HW #22 Solutions EE301

Ch. 16 #'s 10, 12ab, 15

16.10) $e_1 = 10V\sin(\omega t + 30°)$
$e_2 = 15V\sin(\omega t - 20°)$

$V = e_1 + e_2$

a. Convert e_1 and e_2 to phasor form

$$\boxed{E_1 = 10V\angle 30°}$$
$$\boxed{E_2 = 15V\angle -20°}$$

b. Determine $V = E_1 + E_2$

$V = 10V\angle 30° + 15V\angle -20°$

$= (10V\cos 30° + 10V\sin 30°\,j) + (15V\cos(-20°) + 15V\sin(-20°)\,j)$

$= 8.66V + 5.0V\,j + 14.10V - 5.13V\,j$

$= 22.76V - 0.13V\,j$

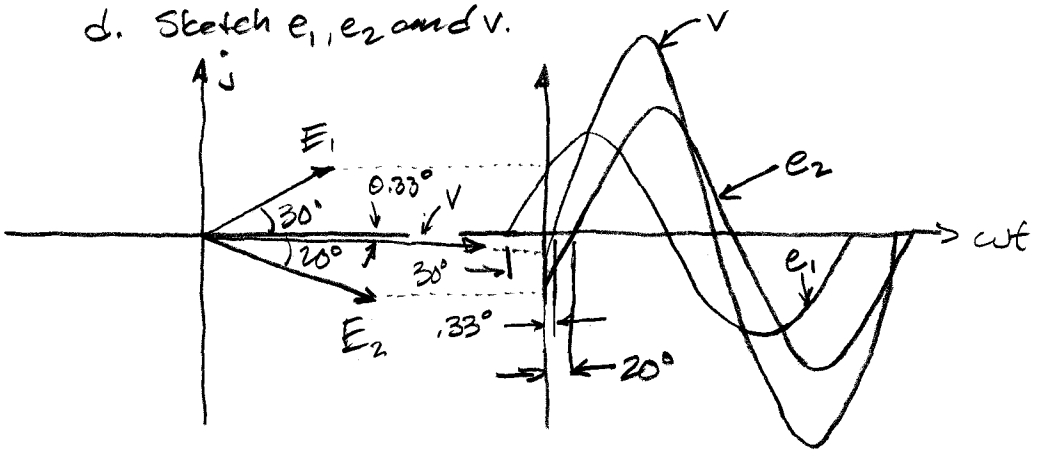
$= \sqrt{(22.76V)^2 + (0.13V)^2}\ \angle \tan^{-1}\left(\frac{-.13V}{22.76V}\right)$

$$\boxed{V = 22.8V\angle -0.33°}$$

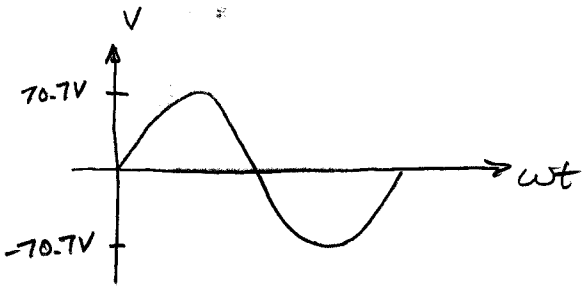
c. Convert V to time domain

$$\boxed{V = 22.8V\sin(\omega t - 0.33°)}$$

d. Sketch e_1, e_2 and V.



16.12) a.



Express as time domain and phasor domain

$$v = 70.7V \sin \omega t$$

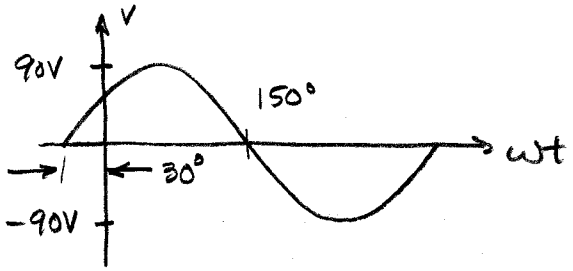
$V = V_{RMS} \angle 0°$

$V = (0.707)(70.7V) \angle 0°$

$$V = 50V \angle 0°$$

Note: From now on, we will use RMS (Effective) values for phasor voltages and currents.

b.



$$v = 90V \sin(\omega t + 30°)$$

$V = V_{RMS} \angle 30° = (0.707)(90V) \angle 30°$

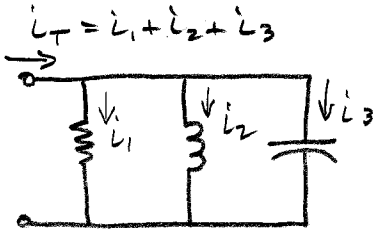
$$V = 63.6V \angle 30°$$

16.15)

$i_1 = 7mA \sin \omega t$

$i_2 = 4mA \sin(\omega t - 90°)$

$i_3 = 6mA \sin(\omega t + 90°)$



a. Phasors

$I_1 = (.707)(7mA) \angle 0° = 4.95mA \angle 0°$

$I_2 = (.707)(4mA) \angle -90° = 2.83mA \angle -90°$

$I_3 = (.707)(6mA) \angle 90° = 4.24mA \angle 90°$

$I_T = 4.95mA \angle 0° + 2.83mA \angle -90° + 4.24mA \angle 90°$

$= (4.95mA + 0j) + 2.83mA\cos(-90°) + 2.83mA\sin(-90°)j + 4.24mA\cos(90°) + 4.24mA\sin(90°)j$

$= 4.95mA - 2.83mA\,j + 4.24mA\,j$

$= 4.95mA + 1.41mA\,j$

$I_T = \sqrt{(4.95mA)^2 + (1.41mA)^2} \angle \tan^{-1}\left(\frac{1.41}{4.95}\right) = 5.1mA \angle 15.9°$

b. time domain, i_T

$i_T = \frac{5.1mA}{.707} \sin(\omega t + 15.9°)$

$$i_T = 7.2mA \sin(\omega t + 15.9°)$$