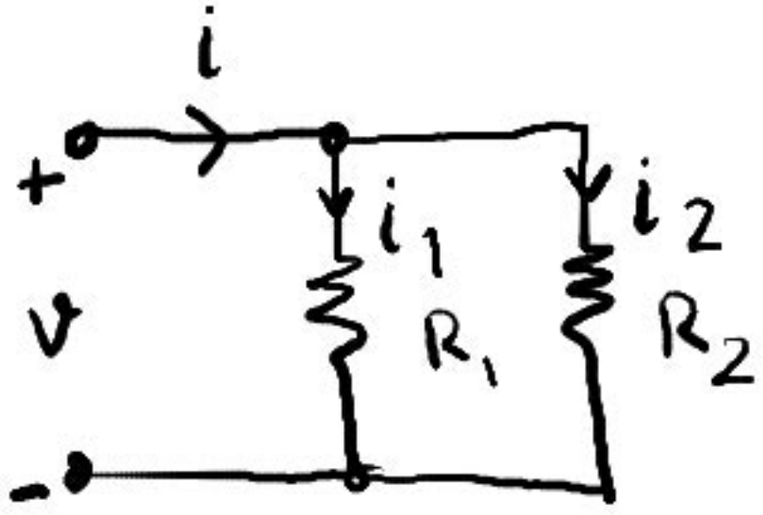
Current Divider



$$i_2 = \frac{v}{R_2} \quad , \quad i_1 = \frac{v}{R_1}$$

$$v = i \times (R_1 /\!/ R_2) = i \left(\frac{R_1 R_2}{R_1 + R_2} \right)$$

$$\therefore i_2 = \frac{i}{R_2} \left(\frac{R_1 R_2}{R_1 + R_2} \right) \rightarrow v$$

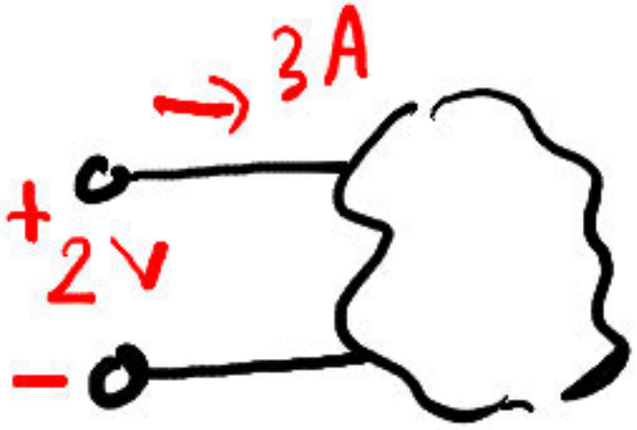
$$i_2 = i \cdot \frac{R_1}{R_1 + R_2}$$

$$\therefore i_K = \frac{\frac{1}{R_K}}{\frac{1}{R_1} + \cdots + \frac{1}{R_N}} \cdot i$$

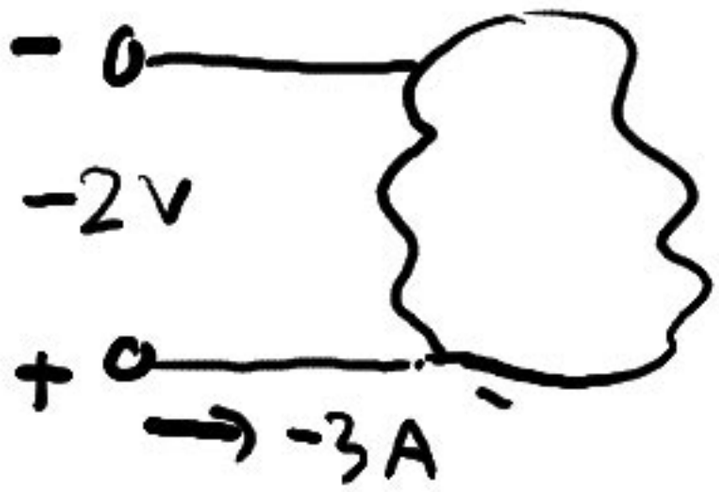
to

$$i_1 = \frac{i}{R_1} \left(\frac{R_1 R_2}{R_1 + R_2} \right) = i \cdot \frac{R_2}{R_1 + R_2}$$

Power (W : VA)

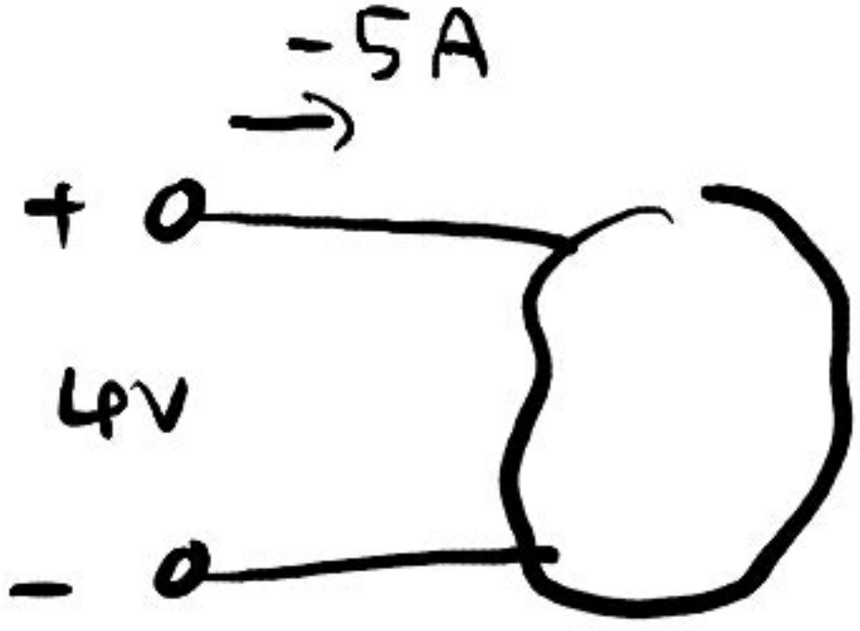


$P = (2V)(3A) = +6W$ (รับพลังงาน)



