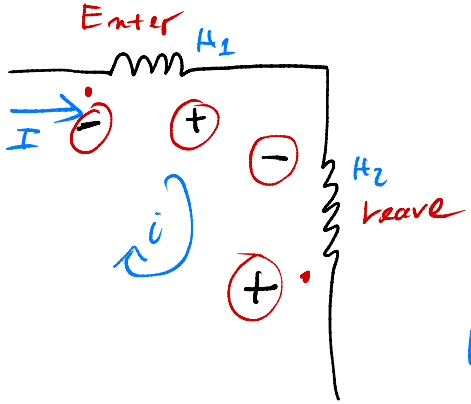


Mutual Inductor

KVL :

Enter → cực còn lại (+) dương tại ngay dot

. Polarity phải đặt trên dot ●

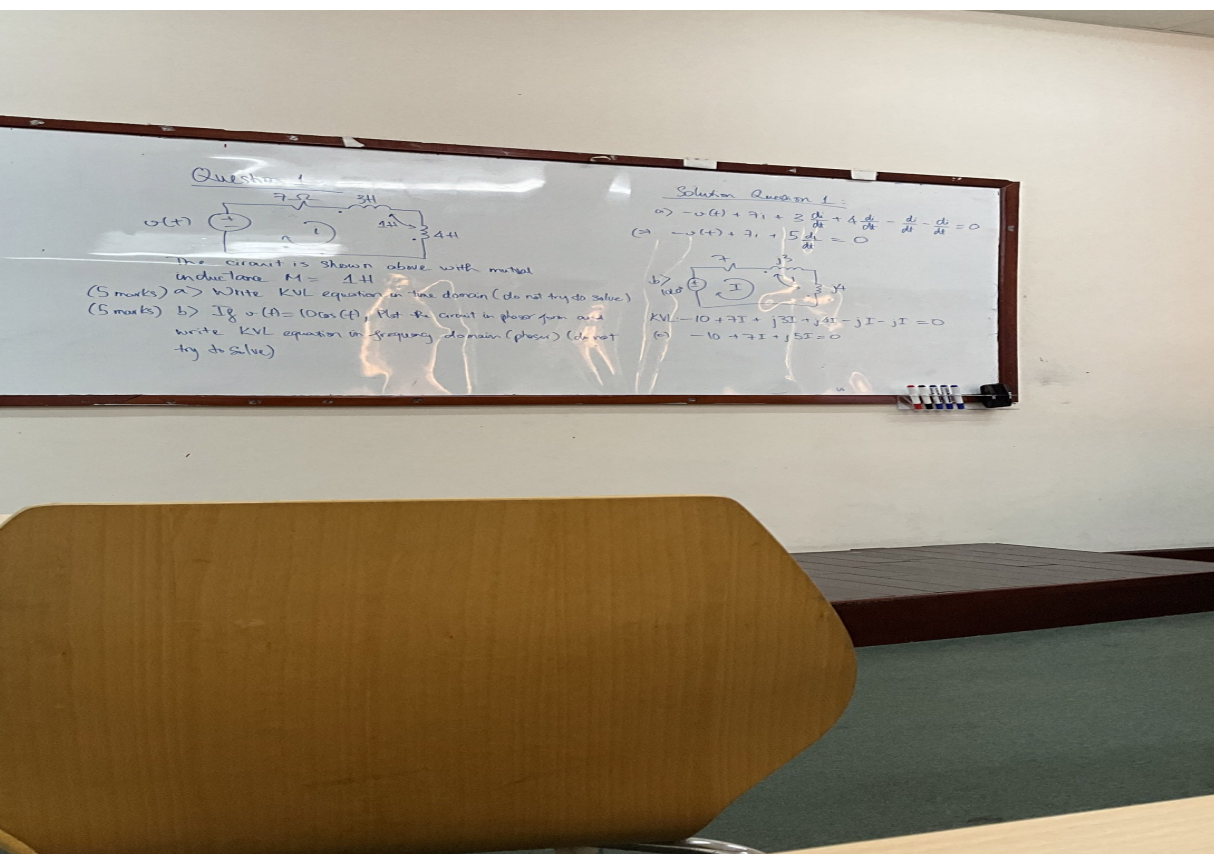
(+ −)

$M = 1\,H$

$$-v(t) + 7i + 5\frac{di}{dt} + 4\frac{di}{dt} - v_{4H} - v_{5H} = 0$$

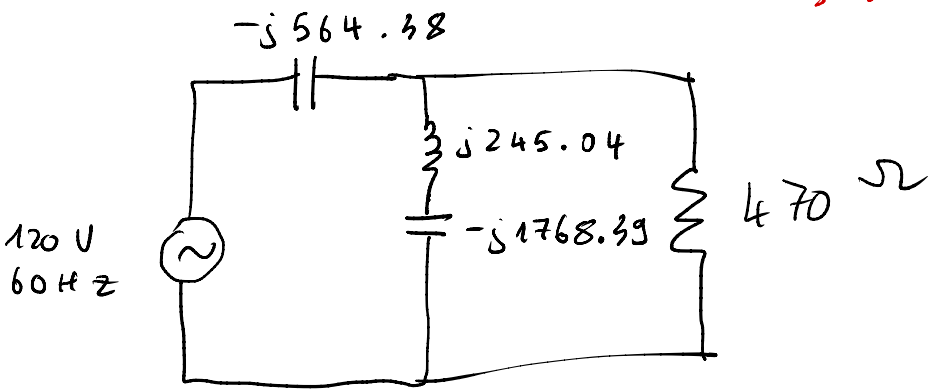
(v_{4H}: $M\frac{di}{dt}$; v_{5H}: $M\frac{di}{dt}$)

$$\Rightarrow -v(t) + 7i + 9\frac{di}{dt}$$



Question 2 : $\omega = 2\pi f = 120\pi$ (rad/s)

