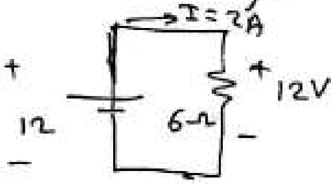
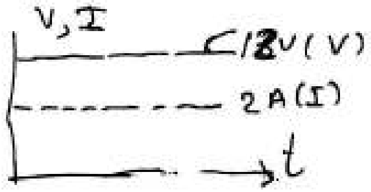
Lec (01) .. Revision

Part 1

(AC) alternating current التيار المتردد

1- Previously, we learned DC Sources → dependent, independent



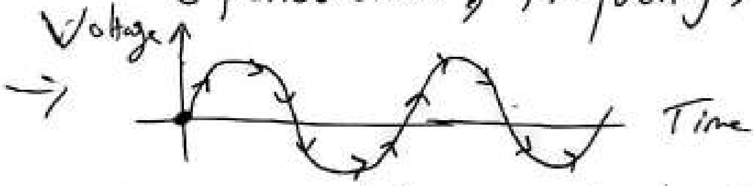


DC source constant values with time (DC = Direct current)

2- Ac (alternating current)

→ Voltage & current vary with time in Amplitude & direction

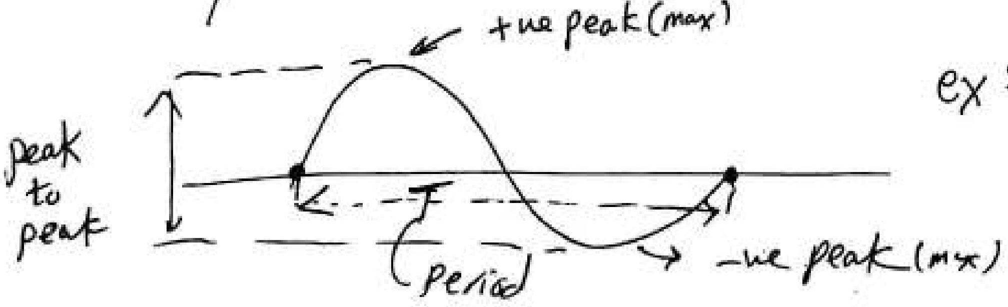
→ Sinusoidal wave (Example of Ac Signals) has some characteristics (period (Time), Frequency, relation between period & Frequency)



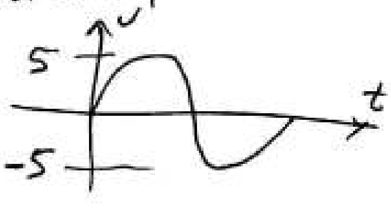
– The Sinusoidal Wave Starts From (0V), increase to maximum Positive Value (+ve peak) and then decreased to zero & continue to maximum negative Value (−ve peak) & returns to zero again and so on (repeat cycles)

– The waveform (signal is called periodic) because every period it repeats itself.

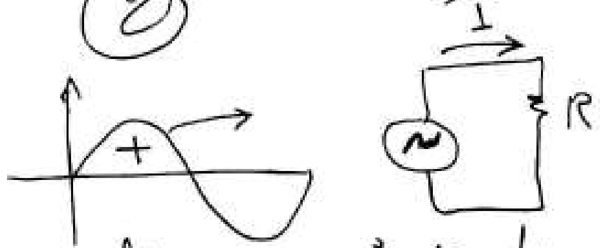
– Symbol of AC in Electrical Circuit



ex signal with peak 5V



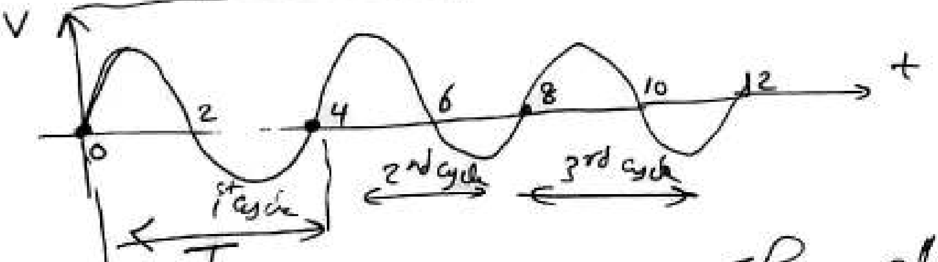
* Polarity of sine wave



During (+ve half cycle) → Voltage source is positive & current generates (clockwise)

During (−ve half cycle) → Voltage source is −ve & current generates (counter clockwise)

* Period of sine wave



(EX1)
Calculate the period of sine wave shown above?

Sol $T = 4\ sec$

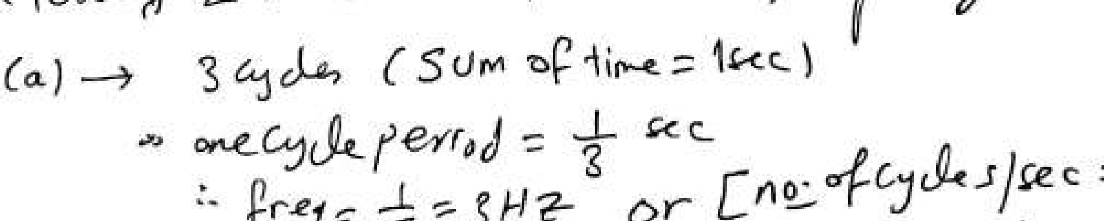
[لعدد الـ cycle
period = زمن cycle واحدة]

* Frequency of sine wave

$f = \frac{1}{T}$ → تقاس بالهرتز HZ

$f = \frac{1}{4} = 0.25\ HZ$

Ex(2)



which of 2 sine waves has more frequency

fig(a) → 3 cycles (sum of time = 1sec)

∴ one cycle period = $\frac{1}{3}$ sec

∴ freq = $\frac{1}{T} = 3\ HZ$ or [no. of cycles/sec = 3]

fig(b) → no. of cycles = 5 ∴ 5HZ or $\frac{1}{T} = \frac{1}{\frac{1}{5}sec} = 5\ HZ$

∴ fig (b) more freq. than fig (a)

EX(3) If the period of certain sine wave is 10ms, what's freq?