$P = (-2V)(-3A) = 6W$

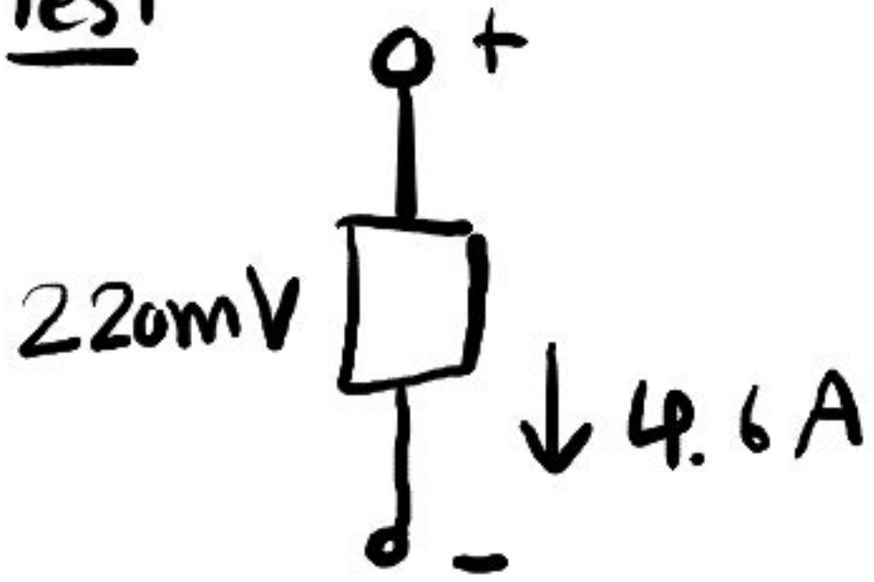
(รับพลังงาน)



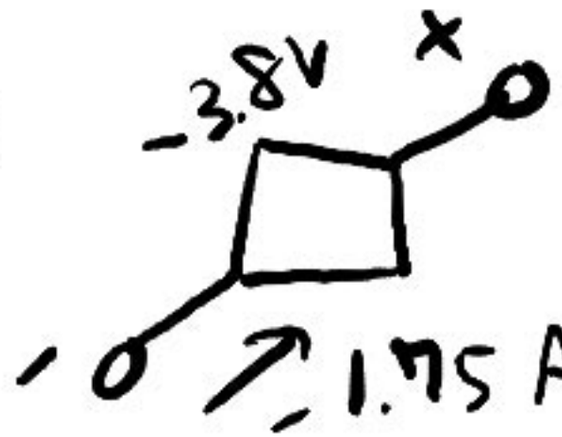
$P = (4V)(-5A) = -20W$

(Supply)

Test

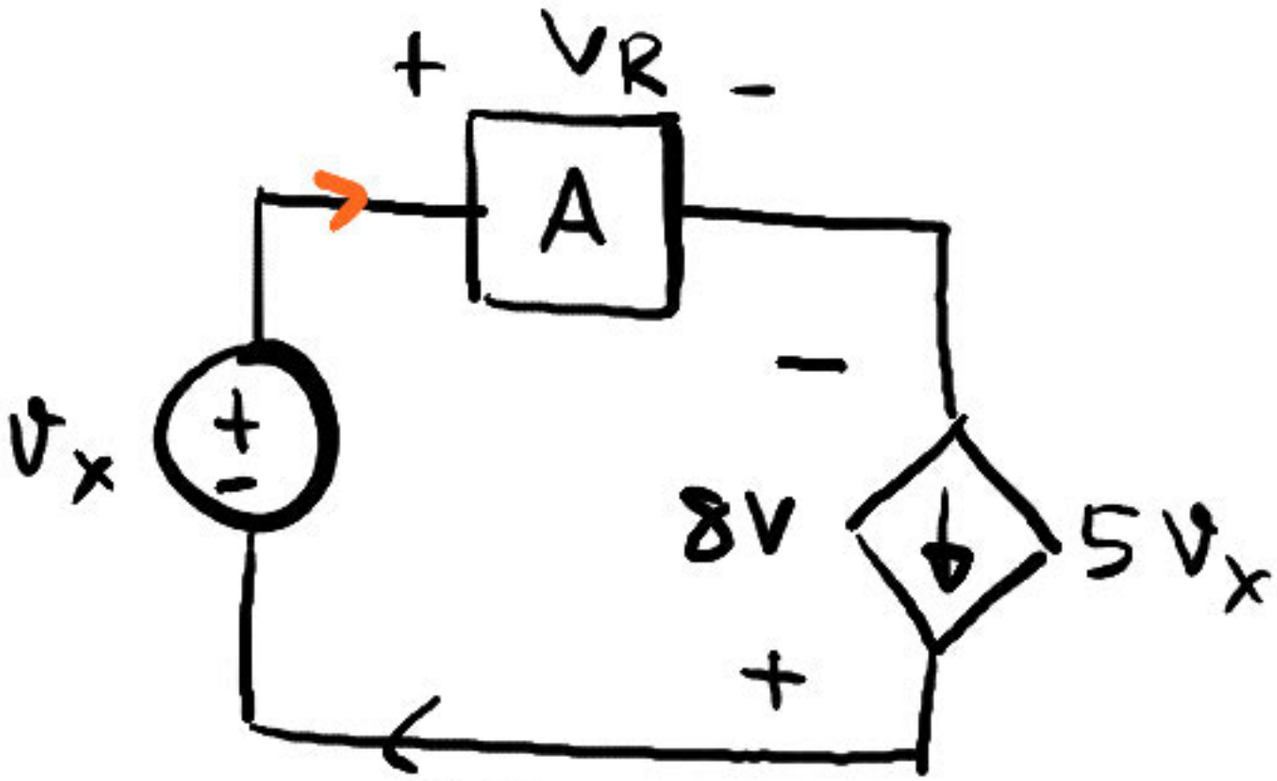


$P = (220mV)(4.6A) = 1.012W$



$P = (-3.8V)(-1.75A)$

$= +6.65W$



ให้ $v_x = 1V$, $v_R = 9V$

จงหาว่า องค์ประกอบ A รับพลังงาน ?