Sinusoidal



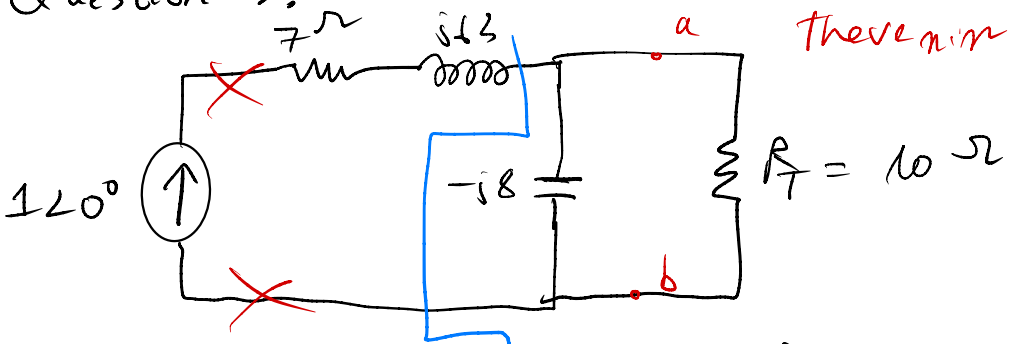
a) $\frac{V-120}{-j564.38} + \frac{V}{-j1523.45} + \frac{V}{470} = 0$

$\Leftrightarrow V\left(\frac{1}{j564.38} + \frac{1}{-j1524.45} + \frac{1}{470}\right) = \frac{j6000}{28219}$

$\Rightarrow V = 49.53 + j44.40$

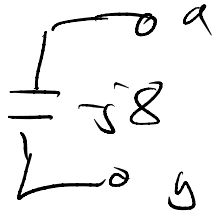
$\Rightarrow v(t) = 66.85\cos(120\pi t + 41.23^\circ)$

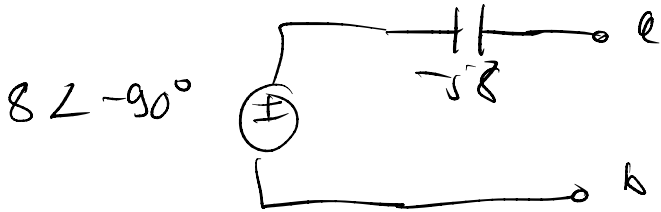
Question 3:



a) $V_{th} = 1\angle 0 \times (-j8) = -j8 = 8\angle -90°$ (V)

$R_{th} = -j8\ (\Omega)$





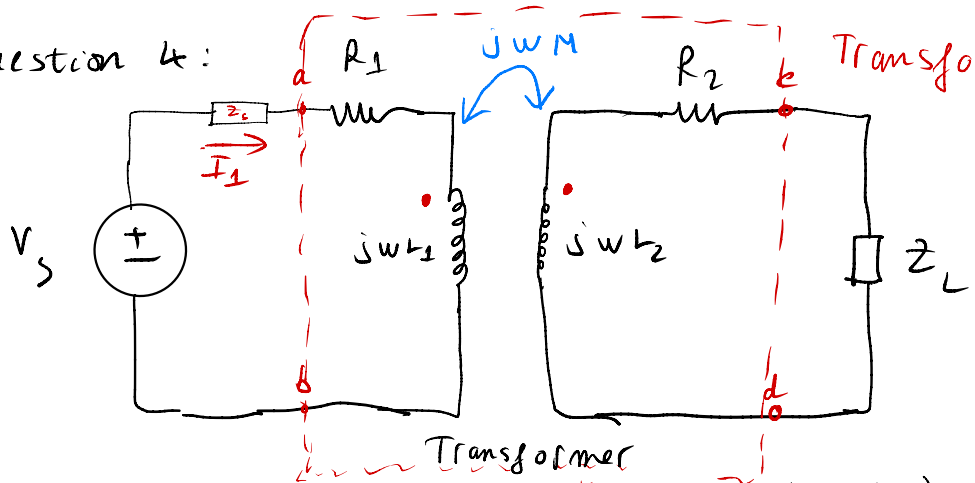
b) $I_{R_T} = \dfrac{V_{Th}}{-j8 + R_{th}} = 0.39 - j0.487$

c) $S = \frac{1}{2} |I_{R_T}|^2 R_{th}$

$= \frac{1}{2} \left(\sqrt{0.39^2 + 0.487^2} \right)^2 \times 10$

$= 1.95$ (W)

Question 4:



$R_1 = R_2 = 0$, $jwL_1 = 150\,(\Omega)$, $jwL_2 = j20\,(\Omega)$

$jwM = j10\,(\Omega)$, $V_s = 20\angle 0^\circ\,(V)$, $Z_s = 10 + j20\,(\Omega)$

$Z_L = 50 + j10\,(\Omega)$

$Z = a + jb$

$Z^* = a - jb$

a) Compute the required impedance from

b) Compute the current which is flow.

