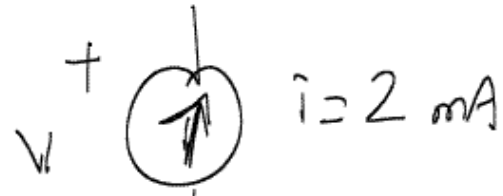
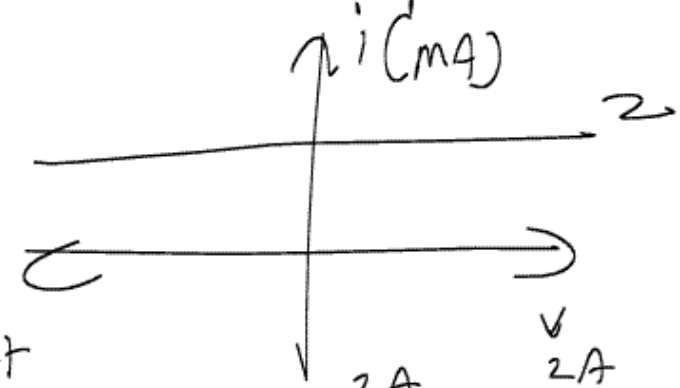
EE100 lecture 2 - Part II (After break)

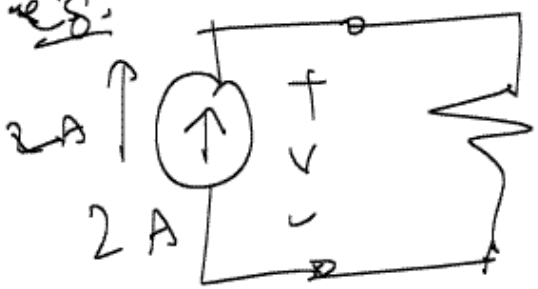
(2) Independent Current Sources:



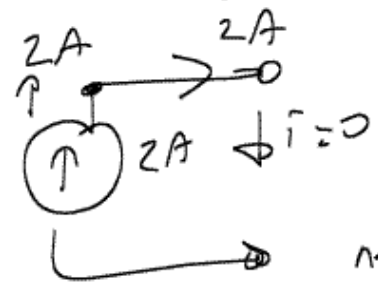
Note: Current sources are a little weird!



e.g.:



loop must be complete



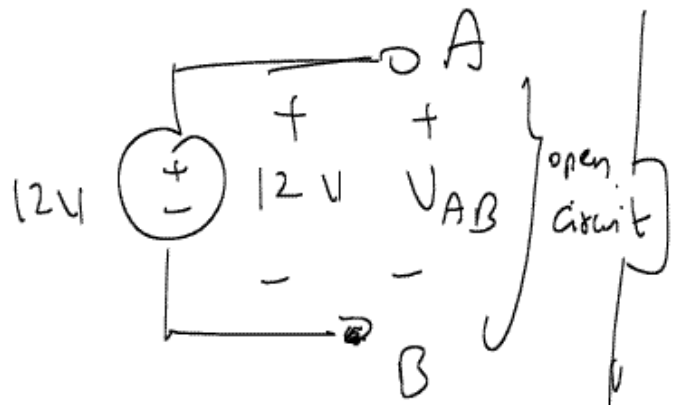
0 = 2 ??

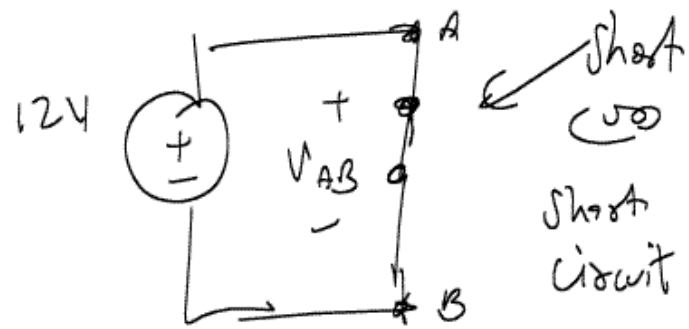
not possible!

