HW # 9

* 9.6
* 9.18
* 9.44
* 9.50
* 9.68
* 9.79

9.6

(a) $i(t) = 4\sin(4t + 50^\circ)$

$= 4\cos(4t + 50 - 90^\circ)$

1/2 $= 4\cos(4t - 40^\circ)$.

Now, $v(t) = 10\cos(4t - 60^\circ)$

1/2 $\therefore$ $i(t)$ leads $v(t)$ by 20°.

(b) $v_2(t) = -20\cos(377t)$

1/2 $= 20\cos(377t + 180^\circ)$

But $v_1(t) = 4\cos(377t + 10^\circ)$

1/2 $\therefore$ $v_2(t)$ leads $v_1(t)$ by 170°.

(c) $x(t) = 13\cos(2t) + 5\sin(2t)$

$= \sqrt{13^2+5^2}\left[\sin(68.96)\cos(2t) + \cos(68.96)\sin(2t)\right]$

$= 13.92 \sin(2t + 68.96)$.

1/2 $= 13.92\cos(2t - 21.03)$

$y(t) = 15\cos(2t - 11.8)$

1/2 $\therefore$ $y(t)$ leads by 9.237°

9.18

(a) $V_1 = 60\angle 15^\circ$, $\omega = 1$

$\therefore v_1(t) = 60\cos(t + 15^\circ)$ 1

(b) $V_2 = 6 + j8 = 10\angle 53.13$

$= 10\cos(40t + 53.13)$ ($\because \omega = 40$) 1

(c). $I_1 = 2.8e^{-j\pi/3}$

$= 2.8\angle -60^\circ$

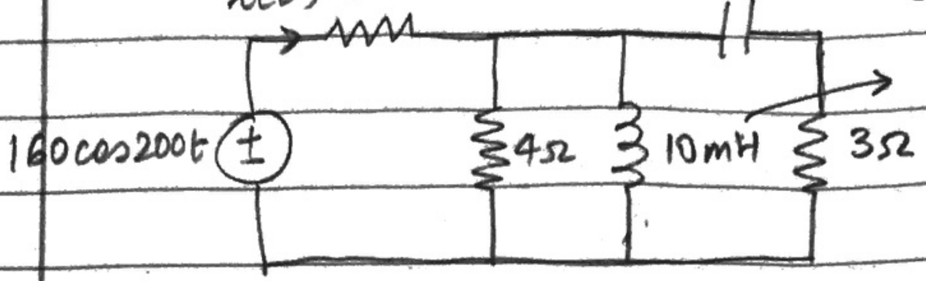
$= 2.8\cos(377t - 60^\circ)$ ($\because \omega = 377$) 1

(d) $I_2 = -0.5 - j1.2$

$= -1.3\cos(10^3 t + 67.38)$ ($\because \omega = 103$)

1

9.44



$5mF = \frac{1}{j(200 \times 5 \times 10^{-3})} = -j$ (1/2)

$j\omega L = j \times (200 \times 10 \times 10^{-3})$

$= 2j$ (1/2)

$\therefore Z = (4\Omega \,||\, 2j \,||\, (3-j))$

$= \left[\frac{1}{4} + \frac{1}{2j} + \frac{1}{(3-j)}\right]^{-1}$

$= \left[\frac{2j(3-j) + 4(3-j) + 8j}{8j(3-j)}\right]^{-1}$

$= \left[\frac{6j + 2 + 12 - 4j + 8j}{24j + 8}\right]^{-1}$

$= \left[\frac{14 + 10j}{8 + 24j}\right]^{-1}$

$= \frac{4 + 12j}{7 + 5j}$

$= \frac{(4 + 12j)(7 - 5j)}{49 + 25}$

$= \frac{28 + 60 - 20j + 84j}{74}$

$= \frac{88 + 64j}{74}$

$= 1.19 + 0.864j$ (1)

$\frac{1}{2}$

$$i(t) = \frac{160}{6.19 + 0.864j}$$

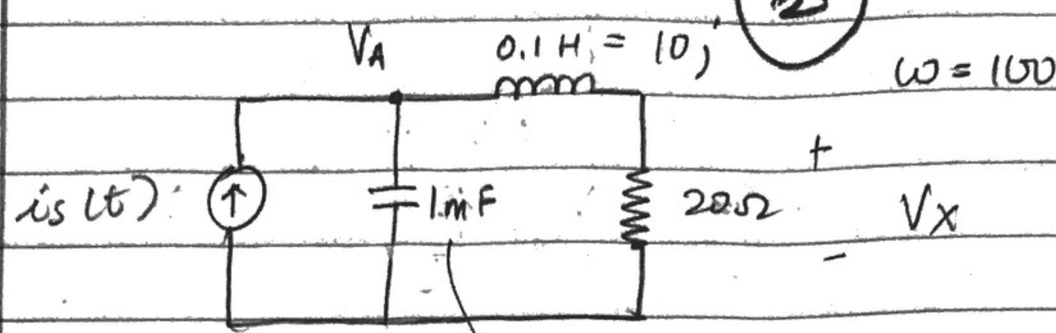
$$= 25.6 \angle -7.946 \quad A$$

$\frac{1}{2}$

$$= 25.6 \cos(200t - 7.946). \ A$$

$(\because w = 200)$

9.50



$\frac{1}{j\omega C} = \frac{1}{j(0.1)} = -10j$ (1/2)