Sol:

a) $Z_{22} = R_2 + Z_L + jwL_2 = 50 + j30$

$$Z_r = \frac{(wM)^2}{|Z_{22}|^2} Z_{22}^* = 1.471 - j0.88$$

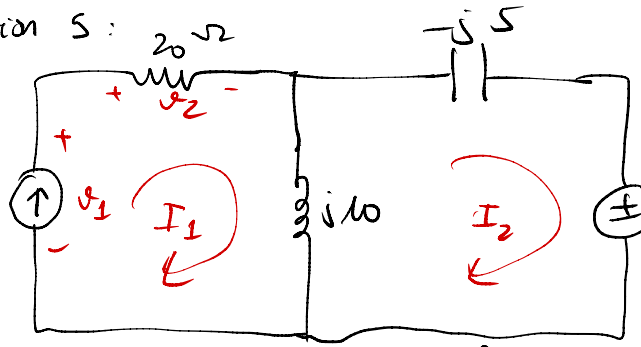
$$= 1.72\angle -31^\circ$$

b) $$I_1 = \frac{V_s}{Z_s + R_1 + jwL_1 + Z_r}$$

$$= 0.285\angle -80.5^\circ$$

$$I_2 = \left(\frac{jwM}{Z_{22}}\right) I_1 = ?$$

Question 5: AC Node-mesh



a) What is the voltage of I_1? and compute I_2.
b) KVL to compute v_1
c) Compute the average power of voltage source.

$P = \frac{1}{2} Re[VI^*]$

Sol:

a) $I_1 = 4\angle 0$ (A)

KVL: $(I_2 - I_1)j10 + I_2(-j5) + 60\angle 30^\circ = 0$

$\Rightarrow I_2 = 8 + j20 - 25 = 21.78\angle 68.45^\circ$

b) KVL: $-V_1 + 20I_1 + j10(I_1 - I_2) = 0$

$\Rightarrow V_1 = 282.57 - j40 = 285.4\angle -8.05^\circ$ (V)

$P = \frac{1}{2} Re[V_1 I_2^*] = \frac{1}{2} \times 60 \times 21.78 \cos(30^\circ - 68.45^\circ)$

$= 511.7$ (W)

Question 6:

Sol:

a) $I_{AN} = \frac{220 \angle 0^\circ}{Z_L} = 4.83 - j\,0.846 \text{ A rms}$

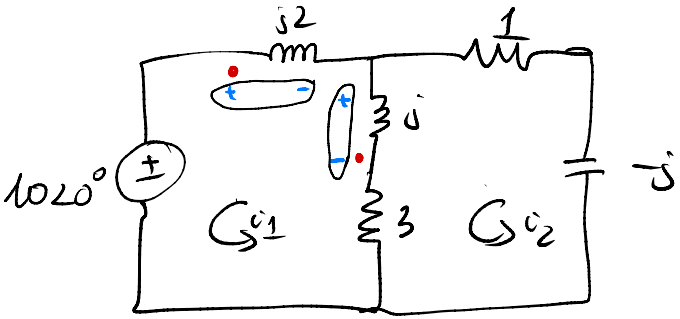
$= 4.91 \angle -11.5^\circ \text{ A rms}$

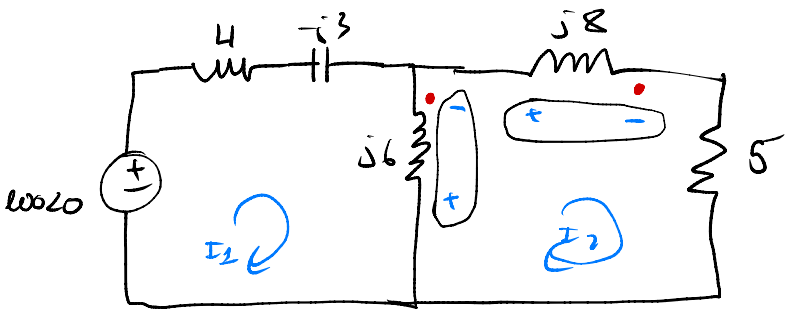
b) $V_{ab} = (\sqrt{3} \angle 30^\circ) \times (220 \angle 0^\circ) = 381 \angle 30^\circ \text{ V rms}$

c) $P = 3 |V_{AN}| |I_{AN}| \cos \Delta\theta$

$= 3 \times 220 \times 1.41 \times \cos(0 - -11.5^\circ)$

$= 2789.5 \text{ (W)}$


j2
1
j
10∠0°
3
-j
i_1
i_2


4
-j3
j8
j6
5
100∠0
I_1
I_2