This brings up $\underbrace{\text{open circuit(s) \& short-circuit(s)}}$

Warning: Watch out for these concepts ⇒ potential pitfalls.

Ex:

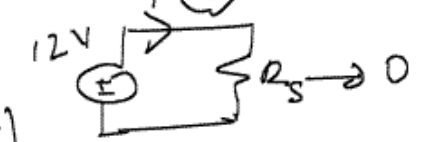




KVL: $V_{AB} - 12 = 0$

$\Rightarrow \boxed{V_{AB} = 12\ V}$

$V_{AB} = 0$ (short circuit)

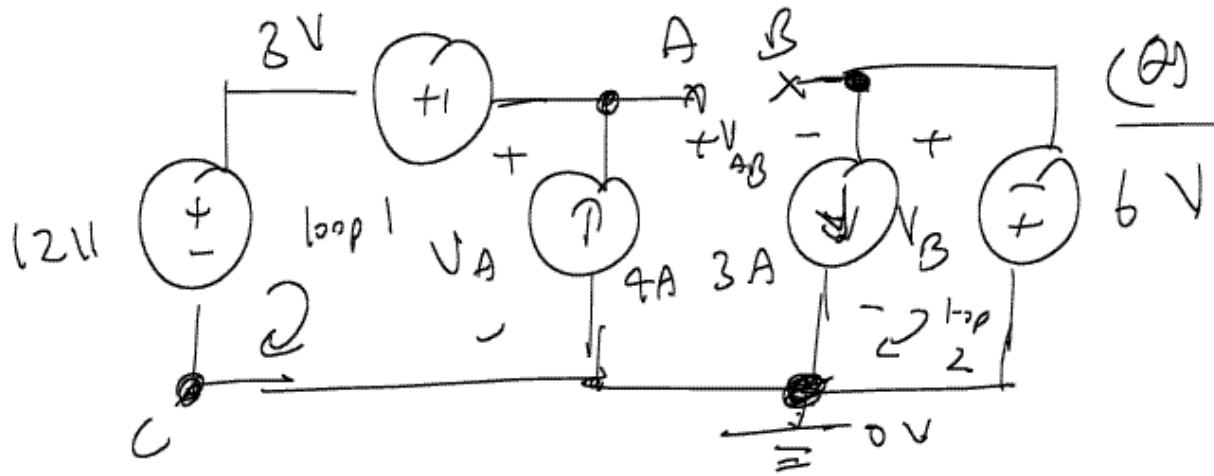


$i = \frac{12}{R} \to \infty$

KVL: $V_{AB} = 12 \Rightarrow \cancel{0 = 12}$

Again: watch out for open circuit & short circuit questions ⇒ tricky!

eg:



(a) Find V_{AB}

$V_{AB} = 3\ V$ (?)

Note: V_{AB} ⇒ + at A, − at B

i.e., in the question above $V_{AB} = V_A - V_B$

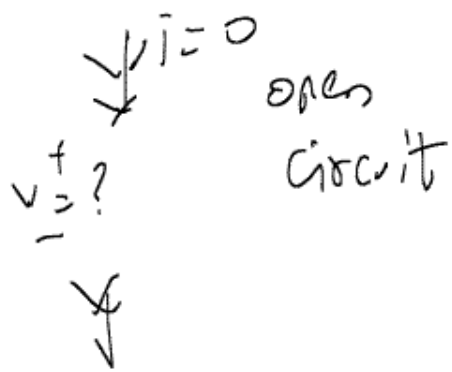
EE convention

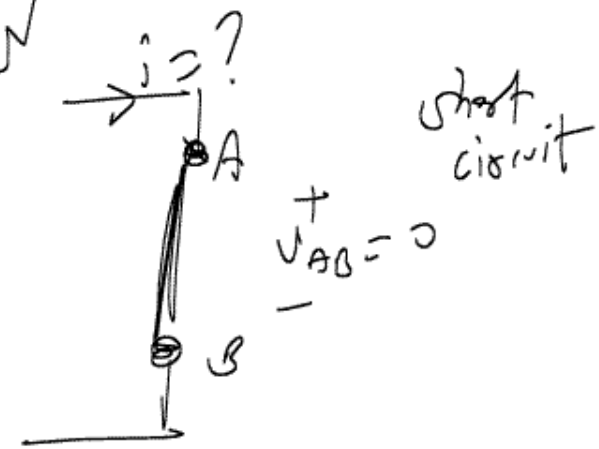
KVL around loop 2: $V_B + 6 = 0$ ⇒ $V_B = -6\ V$