5A

$5v_x = 5A$

$\therefore P_A = (v_R)(5v_x)$

$= (9V)(5A)$

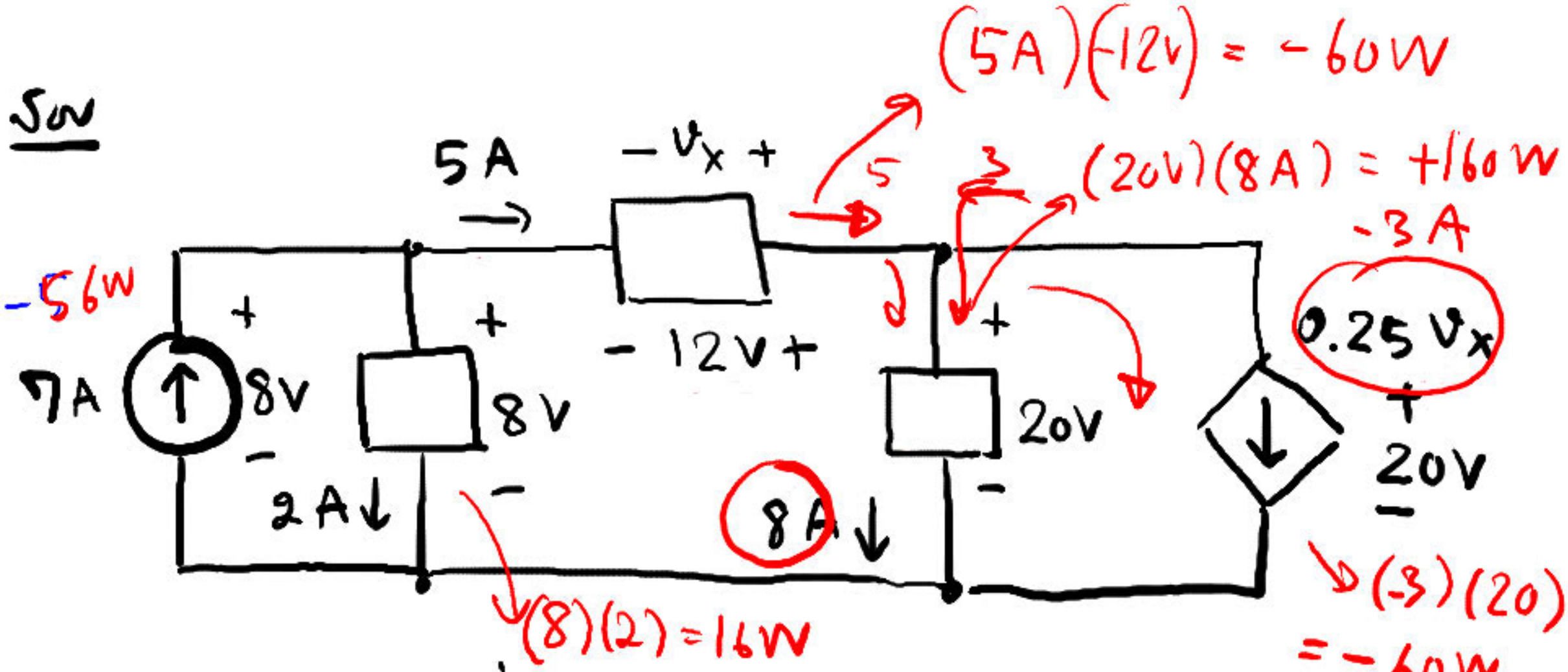
$= +45\ W$ *

$P_{5v_x} = (-8V)(5A)$

$= -40\ W$

$P_{v_x} = (-1V)(5A) = -5W$

5ข้อ



จงหาพลังงานหรืออัตราการเปลี่ยนแปลงตัวใดรับ(หรือให้)