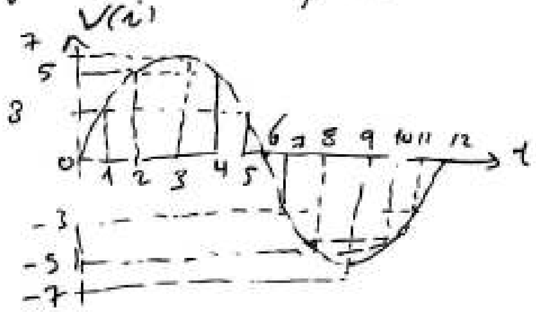
sol $f = \frac{1}{T} = \frac{1}{10ms} = \frac{1}{10\times10^{-3}} = 100\,Hz$

EX(4) The freq. of sine wave is 60Hz, what's period?

$T = \frac{1}{f} = \frac{1}{60} = 16.7\,ms$

Sinusoidal voltage values

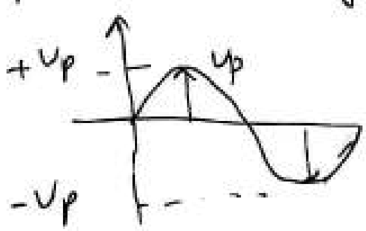
1- Find instanteneous value at any time
2- find peak
3- Peak-to-peak
4- RMS
5- Average



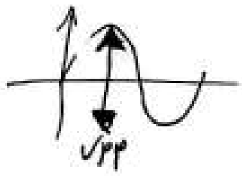
[1] instantenous value

قصدها كل Time في قيمة لـ v أو i

[2] Peak value (positive or negative maximum with respect to zero)



[3] peak to peak value $V_{pp} = 2V_p$



[4] RMS (root mean square value) ⇒ AC voltmeter measured value
= effective value

هي نفس قيمة الحرارة الناتج عند توصيل بطارية dc مع مقاومة وينتج عنها درجة حرارة تساوي نفس درجة الحرارة الناتجة من توصيل AC مع نفس المقاومة.

$RMS = \frac{V_{max}}{\sqrt{2}}$ ex $V_{max} = 5V$ $\therefore V_{RMS} = \frac{5}{\sqrt{2}}$, $V_{pp} = 10V$

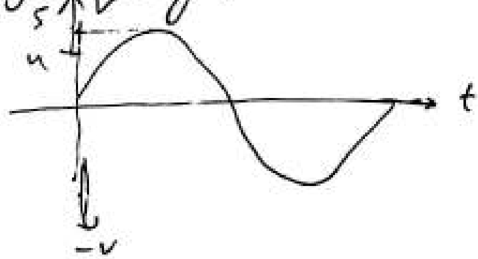
$\boxed{5}$ Average value (DC Value) (mean Value) = read of DC Avometers

= total area under the half cycle curve divided By distance along horizontal axis (For complete cycle = zero)

(in half sine wave) → $V_{avg} = \dfrac{2V_{max}}{\pi} = \dfrac{2V_p}{\pi}$

نفس الكلام للـ AC لنصف موجة فقط
اما موجة كاملة = صفر

$\underline{\underline{EX}}$(5) find V_p, V_{pp}, V_{rms}, The half cycle V_{avg}.



حل $V_p = 4.5V$

$V_{pp} = 2 \times V_p = 9V$

$V_{rms} = V_p/\sqrt{2} = \dfrac{4.5}{\sqrt{2}} = 3.18V$

$V_{avg} = \dfrac{2V_p}{\pi} = \dfrac{2}{3.14} \times 4.5 = 2.87V$

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angular Measurement of sinewave

radian ⟷ degree

$\dfrac{\text{degree}}{180^\circ} = \dfrac{\text{rad}}{\pi}$

So $\quad$ 1 degree = $\left(\dfrac{180^\circ}{\pi}\right) \times$ rad

$\quad$ 1 rad = $\left(\dfrac{\pi}{180^\circ}\right) \times$ degree

exaple $180^\circ = ?!$ rad

$\therefore \quad = \dfrac{\pi}{180} \times 180 = \pi$ rad

ex(6)

Convert 60° to rad. & $\dfrac{\pi}{6}$ rad to degrees

a- Rad $= \dfrac{\pi}{180} \times 60 = \pi/3$ rad

b- deg → $\dfrac{180}{\pi} \times \left(\dfrac{\pi}{6}\right) = 30^\circ$

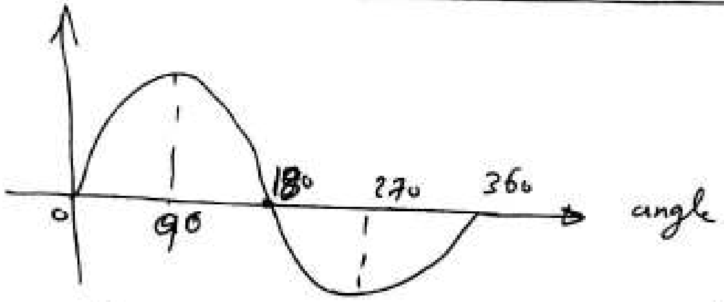
Sine wave angle → (phase)

كأنه موتور يلف مختلف زاوية يتولد جهد

angle ⇒ angular freqeny

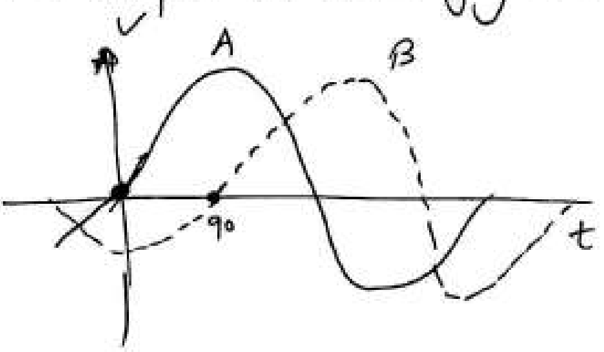
$= \omega t = 2\pi f t \Rightarrow 2\pi$

$\rightarrow$ one cycle $= 2\pi = 360°$

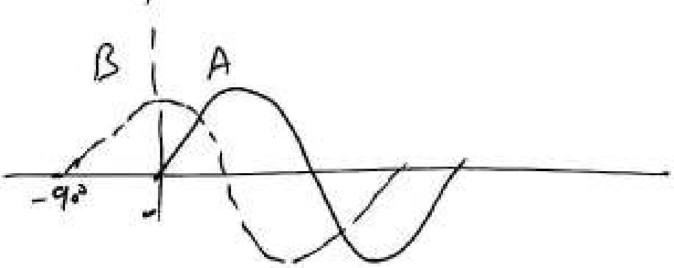


The phase of sine wave is [angular measurement ~~of~~ That specifies The position of that Sinewave].