KVL around loop 1: $12 - 3 - V_A = 0 \Rightarrow \boxed{V_A = 9\ V}$

$\therefore \boxed{V_{AB} = V_A - V_B = 15\ V}$

Summary:





Dependent sources: Sources (voltage or current) whose output depends on a current or voltage elsewhere in the circuit. Four types:

$v_o = \alpha v_i$

$\alpha \in \mathbb{R}$

real no. (constant)

Voltage controlled voltage source

(VCVS)

$v_1 = \beta i_2$

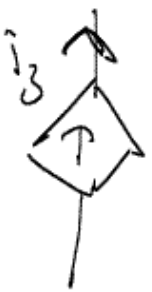
(CCVS)

$[\beta] = \frac{V}{A}$

$i_1 = \gamma i_3$

(CCCS)

$[\gamma] =$ none

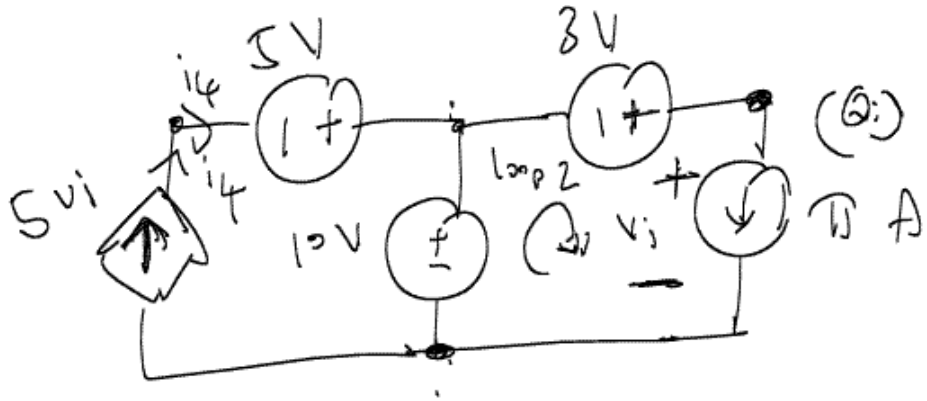


$i_3 = \Delta V_4$

(VCCS)

$[\Delta] = \frac{A}{V}$

eg:



(Q:) Find i_4 ?

(A:) $i_4 = 5v_i$

KVL around loop 2:

$10 + 3 - v_i = 0 \Rightarrow \boxed{v_i = 13\ V}$

$\boxed{i_4 = 65\ A}$

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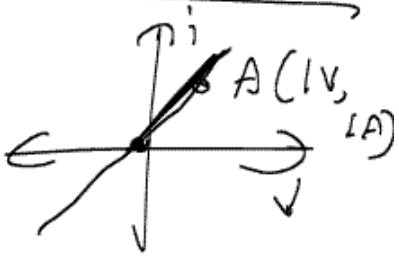
resistors:

symbols:

$\Leftrightarrow v = -iR$

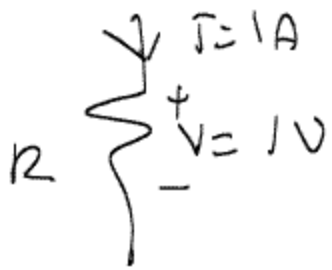
$\Leftrightarrow v = iR$

(Ohm's law)

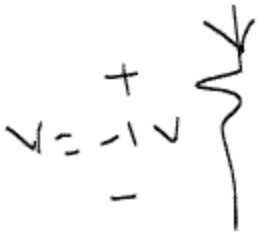


Notice: Resistors always absorb energy!