วิธีทำ

$\Rightarrow P = (-8V)(7A) = \underline{-56W}$ ✓

$-56 + \underline{16} + \underline{160} - \underline{60} - \underline{60} = 0$

Ohm's Law

- กระแสไฟฟ้าแปรผันกับแรงดันไฟฟ้า

$$i \propto V$$

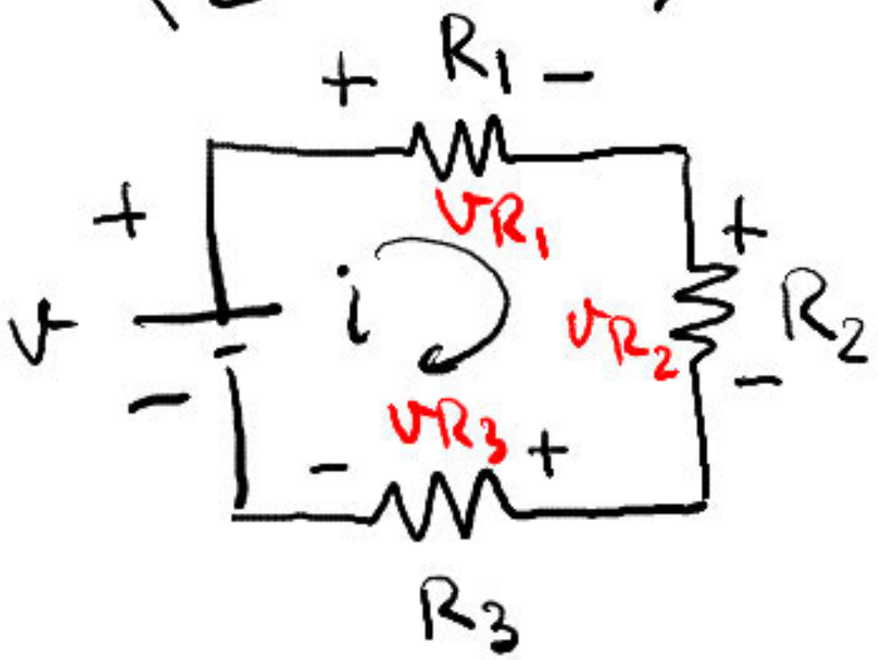
- กระแสไฟฟ้าแปรผกผันกับความต้านทาน

$$i \propto \frac{1}{R}$$

$$\therefore \quad V = iR$$

Kirchoff Voltage Law (KVL)