* it is useful to identify which signals lead (متقدم) / or lag (متأخر)

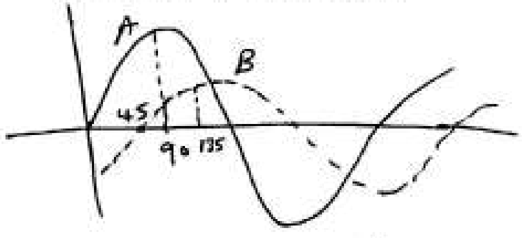


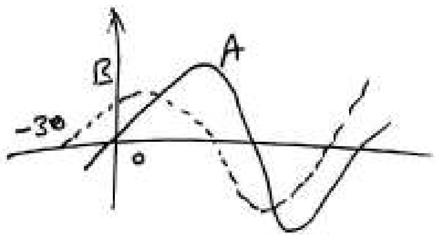
A lead B by 90°
or B lag A by 90°



B lead A by 90°
or A lag B by 90°

EX(7) what is the phase angles between the two Sine waves in ~~Both~~ Circuits





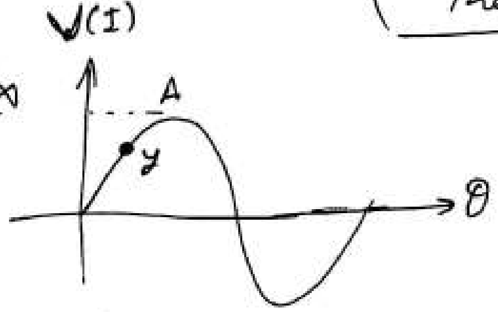
A lead B by 45°
Phaseangle 45°

B lead A by 30°
Phaseangle 30°

6

The Sine wave formula (instantenous wave)

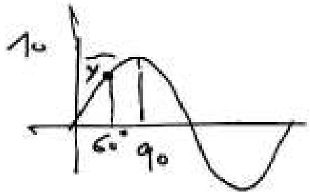
ex



$$y = A \sin\theta$$

عند أي نقطة

$$V(t) = V_p \sin\theta$$

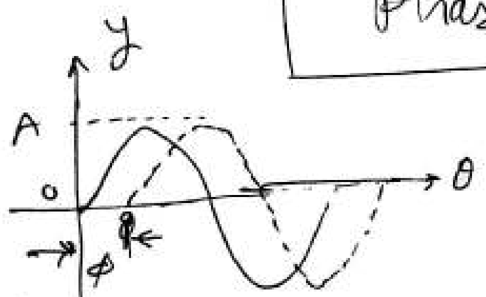


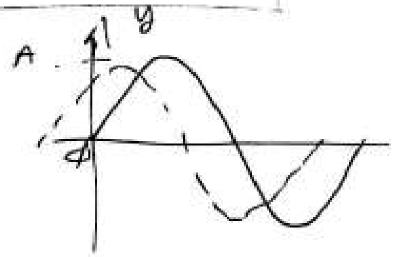
$\rightarrow V = 10 \sin\theta$

at $60^\circ \longrightarrow V = 10 \sin 60 = 8.66V$

$\therefore y = 8.66V$

Phaseshift sinewave





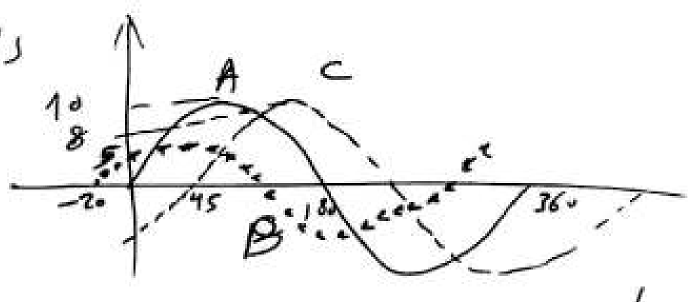
معادلة الموجة المتقطعة $y = A \sin(\theta - \phi)$

لو عايزة الموجة solid ← Reference

$y = A \sin(\theta + \phi)$ معادلة الموجة المتقطعة

لـ الموجة solid ← Ref.

Ex (8) Determine instantenous Value at 90° reference Point on horizontal axis



$V_A = A \sin\theta = 10 \sin\theta \Big|_{90^\circ} = 10 \sin 90 = 10V$ المرجع (ref)

متقدمة بـ 20° عن Ref.

$V_B = 5 \sin(\theta + 20) \Big|_{\theta = 90} = 5 \sin(\underset{90+20}{110^\circ}) = 4.7V$ المتقدمة

$V_C = 8 \sin(\theta - 45^\circ) = 8 \sin(90 - 45) = 5.66V$ المتأخرة

Part 2 [1]

[1] Capacitors

symbol $-||-$ two plates charged with ac Source

$$\text{Capacitance} = C = \frac{Q \to \text{charge}}{V \to \text{applied voltage}} = \frac{\varepsilon_0 \varepsilon_r A}{d}$$

$\varepsilon_0 \to 8.85\times10^{-12}$ F/m

$\varepsilon_r \to$ ثابت عازلية permitivity

$A \to$ area of plates

$d \to$ dist. betw plates

or $Q = CV$

its Unit is Farad (F) $\to$ actually (micro, nano, Pico farad)

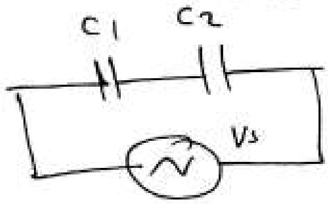
EX(1) A certain Capacitor Stores 50 microcolombs with 10V across its plates. What is Capacitance (in microfarad)

Sol/ $C = Q/V = \frac{50 \text{ micro}}{10} = 5\mu F$

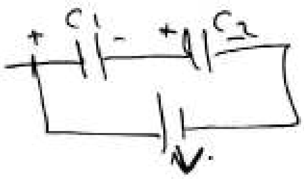
EX(2) determine the capacitance of parallel plates having area $0.01\,m^2$ & separation 0.5 mil $= [1.27\times10^{-5} m]$, Dielectric is mica (has ε_r of 5)

Sol $C = \frac{\varepsilon_0 \varepsilon_r A}{d} = \frac{(8.85\times10^{-12})(5)(0.01)}{1.27\times10^{-5}} = 0.035\,\mu f$

a- Series Connection of capacitors



or



note if $C_1 = C_2 = C_3 = \cdots$

$\therefore C_T = \frac{C}{n}$, $n \to$ عدد المكثفات

$V_T = V_1 + V_2 + \cdots$

$Q_1 = Q_2 = Q_3 \cdots$

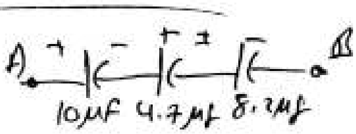
$\frac{Q_T}{C_T} = \frac{Q_1}{C_1} + \frac{Q_2}{C_2} + \cdots$

$$\therefore \boxed{\frac{1}{C_T} = \frac{1}{C_1} + \frac{1}{C_2} + \cdots}$$

قواعد المكثفات series
parallel عكس قواعد المقاومات

$\therefore$ Series Capacitor Like Parallel Resistors

EX(3) Find total Capacitance between A & B



$\frac{1}{C_T} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3}$ $\therefore \frac{1}{C_T} = \frac{1}{2.3\mu f}$ $\therefore C_T = 2.3\mu f$

