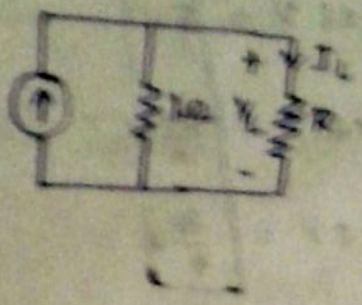


R	V_L	I_L
1Ω	2.5V	2.5A
2Ω	$\frac{10}{3}$ V	$\frac{5}{3}$ A
3Ω	$\frac{15}{4}$ V	$\frac{5}{4}$ A

↓

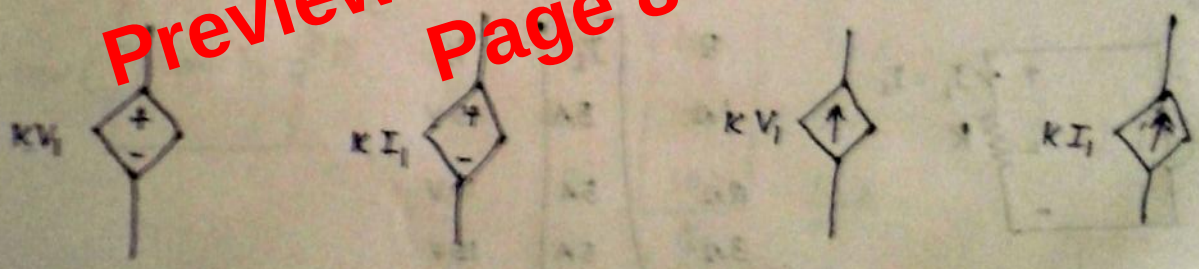
not constant

② Dependent Sources

A source whose vtg / current depends on other circuit parameters

Dependent Vtg Sources — Dependent Current Sources

a) VCVS b) CCVS c) VCCS d) CCCS



Dependent source is linear w.r.t the control variable.

#3 KIRCHHOFF'S LAWS

1) Kirchhoff's Current law (KCL):

Algebraic sum of currents at a node = 0

a) For a resistor:

$$I_{R1} = I\left[\frac{R_2}{R_1 + R_2}\right] \qquad I_{R2} = I\left[\frac{R_1}{R_1 + R_2}\right]$$

b) For an inductor:

$$I_{L1} = I\left[\frac{L_2}{L_1 + L_2}\right] \qquad I_{L2} = I\left[\frac{L_1}{L_1 + L_2}\right]$$

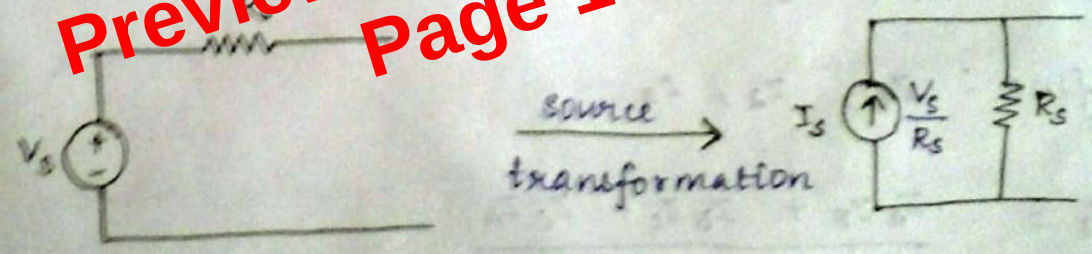
c) For a capacitor:

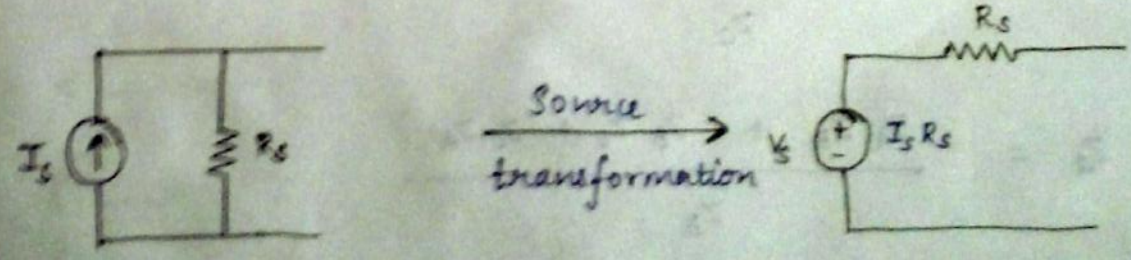
$$I_{C1} = I\left[\frac{C_1}{C_1 + C_2}\right] \qquad I_{C2} = I\left[\frac{C_2}{C_1 + C_2}\right]$$