(1/2)

* $Z = (-10j) \parallel (20 + 10j)$

$= \left[\frac{-1}{10j} + \frac{1}{10(2+j)} \right]^{-1}$

$= \left[\frac{-(2+j) + j}{10j(2+j)} \right]^{-1}$

$= \frac{-10 \cancel{20}j - \cancel{10}5}{\cancel{-2}}$

$= 5 - 10j$ (1)

* $V_A = i_s(t) \times (5 - 10j)$

$= 5 \angle 40 \times (5 - 10j)$

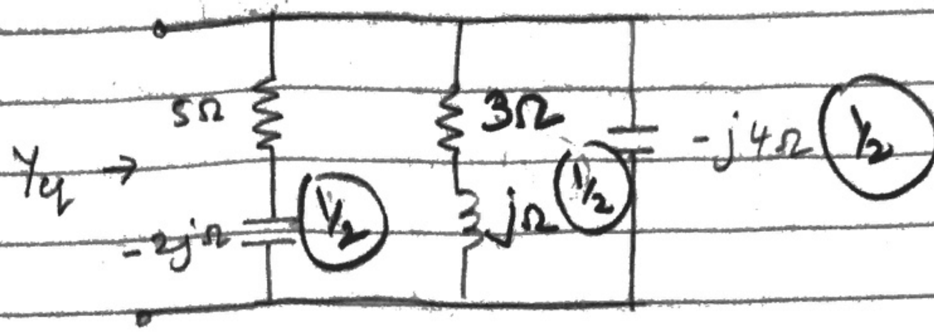
$= 25\sqrt{5} \angle -23.43$ V (1/2)

* $V_x = \frac{20}{20 + 10j} (V_A)$

$= \frac{\cancel{20}2}{\cancel{10}\cancel{\sqrt{5}} \angle 26.57} \left[25\cancel{\sqrt{5}} \angle -23.43 \right]$ V

(1/2) $= 50 \angle 49.99$ V $= 50 \cos(100t - 49.99)$ V

9.68



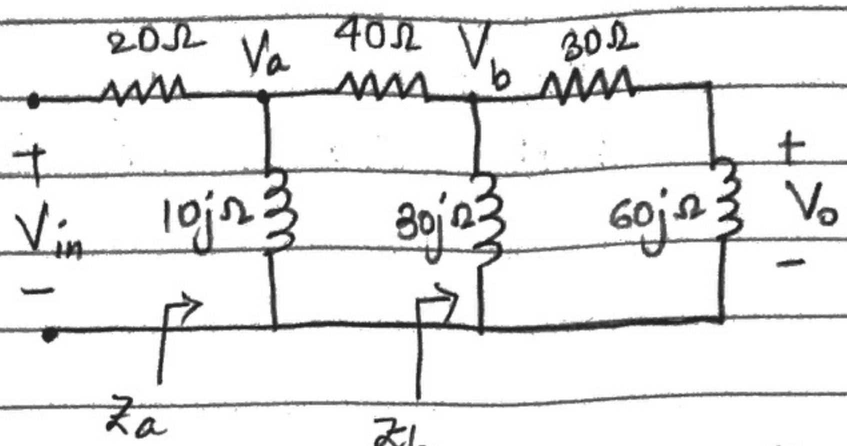
$$Y_{eq} = \left[\frac{1}{(5-2j)} + \frac{1}{(3+j)} - \frac{1}{4j} \right]$$

$$= \frac{5+2j}{29} + \frac{3-j}{10} + 0.25j$$

$$= 0.172 + 0.068j + 0.3 - 0.1j + 0.25j$$

½ $$= (0.472 + 0.218j)\ S$$

9.79



(a)

$Z_b = 30j \parallel (30+60j) = 3+21j$ ½

$Z_a = 1.53 + 8.89j$ ½

$\therefore \quad V_a = \dfrac{Z_a}{20+Z_a} V_{in}$

$= (0.206 + 0.328j)\, V_{in}$ ½

$V_b = \dfrac{Z_b}{40+Z_b} V_a$

$= (-0.07 + 0.157j)\, V_{in}$ ½

And $V_o = \left(\dfrac{60j}{30+60j} \times (-0.07 + 0.157j) \right) V_{in}$

$= (-0.119 + 0.098j)\, V_{in}$

$= (0.154 \angle -39.47)\, V_{in}$

$= (0.154 \angle 140.53)\, V_{in}$ 1

$\therefore$ Phase shift is 140.53

(b) Phase shift : Leading 1

(c) $V_0 = 120 \times (0.154 \angle 140.53)$

$= 18.48 \angle 140.53 \text{ V}$ (1)