$(\Sigma V = 0)$



$\Rightarrow V_{R_1} + V_{R_2} + V_{R_3} + (-v) = 0$ ✓

KVL

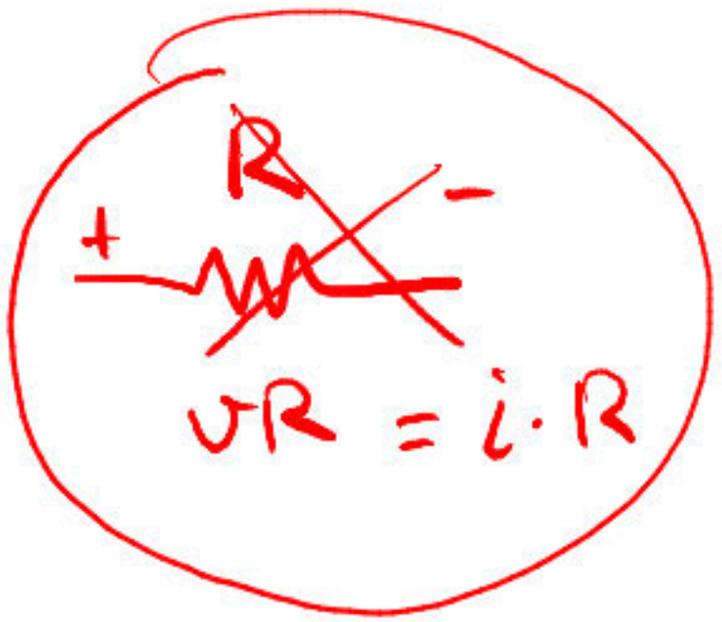
$iR_1 + iR_2 + iR_3 = v$

$i(R_1 + R_2 + R_3) = v$

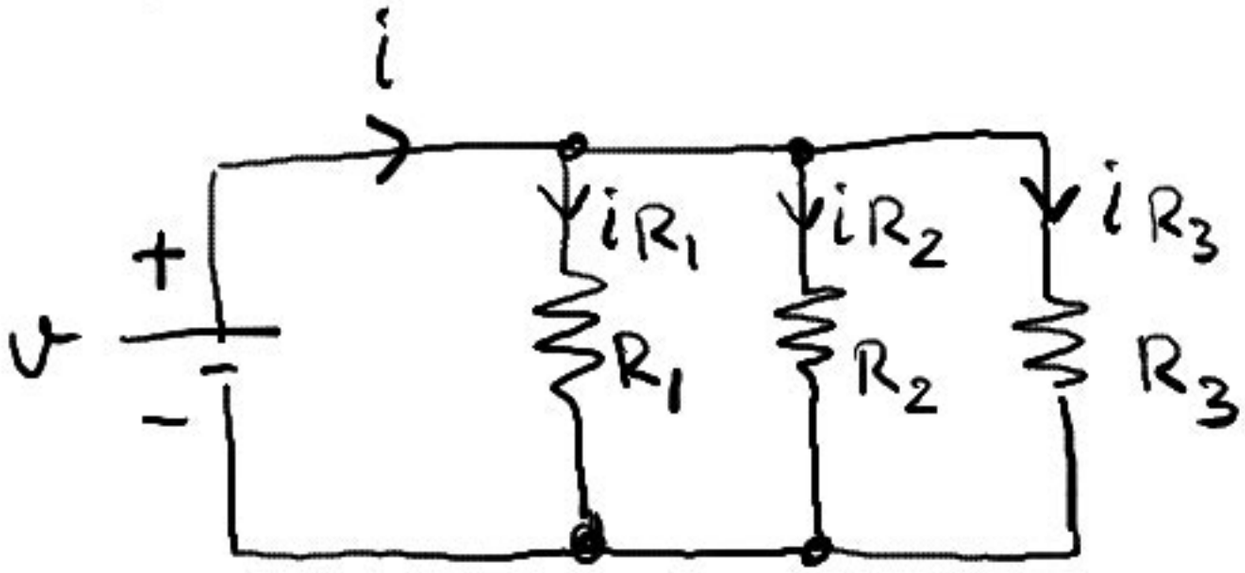
$i(R_T) = v$

Ohm's Law →

$$i = \frac{v}{R_T}$$



Kirchoff Current Law (KCL) $\Rightarrow (\Sigma I = 0)$



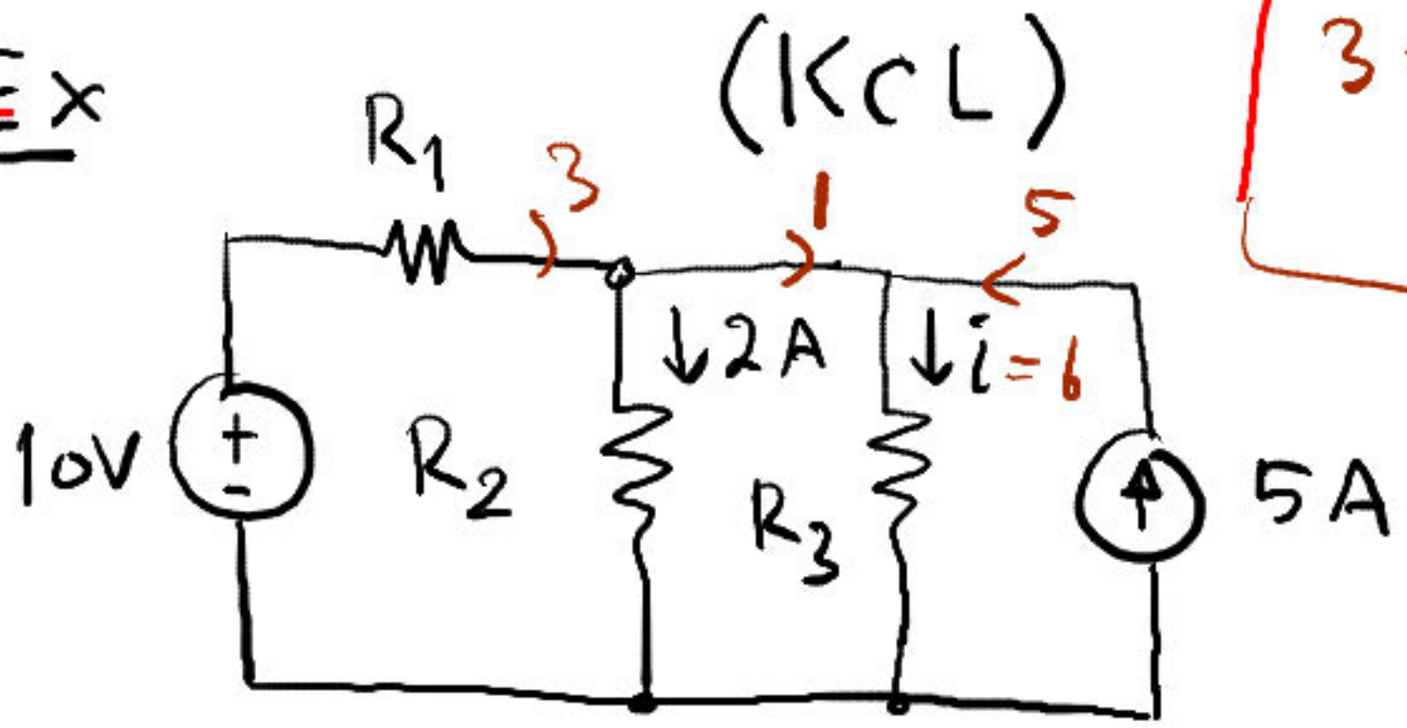
$\Rightarrow$ $i_{R_1} + i_{R_2} + i_{R_3} + (-i) = 0$

KCL $\frac{v}{R_1} + \frac{v}{R_2} + \frac{v}{R_3} = i$

$v\left(\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}\right) = i$

Ohm's Law $\rightarrow$ $\boxed{v\left(\frac{1}{R_T}\right) = i}$

Ex (KCL)