#5 SOURCE TRANSFORMATIONS

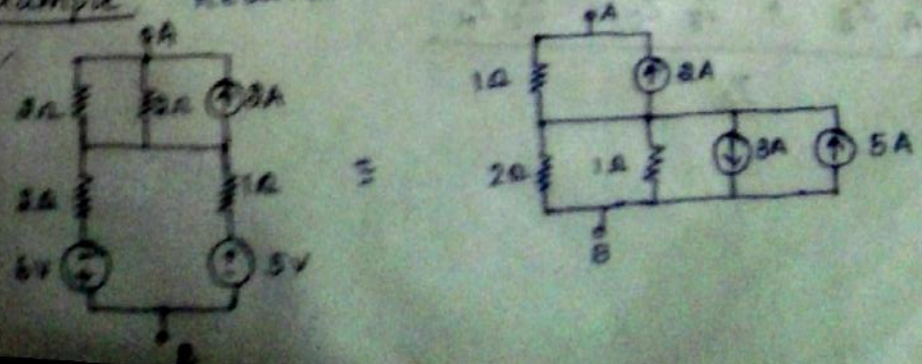
Source transformation can be performed only on practical vtg / current sources.

Do not perform source transformation on ideal current/vtg source.





Example: Reduce the ckt b/w A and B



b) delta to star:

