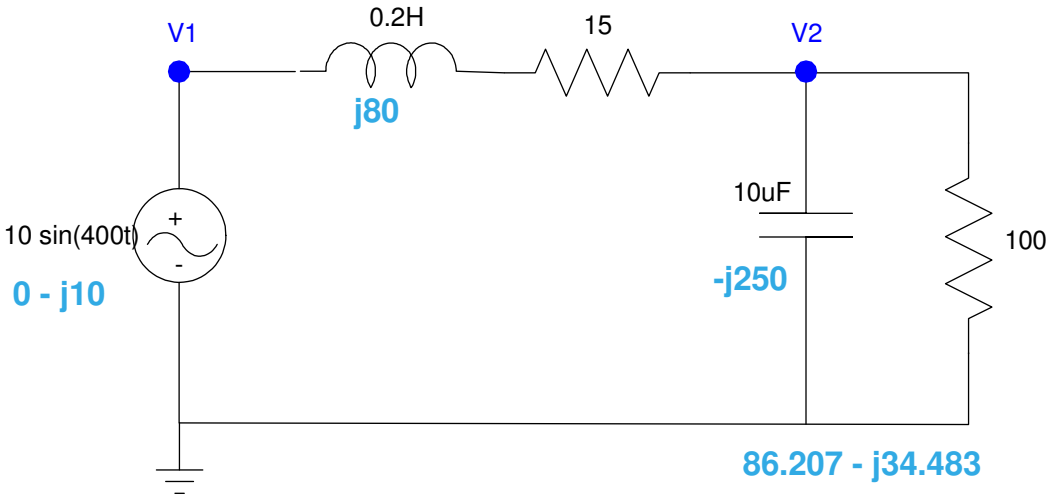
Use voltage division

$$V_2 = \left(\frac{(86.207 - j34.483)}{(86.207 - j34.483) + (15 + j80)}\right)(0 - j10)$$

$$V_2 = -6.020 - j5.810$$

$$v_2(t) = -6.020\cos(400t) + 5.810\sin(400t)$$

Free42 Commands



Free42 commands to find V2

```
100
1/x
0
enter
-250
complex         x = 0 - j250
1/x
+
1/x             x = 86.207 - j34.483
enter
enter
15
enter
80
complex         x = 15 + j80
+               x = 101.207 + j45.517
/               x = 0.581 - j0.602
0
enter
-10
complex         x = 0 - j10
*               x = -6.02 - j5.810
```