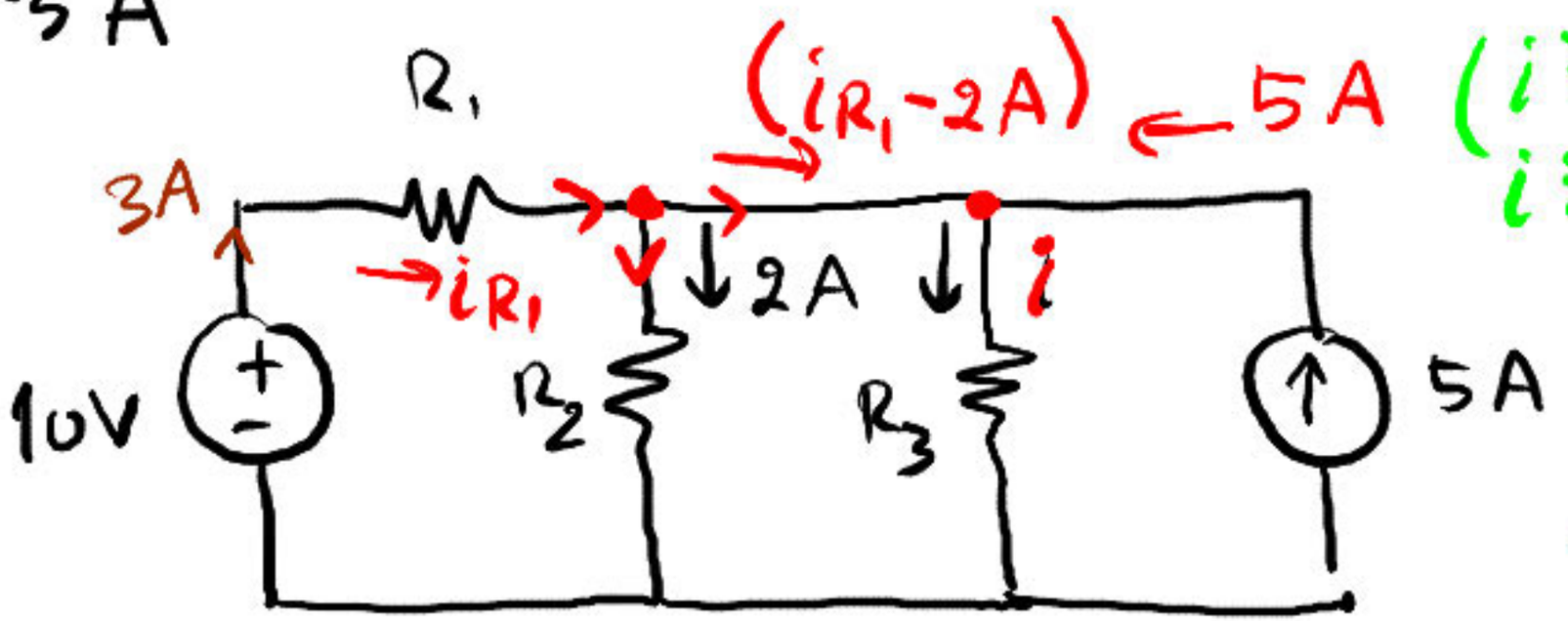
จงหา $i_{R_1} = 3\ A$ ใน ① ✓

$3 - 2 - i + 5 = 0$

$i = 6\ A$ //

จงหา i ที่ไหลผ่าน R_3 เมื่อ แหล่งจ่าย (10V) จ่าย กระแส 3 A

วิธีทำ



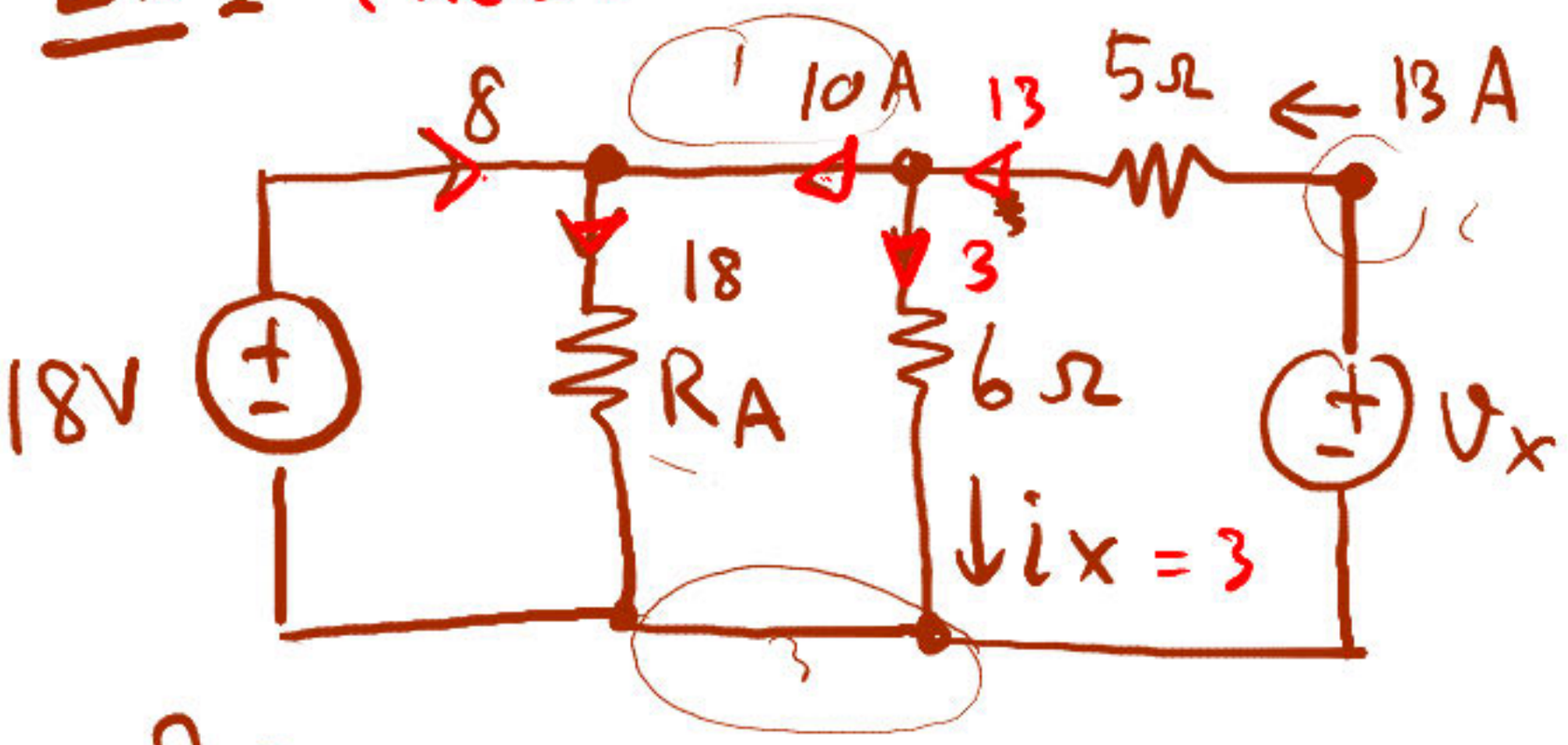
(i ไหลเข้า • = +
i ไหลออก • = −)

KCL ; $i_{R_1} - 2 - i + 5 = 0$ — ②

$$R_A = \frac{v}{i} = \frac{18V}{8+10A}$$

$$= 1\,\Omega$$

Ex 2 (KCL)