eg: If $V = 1\ V$, $i = 1\ A$, $R = 1\ \Omega$



eg: If $V = -1\ V$, $i = -1\ A$,



$\Leftrightarrow \quad V = iR \Rightarrow (-1\ V) = (-1\ A)R$

$\Rightarrow \boxed{R = 1\ \Omega}$

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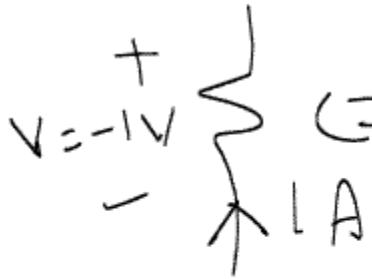

$\Leftrightarrow v = -iR$

$\Rightarrow (-1\ V) = -(1\ A)R$

physically

$R = \frac{\rho L}{A}$

read p. 30

$\Rightarrow \boxed{R = 1\ \Omega}$

Note: power can be expressed in terms of R for a resistor: $p = vi$

$\Rightarrow p = (iR)i = i^2R$

Now, we will do circuits, circuits, circuits, ...

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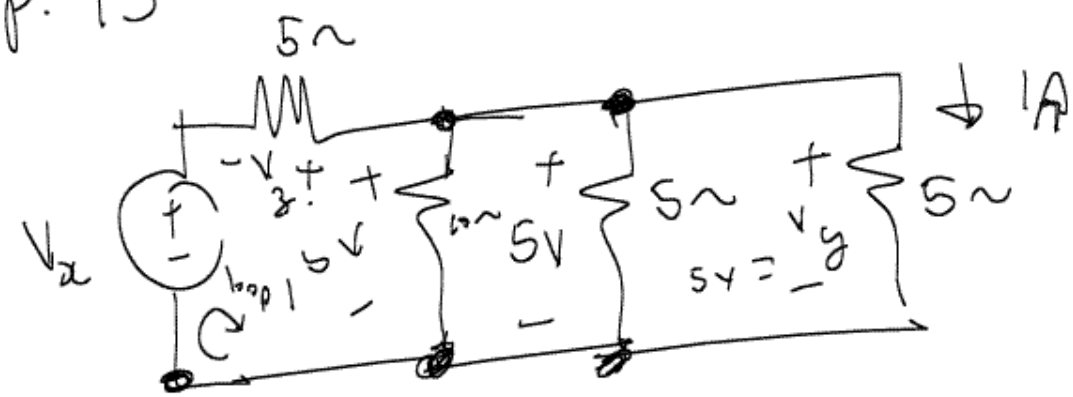
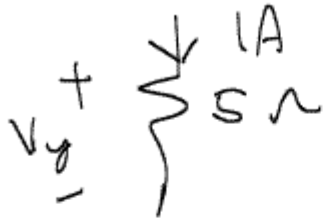
eg: (P1.50) p. 43 Find V_x



Use KVL, KCL & Ohm's law to find V_x,
(Do NOT use resistors in parallel and/or series)

Step 1: Use Ohm's law on rightmost resistor!