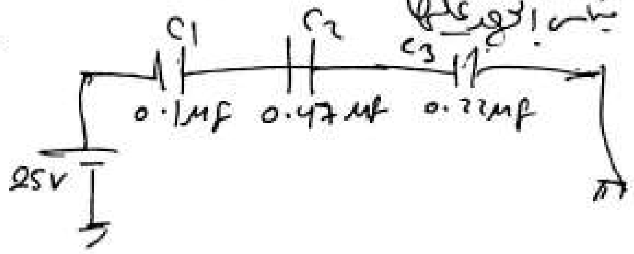
note if you want to use voltage divider in series connection to determine voltage across each individual capacitor, So:-

$$\text{مثلا } V_1 = V_T \times \frac{X_{C1}}{X_{CT}} = V_T \cdot \frac{C_T}{C_1}$$

$C_T \rightarrow$ total cap

$C_1 \rightarrow$ قيمة المتسعة المراد حساب الجهد عليها

EX(4) find voltage across each capacitor



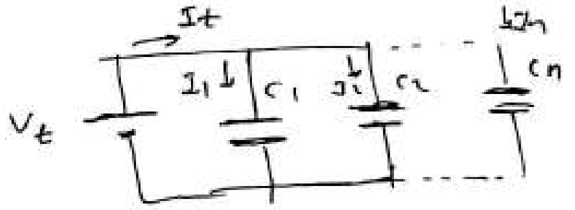
$$C_T = \frac{1}{\frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3}} = 0.06\mu f$$

$$V_1 = V_T \frac{C_T}{C_1} = 25 \times \frac{0.06\mu}{0.1\mu} = 15V$$

$$V_2 = V_T \frac{C_T}{C_2} = 25 \times \frac{0.06\mu}{0.47\mu} = 3.19V$$

$$V_3 = V_T \frac{C_T}{C_3} = 25 \times \frac{0.06\mu}{0.22\mu} = 6.81V$$

b- Parallel Connection of C



$$Q_T = Q_1 + Q_2 + Q_3 + \cdots Q_n$$

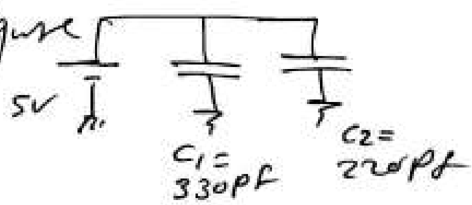
$$C_T V_T = C_1 V_1 + C_2 V_2 + C_3 V_3 + \cdots + C_n V_n$$

but $V_T = V_1 = V_2 = \cdots V_n$

$$\therefore \boxed{C_T = C_1 + C_2 + C_3 + \cdots + C_n}$$

So parallel $\underline{C} \equiv$ series R

EX(5) what is the voltage across each cap of figure

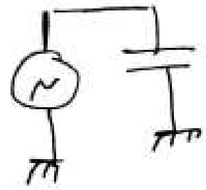


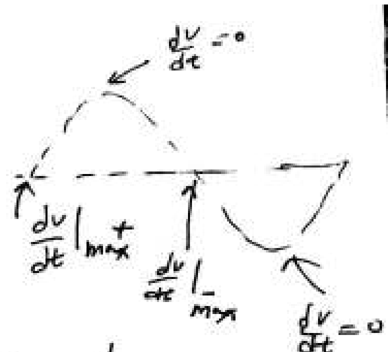
$$C_T = C_1 + C_2 = 330 + 220 = 550pf$$

$$V_T = V_1 = V_2 = 5V$$

in capacitor

$$i = c\frac{dv}{dt}$$

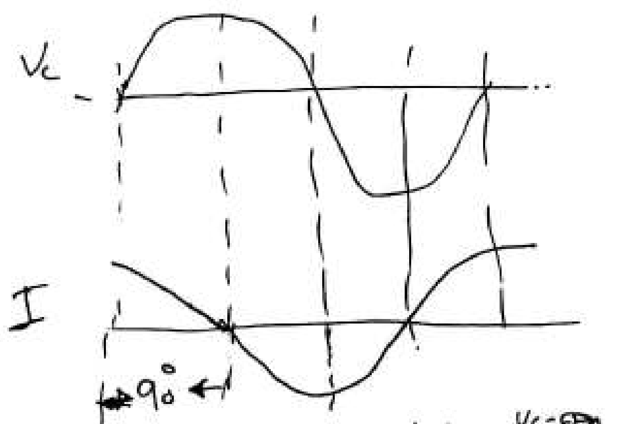


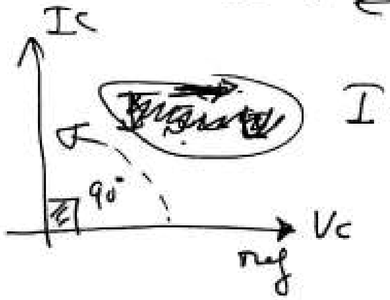


Relation between I & V in capacitor

I lead V by 90° in pure capacitive circuit

v يسبقه





I lead v

$V_c = 0$, $I_{c\,max}^{+}$ | $V_{c\,max}^{+}$, $I_c = 0$ | $V_c = 0$, $I_{c\,max}^{-}$ | $V_{c\,max}^{-}$, $I_c = 0$ | $V_c = 0$, $I_{c\,max}^{+}$

Capacitive Reactance

المفاعلة السعوية للمكثف

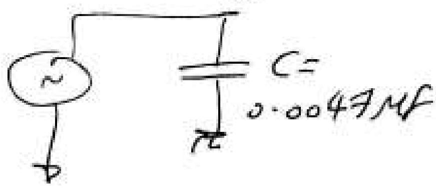
$$X_c = \frac{1}{2\pi f C}$$ ↳ magnitude

, also written $-jX_c$ or $\frac{1}{jX_c}$ ↳ phase (90°)

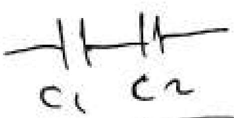
EX(6) for the circuit shown, Determine capacitive Reactance if f = 1 KHz