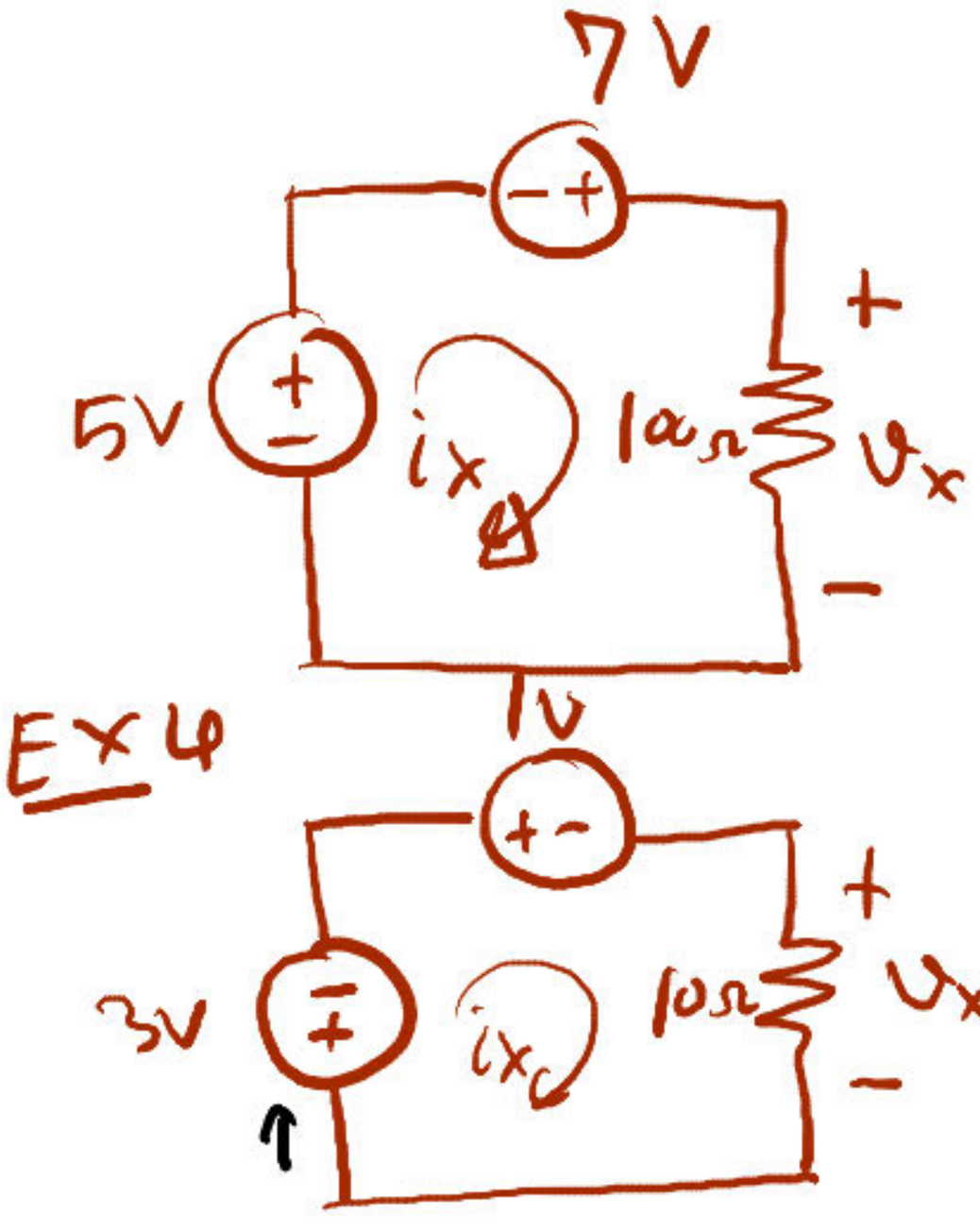
ให้ $i_x = 3A$, แหล่งจ่าย 18 V จ่ายกระแส 8A ผ่าน R_A

(5 branches, 3 nodes)

$$\frac{V}{I|R}$$

Ex3 (KVL)

หาค่า v_x (ลงไข KVL



Ex4

วิธีทำ (เขียนทางเดินรอบวงปิด)

