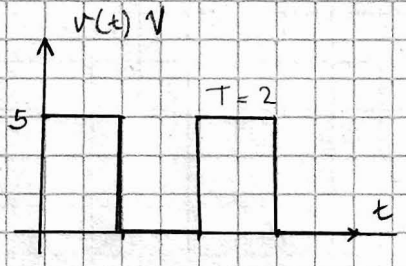
ECE 301
HW # 8 Solutions

5.11

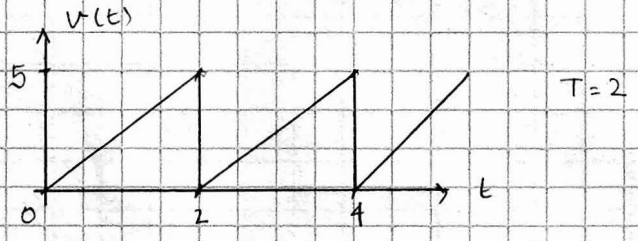


$$V_{RMS} = \sqrt{\frac{1}{T}\int_0^T v^2(t)\,dt}$$

$$= \sqrt{\frac{1}{2}\left(\int_0^1 5^2\,dt + \int_1^2 0^2\,dt\right)}$$

$$= \underline{\underline{3.54\ V}}$$

5.17

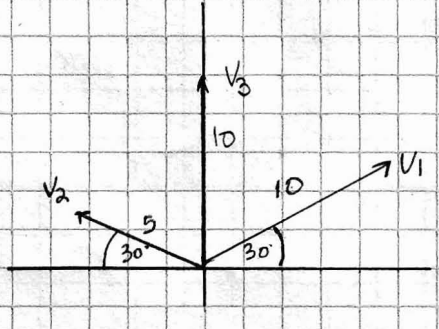


$$V_{RMS} = \sqrt{\frac{1}{4}\int_0^T v^2(t)\,dt}$$

$$= \sqrt{\frac{1}{2}\int_0^2 (2.5t)^2\,dt}$$

$$= \sqrt{\frac{1}{2}\left(6.25\,\frac{t^3}{3}\right)\Big|_0^2} = \underline{\underline{2.887\ V}}$$

5.22



$f = 200$ Hz

Write each signal in time-domain expression

$V_m \cos(\omega t + \theta)$

$\omega = 2\pi f = 400\pi$, therefore:

$$V_1 = 10\cos(400\pi t + 30°)$$

$$V_2 = 5\cos(400\pi t + 150°)$$

$$V_3 = 10\cos(400\pi t + 90°)$$

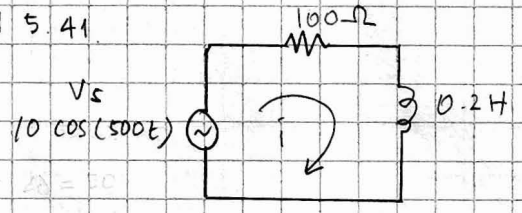
5.22 cont'd

V_1 lags V_2 by 120°
V_1 lags V_3 by 60°
V_3 lags V_2 by 60°

5.32 State the phase relationship between current & voltage for a RESISTANCE, for an inductance, & for a capacitance

For a PURE RESISTANCE, CURRENT & voltage ARE in phase
" " INDUCTANCE, CURRENT lags voltage by 90°
" " capacitance, CURRENT leads voltage by 90°.

5.41



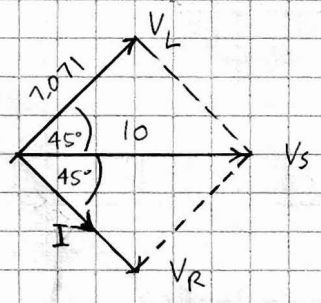
(a) Find phasors for the current & voltages

$$I = \frac{V_s}{R + j\omega L} = \frac{10\angle 0°}{100 + j100} \qquad \omega = 500$$

$$= \underline{\underline{7.071\angle -45° \text{ mA}}}$$

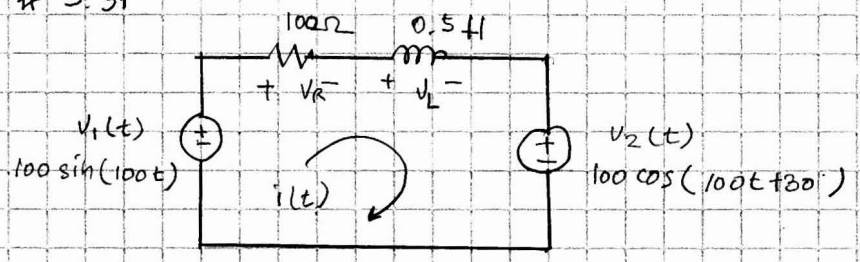
$$V_R = IR = \underline{\underline{7.071\angle -45° \text{ V}}}$$
$$V_L = I(j\omega L) = \underline{\underline{7.071\angle +45° \text{ V}}}$$

(b) Phasor diagram:



(b) I lags V_s by 45°

5.51



(a) $V_1 = 100\angle -90^\circ$

$V_2 = 100\angle 30^\circ$

$$I = \frac{V_1 - V_2}{R + j\omega L} \qquad \omega = 100$$

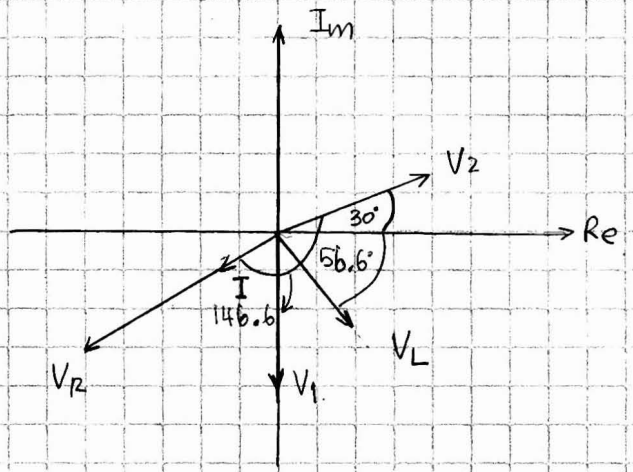
$$= \frac{(100\angle -90) - (100\angle 30^\circ)}{100 + j50}$$

$$= \frac{-86.60 - j160}{100 + j50} = 1.549\angle -146.6^\circ \text{ A}$$

$\bar{V}_R = IR = 154.9\angle -146.6^\circ$ V

$V_L = I(j\omega L) = I(j50) = 77.45\angle -56.6^\circ$ V

(b) Phasor diagram



(c) I lags V_1 by 56.6°
I lags V_L by 90°