Sol

$$X_c = \frac{1}{2\pi f c} = \frac{1}{2\pi \times 10^3 \times 0.0047 \times 10^{-6}} = 33.9\ K\Omega$$



نتعامل مع X_c كأنها مقاومة في الدوائر اللي فيها C



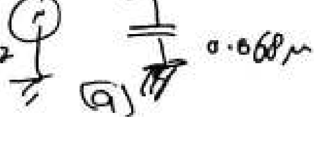
$$X_{CT} = X_{C1} + X_C$$ كأنها مقاومة عادية توالي

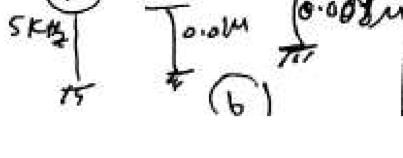
$$X_{CT} = \frac{X_{C1} \cdot X_{C2}}{X_{C1} + X_C}$$ كأنها مقاومة توازي

EX(7) Calc. total capacitive reactance for Cts

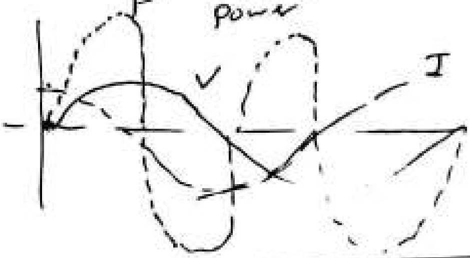
(a) $X_{CT} = X_{C1} + X_{C2} = \frac{1}{2\pi \times 5K \times 0.01\mu} + \frac{1}{2\pi \times 5K \times 0.068\mu} = 3.65K\Omega$

(b) $X_{CT} = \frac{X_{C1} X_{C2}}{X_{C1} + X_{C2}} = 408\ \Omega$





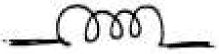
Power in capacitor $\quad P_{\text{reactive power}} = V_{rms} I_{rms} = \frac{V_{rms}^2}{X_C} = I_{rms}^2 X_C$



→ True power = 0 (ideal capacitor)
صفر

Note:- يستخدم الـ capacitor في دوائر filters الـ Power supply وغيرها

2- Inductors (Coils)

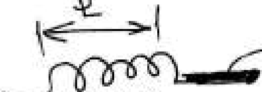


coil with (N) turns

inductance (henry)

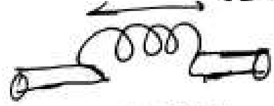
current rate (Amp/sec)

- $\boxed{\text{The induced voltage } \left(V_{ind} = L\frac{di}{dt}\right)}$
- $L = \frac{N^2 \mu A}{\ell}$



صفر → $A = \pi r^2$ ← نصف قطر اللفة

Ex



$\mu = 0.25 \times 10^{-3}$ H/m

$N = 350$, $A = \pi r^2$ $\quad r = \frac{1}{2}(0.5 \times 10^{-2})$

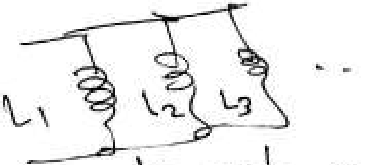
$$\ell = \frac{(350)^2 \times (0.25\times10^{-3}) \left(\pi (0.25 \times 10^{-2})^2\right)}{1.5 \times 10^{-2}} = 40\,mH$$

series connection

$L_T = L_1 + L_2 + L_3 + \cdots$

تعامل معاملة المقاومات series

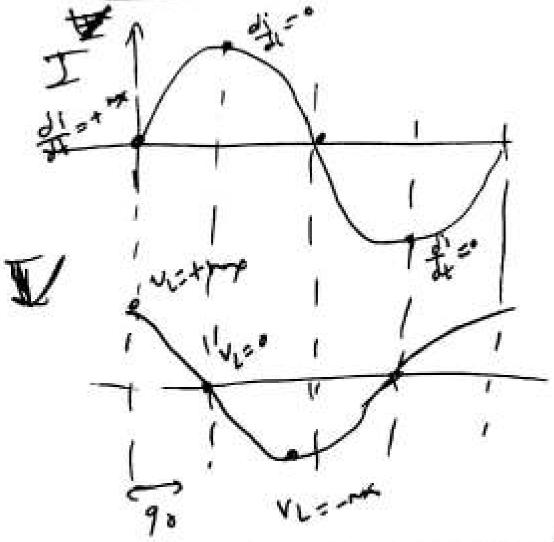
Parallel Connection



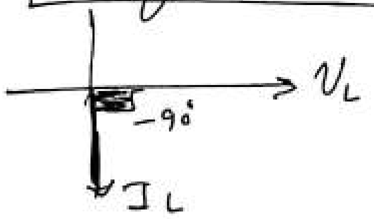
$$\frac{1}{L_T} = \frac{1}{L_1} + \frac{1}{L_2} + \frac{1}{L_3} + \cdots$$

تعامل معاملة المقاومات Parallel

relation between I & V in inductor



$\boxed{I \text{ lag } V \text{ by } 90^\circ}$



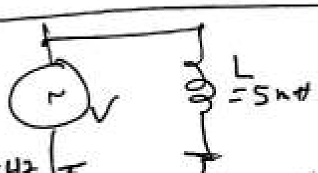
inductive reactance

$$\boxed{X_L = 2\pi f L}$$

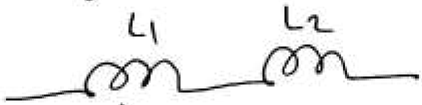
وتكتبها لو عايز كده

$$jX_L = j2\pi f L = j\omega L$$

ex



find inductive Reactance // sol → $X_L = 2\pi f L = 2\pi \times 10\times10^3 \times (5\times10^{-3}) = 314\,\Omega$