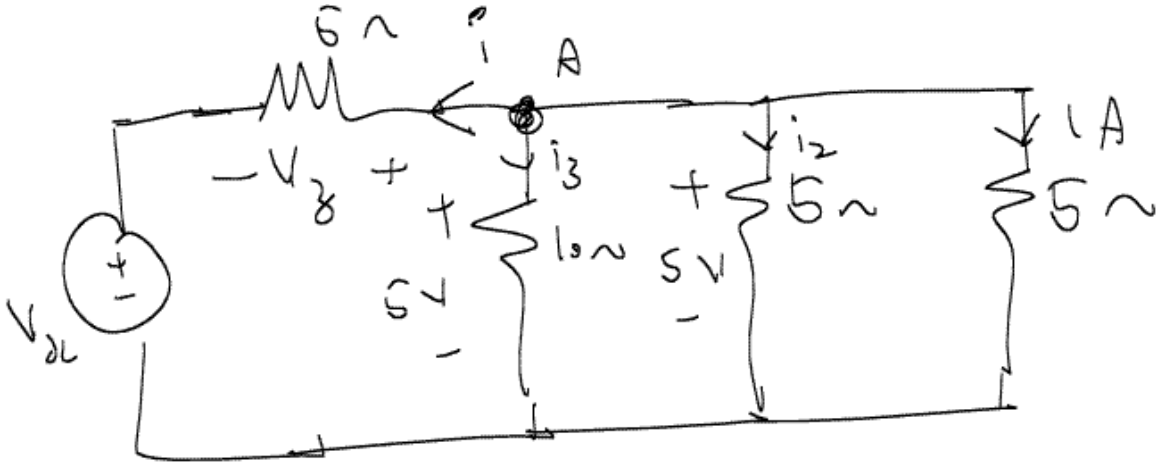


$V_y = (1)(5) = 5\ V$

Step 2: Use parallel elements idea to set voltage across 10 Ω as 5 V

Step 3: KVL around loop: $V_x + V_z - 5 = 0$

We still need $V_z \Rightarrow$ ohm's law:

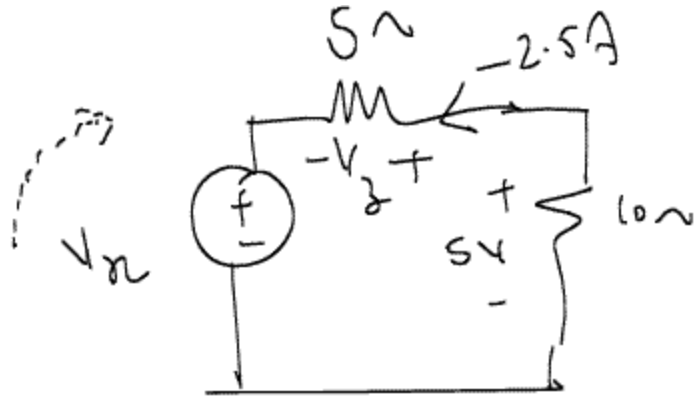


Step 4: Use KCL at node A: $i + i_3 + i_2 + 1 = 0$

$$i_2 = \frac{5V}{5\Omega} \quad \text{(ohm's law)} \quad = 1A$$

$$i_3 = \frac{5V}{10\Omega} \quad \text{(ohm's law)} \quad = 0.5A$$

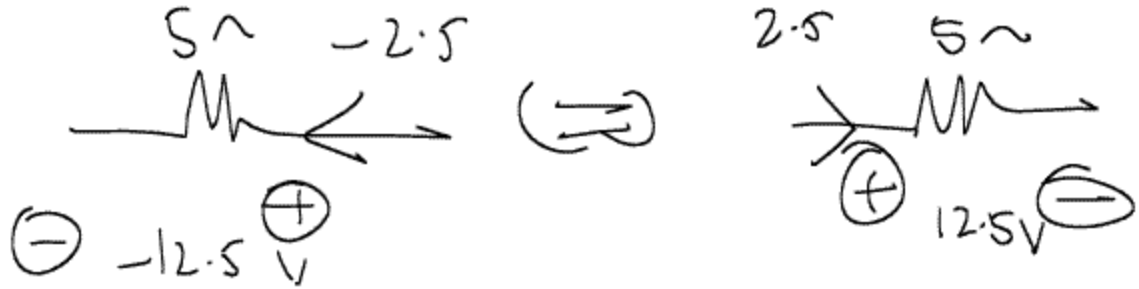
$\therefore \; i = -(1+1+0.5) \Rightarrow i = -2.5A$



$V_z = iR$ (Ohm's law)

$= (-2.5)(5) = \underline{\underline{-12.5\,V}}$

<u>Note:</u>



$\therefore\ V_x + V_z - 5 = 0 \Rightarrow \boxed{V_x = 17.5\ V}$

Next time → (1) Chapter 2] READ!

(2) Intro to PSPICE

(notice hours)

START HWK #1, USE OH for questions