given : Z_1, Z_2, Z_3

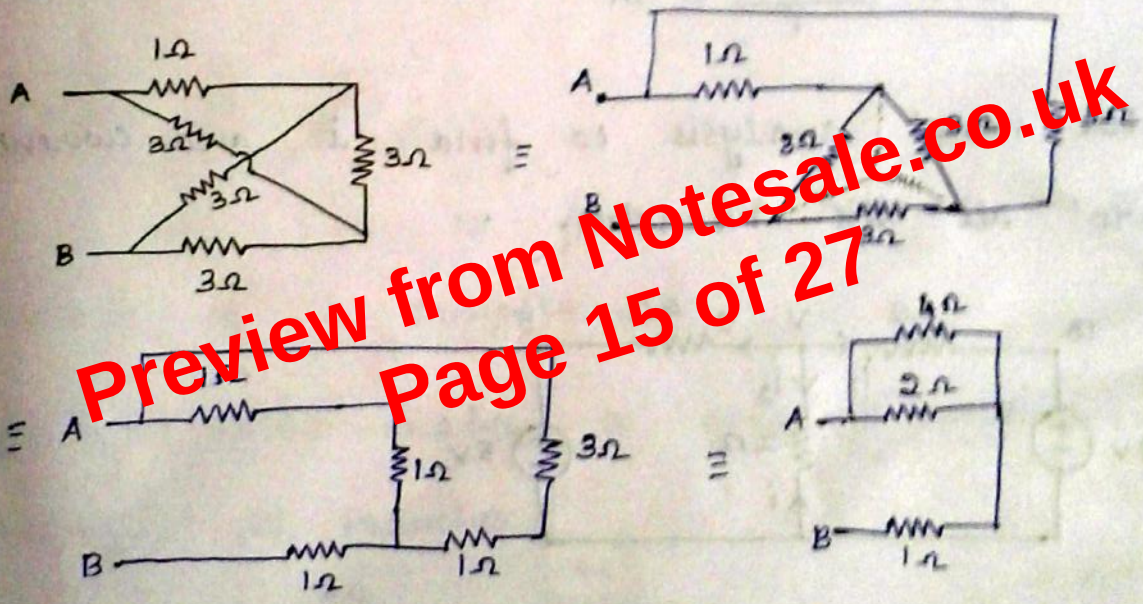
To find : Z_A, Z_B, Z_C

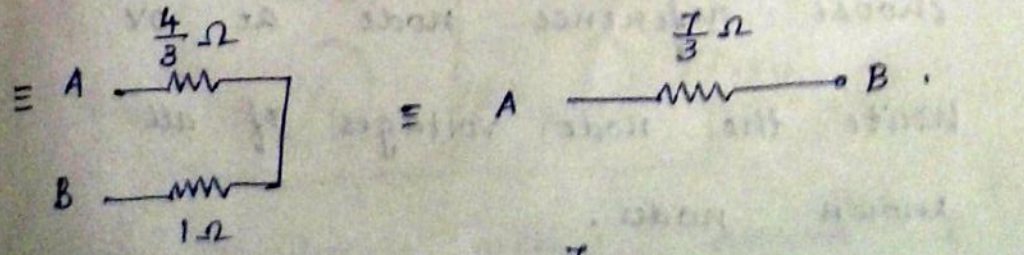
$$Z_A = \frac{Z_1 Z_2}{Z_1 + Z_2 + Z_3}$$

$$Z_B = \frac{Z_1 Z_3}{Z_1 + Z_2 + Z_3}$$

$$Z_C = \frac{Z_1 Z_2}{Z_1 + Z_2 + Z_3}$$

Example : Find R_{AB}



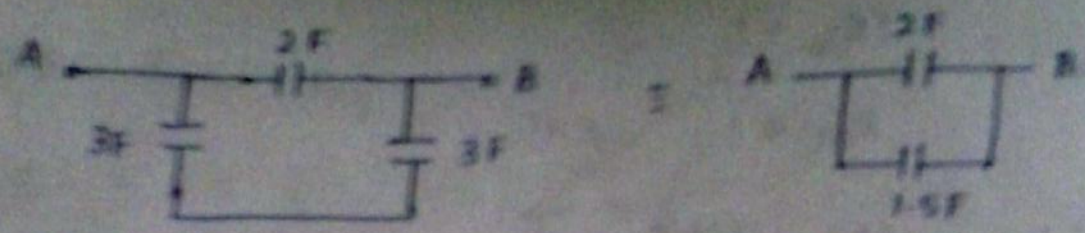


$$R_{AB} = \frac{7}{3}\ \Omega .$$

#7 NODAL AND MESH ANALYSIS

a) Nodal analysis

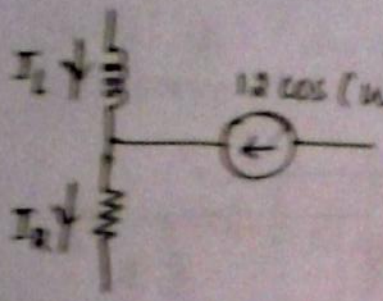
uses KCL to find the response in any



$$C_{AB} = 3.5\,F$$

#7: Find θ. Given $I_R = 3e^{-4t} + 4e^{-3t}$

$I_L(0) = 1A$



KCL: $I_L + 12\cos(\omega t - \theta) = I_R$

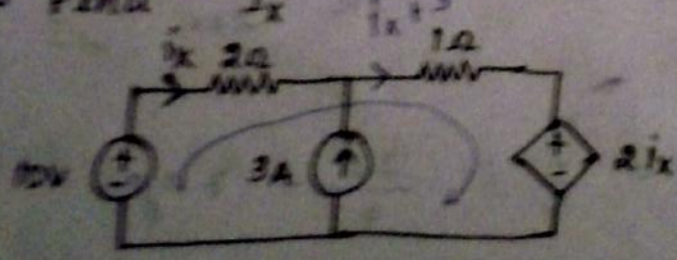
@ $t = 0$

$12\cos\theta = 3 + 4$

$12\cos\theta = 6$

$\theta = \cos^{-1}\left(\frac{1}{2}\right) = 60^\circ$

#8 Find I_x



$-10 + 2i_x + i_x + 3 + 2i_x = 0$

$5i_x = 7$

$i_x = \frac{7}{5}\,A$