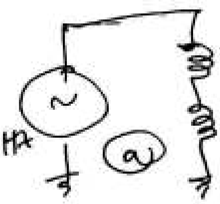


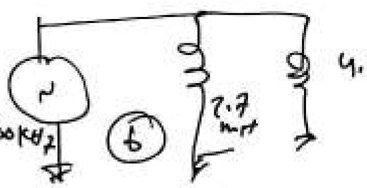
$$X_{LT} = X_{L1} + X_{L2} + \text{—}$$

$$\frac{1}{X_{LT}} = \frac{1}{X_{L1}} + \frac{1}{X_{L2}}$$

تتعامل معاها معاملة زيها زي R & X_C

ex)





$$X_{L1} = 2\pi f L_1 = 2\pi \times (200\times10^3)(2.7\times10^{-3}) = 3.39\,k\Omega$$

$$X_{L2} = 2\pi f L_2 = 2\pi (200\times10^3)(4.7\times10^{-3}) = 5.91\,k\Omega$$

fig a $X_{L\,tot} = X_{L1} + X_{L2} = 9.3\,k$

fig b $X_{L\,tot} = \frac{X_{L1}\cdot X_{L2}}{X_{L1}+X_{L2}} = 2.15\,k\Omega$

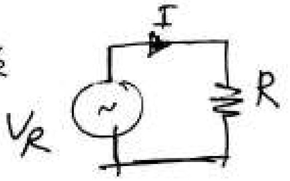
Power in inductor $P_{react} = V_{rms} I_{rms} = V_{rms}^2 / X_L = I_{rms}^2 X_L$

6

R, L, C in Circuits

1. Pure Resistance
2. Pure capacitance
3. Pure inductance
4. Series RL
5. Series RC
6. Series RLC
7. General Case
8. Problem
9. Admittance

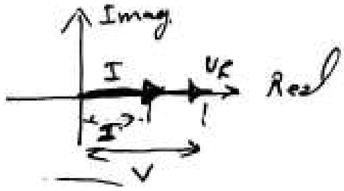
1 pure resistance



impedance

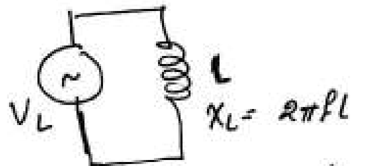
$$Z = \frac{V_R}{I} = \frac{V_R \angle 0}{I_R \angle 0} = R \angle 0$$

magnitude → V_R, phase → $\angle 0$

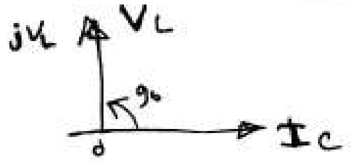


note: V, I in the same phase in pure resistance

2 pure inductance

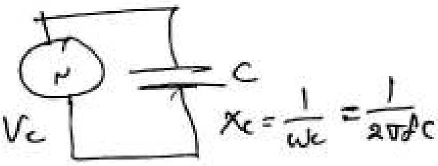


$$Z = \frac{V_L \angle 90}{I_L \angle 0} = X_L \angle 90 = jX_L = j\omega L = j2\pi f L$$



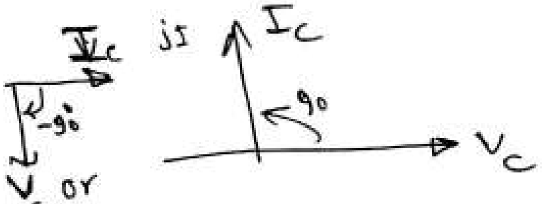
I lag V

3 Pure capacitance

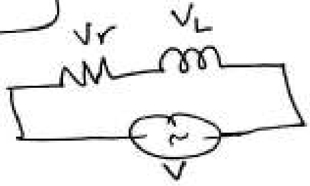


$X_C = \frac{1}{\omega C} = \frac{1}{2\pi f C}$

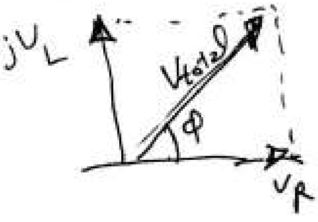
$$Z = \frac{V_C \angle 0}{I_C \angle 90} = X_C \angle -90 = -jX_C = -\frac{j}{\omega C} = \frac{-j}{2\pi f C} = \frac{1}{j\omega C}$$



4 series RL



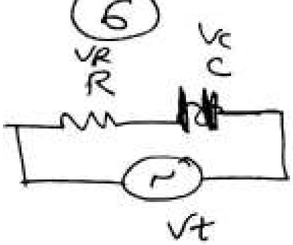
The phasor is sum of V_r & V_L
Then I lag V by angle between (0, 90°)

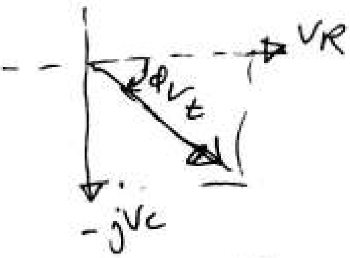


$$Z = 3 + j4 = 5 \angle \tan^{-1}\tfrac{4}{3}$$

3 → R; j4 → $X_L = 2\pi f L$; 5 → magnitude V_{total}; $\angle \tan^{-1}\frac{4}{3}$ → phase (ϕ)

5- series RC





I lead V by angle between (0, 90°)

$V_t = V_R - jV_c$

$$\boxed{Z = R - jX_c = R - j\left(\frac{1}{\omega c}\right)}$$

$$= \left[R + X_c = R + \frac{1}{j\omega c} = R - j\left(\frac{1}{\omega c}\right)\right]$$

magnitude $= \sqrt{R^2 + X_c^2}$, phase $\tan^{-1}\left(-\frac{X_c}{R}\right)$

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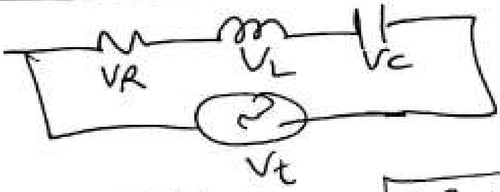
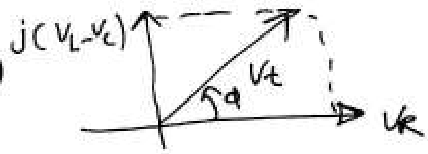
6 - Series RLC



$V = V_R + j(V_L - V_c)$

$$\boxed{Z = R + j(X_L - X_c)} = \sqrt{(R)^2 + (X_L - X_c)^2} \angle \tan^{-1}\left(\frac{X_L - X_c}{R}\right)$$



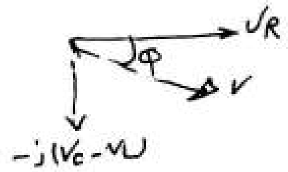
note This Circit used in (Resonance Circit)

There are 3 cases

1- if $X_L = X_c$ $(V_L = V_c)$ $\therefore Z = R$ (pure Resistance)
وتسمى الدائرة في حالة الرنين resonance (دوائر الرنين)

2- if $X_L > X_c$ $(V_L > V_c)$ $\therefore Z = R + \underbrace{j(X_L - X_c)}_{+\text{ve value}}$
Circit is inductive effect

3- if $X_L < X_c$ $(V_L < V_c)$ $\therefore Z = R + j\underbrace{(X_L - X_c)}_{-\text{ve value}}$
circit is capacitive effect



AC Circuit Theory Techniques

حل الدوائر الكهربية تحتوي على AC (Components, Source) باستخدام نظريات

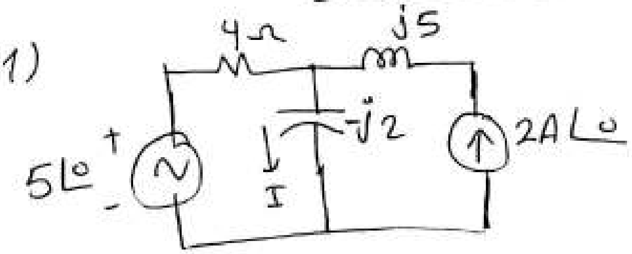
Node
Mesh
Delta-Y
Source transformation
Superposition
Thevenin's & Norton's

$\boxed{1}$ Don't forget $Z = \frac{V}{I}$ = magnitude $\angle$ phase   مهم جدا

Power factor = Cos [phase]

طب PF خذ Z وخذ cosine الزاوية

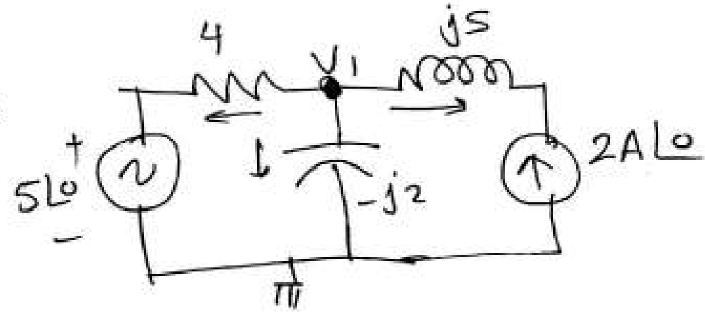
EX(1)



Determine I using
* Node
* Mesh
* Superposition
* Thevenin's
* Source transformation

$\boxed{1}$ Node method

هنا مجموع التيارات الخارجة = صفر



$$\therefore \frac{V_1 - 5\angle 0}{4} + \frac{V_1}{-j2} - 2A\angle 0 = 0$$

$$\therefore \frac{V_1}{4} - \frac{5}{4} - \frac{V_1}{2j} - 2 = 0$$

$$\frac{V_1}{4} - \frac{5}{4} - \left(\frac{V_1}{2j} \cdot \frac{j}{j}\right) - 2 = 0 \longrightarrow \frac{V_1}{4} - \frac{5}{4} + \frac{jV_1}{2} - 2 = 0$$

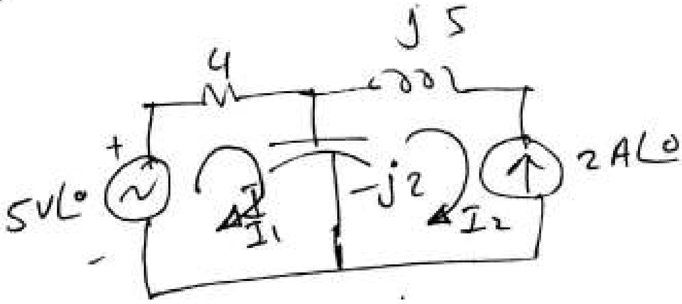
$$V_1\left[\frac{1}{4} + \frac{j}{2}\right] = \frac{5}{4} + 2 = \frac{13}{4}$$

$$V_1 = \frac{13/4}{\frac{1}{4} + j/2} = \frac{13}{1+2j} = \frac{13\angle 0}{\sqrt{1+4}\ \angle \tan^{-1} 2} = \frac{13\angle 0}{2.23\angle 63.43}$$

$$\boxed{V_1 = 5.81\angle -63.43^\circ}$$

$$\therefore I = \frac{V_1}{-j2} = \frac{5.81\angle -63.43}{2\angle -90} = 2.9\angle 26.56\ A$$

2- Mesh loop



loop 1

$5\angle 0 = (4-j2)I_1 - (-j2I_2)$

$\therefore 5\angle 0 = (4-j2)\underline{I_1} + 2j\,\underline{I_2} \longrightarrow \boxed{1}$

loop 2 $\quad I_2 = -2A\angle 0$ مش محتاج معادله

substitude in ① $\quad \therefore 5 = (4-j2)I_1 + 2j \times (-2)$

$5 = [4-2j]I_1 - 4j \quad \rightarrow \quad (5+4j) = (4-2j)I_1$

$\therefore \quad I_1 = \dfrac{5+4j}{4-2j} = \dfrac{\sqrt{25+16}\ \angle \tan^{-1}\frac{4}{5}}{\sqrt{16+4}\ \angle \tan^{-1}\frac{-2}{4}} = \dfrac{6.4\angle 38.66}{4.47\angle -26.56}$

$I_1 = 1.43\angle 65.22$

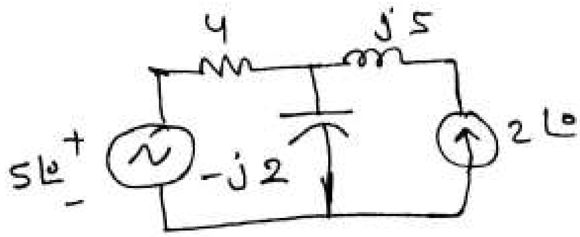
المطلوب $I = I_1 - I_2 = 1.43\angle 65.22 - (-2)$

$= (1.43\cos 65.22) + j(1.43\sin 65.22) + 2$

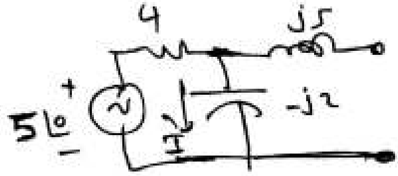
$I = 2.6 + 1.3j = 2.9\angle 26.56^\circ$

③ Superposition

[3].



[1] 1st step open circuit current source



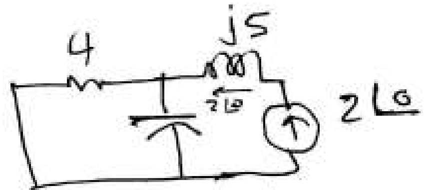
ثم نطبق اي نظرية قديمة لحساب التيار I ونسميه I'

علماً أن ال open circuit :.

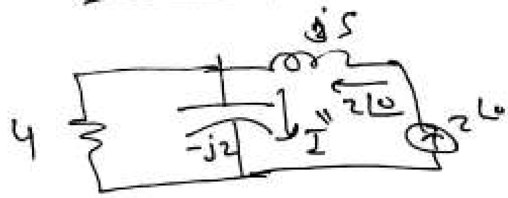
الدائرة تكافئ دائرة مفتوحة
قصر

$$\therefore I' = \frac{5\angle 0}{4-2j} = \frac{5\angle 0}{4.47\angle -26.57} = 1.118\angle 26.57$$

[2] 2nd step S.C voltage source



using current divider to calc. I''



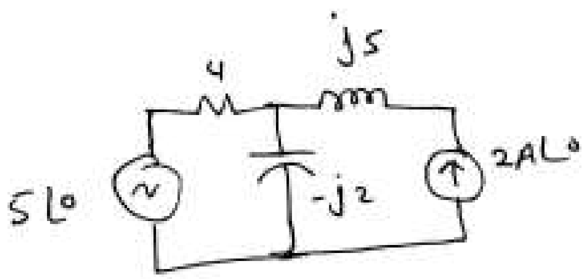
$$I'' = \frac{I_{total} \times 4}{4-2j} = \frac{2 \times 4\angle 0}{4-2j}$$

$$= \frac{8\angle 0}{4.47\angle -26.57} = 1.789\angle 26.57$$

$$\therefore I = I' + I'' = 1.118\angle 26.57 + 1.789\angle 26.57$$

$$= 2.9\angle 26.56$$

[4] Source transformation



1st equivalent circuit

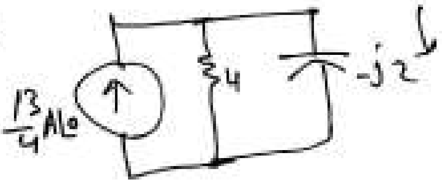
→ replace v.s by c.s

→ coil removed (has no effect with independent sources)

- اتفقنا ان لو ال current source independent وموصل معاه مقاومه series او اي element يلغى ال element

ولو independent voltage source وموصل معاه بالتوازي مقاومه او اي element يعتبر ال element ده o.c

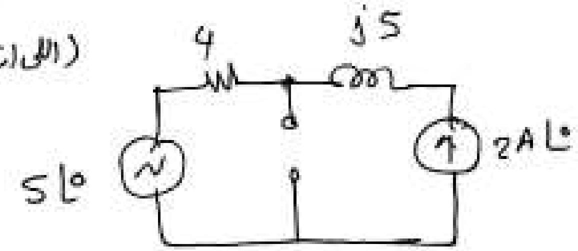
$\Rightarrow$



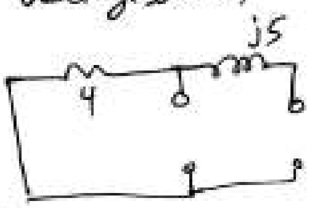
$$I = \frac{\frac{13}{4}\angle 0 * 4}{4 - j2} = \frac{13\angle 0}{4.47\angle -26.56} = 2.9\angle 26.56^\circ$$

[5] Thevenin [1] open circuit the capacitor

[2] calc. V_{th}, Z_{th} across cap (الاشتغال)



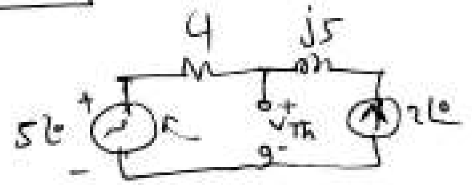
(a) to calc Z_{th} (o.c current source, s.c voltage source)



j5 cancelled open -c.c

$$\boxed{\therefore Z_{th} = 4\,\Omega \text{ only}}$$

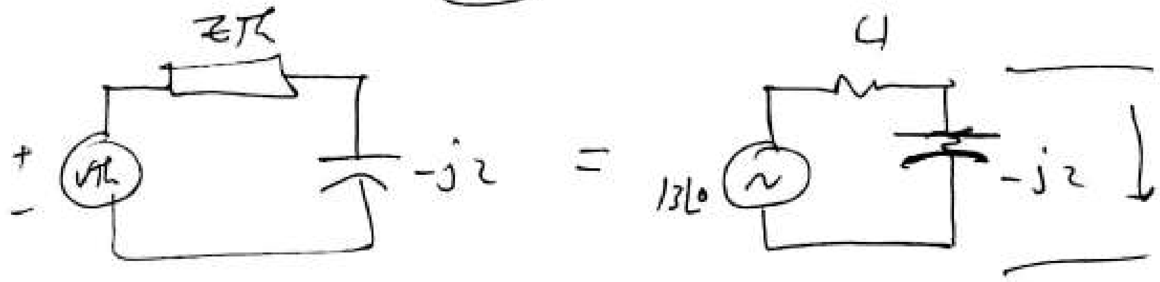
(b) calc. V_{th} using KVL



loop (1) $5 - V_{th} = 4I$ $\qquad I = -2\angle 0$ $\qquad \therefore 5 - V_{th} = 4 \times -2$ $\qquad V_{th} = 13\angle 0$

~~loop (2) $V_{th} = 2 \times j5$~~

(5)



$$I = \frac{13\angle 0}{4-j2} = 2.9\angle 26.56$$

لا يمكن استخدام Δ-Y في المسائل السابقة لأنه لو استخدمتها هيفيد حاجات وقتية المكثف والمراد حساب التيار فيه

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* مسائل عامة للمراجعة * المحاضرة القادمة DC & AC

Good Luck!

Quiz

لاحظ لو قابلت معادلة (Meshloop) هكذا

$$2\angle 30 = (2+j)I_1 + (3-2j)I_2 \quad \leftarrow 2\cos 30 + j2\sin 30$$

$$4\angle 60 = (5-2j)I_1 + (4)I_2 \quad \leftarrow 4\cos 60 + j4\sin 60$$

خليك ازاي !! الأسهم تشير للمعادلة بعدكده لـ complex source

$$\Delta = \begin{vmatrix} 2+j & 3-2j \\ 5-2j & 4 \end{vmatrix} = \text{نفكها} \qquad \Delta_1 = \begin{vmatrix} 2\cos 30 + j2\sin 30 & 3-2j \\ 4\cos 60 + j4\sin 60 & 4 \end{vmatrix} = \text{نفكها}$$

$$\Delta_2 = \begin{vmatrix} 2+j & 2\cos 30 + j2\sin 30 \\ 5-2j & 4\cos 60 + j4\sin 60 \end{vmatrix} = \text{نفكها}$$

$$\therefore I_1 = \frac{\Delta_1}{\Delta} \qquad I_2 = \frac{\Delta_2}{\Delta}$$