$$-5 - 7 + v_x = 0 \quad \cdots (1)$$

$$\therefore v_x = 12\,V$$

จงหา v_x, i_x ลงไข KVL

วิธีทำ

$$+3 + 1 + v_x = 0$$

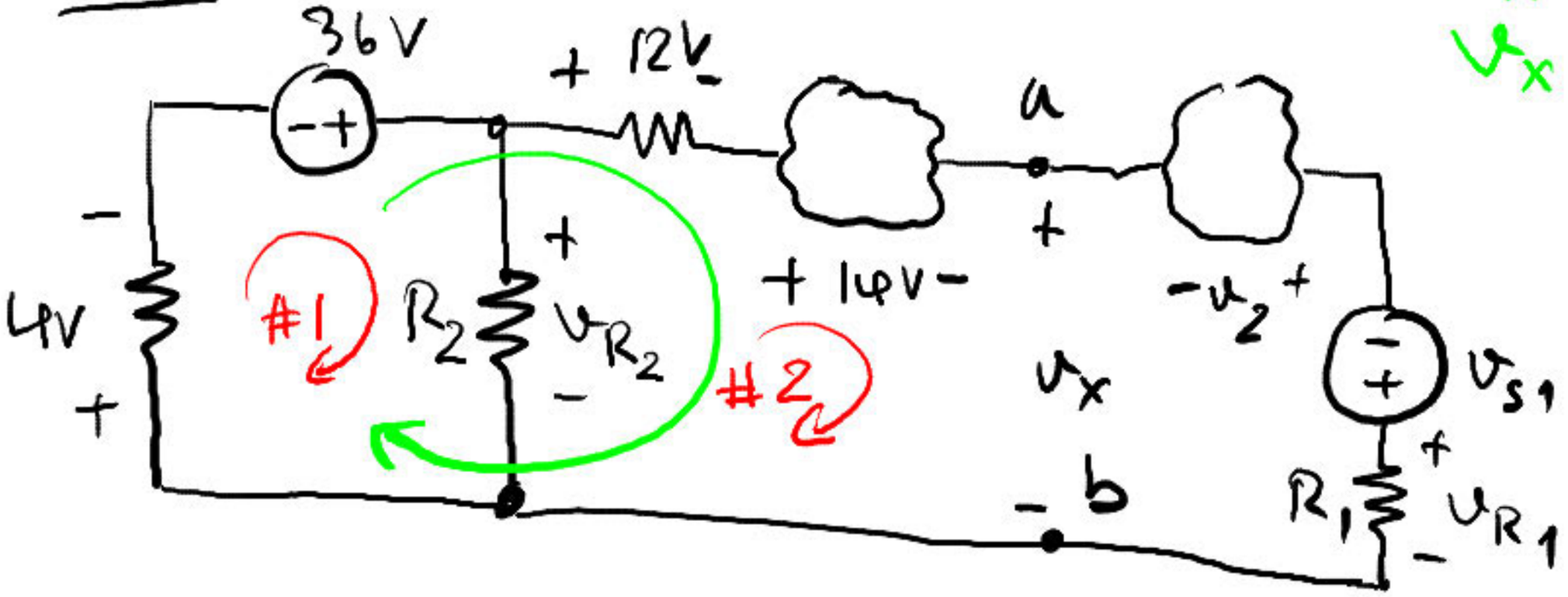
$$\therefore v_x = -4\,V$$

$$\therefore i_x = \frac{v_x}{10\Omega} = \frac{-4}{10} = -400\,mA$$

Test 2 (KVL)

$+4-36+12+14+v_x=0$

$v_x=6\ V$



หา v_{R_2} และ v_x

วิธีทำ KVL(#1) $4-36+v_{R_2}=0$

$\therefore v_{R_2}=36-4=32\ V$ #

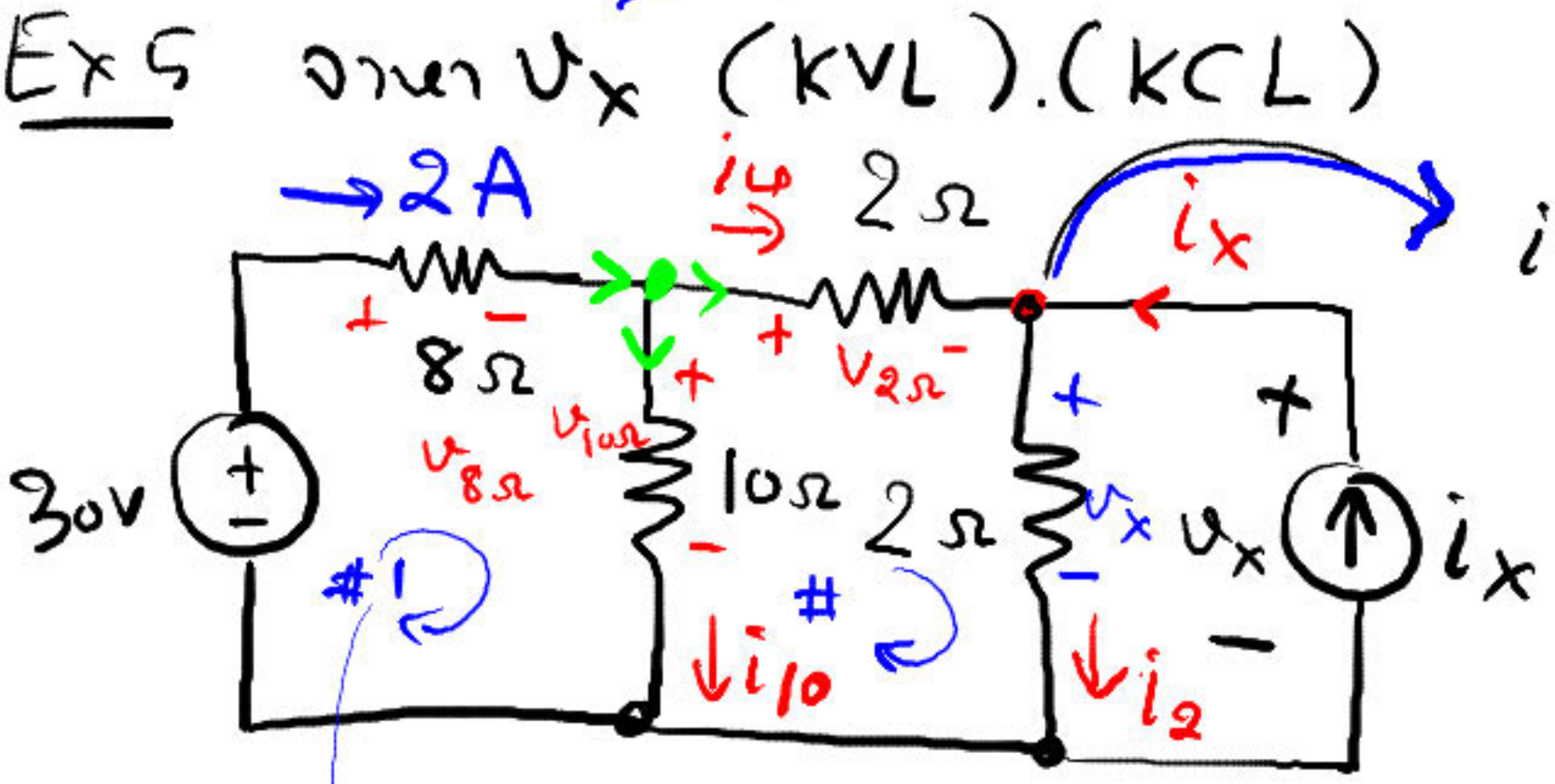
KVL(#2)

$-v_{R_2}+12+14+v_x=0$

$-32+12+14+v_x=0$

$\therefore v_x=32-12-14=6\ V$

Ex 5 מצא v_x (KVL).(KCL)



$i_4 + i_x = i_2$ → (KCL) -①

Loop #1

$-30 + v_8 + v_{10} = 0$ (KVL) -②

$v_8 = i \cdot R = (2)(8) = 16V$

$v_{10} = 30 - 16 = 14V$

$i_{10} = \frac{v_{10}}{10} = \frac{14}{10} = 1.4A$

Loop #2

$-v_{10} + v_2 + v_x = 0$ -③

$i_4 + i_{10} = 2A$

$i_4 + 1.4 = 2A$

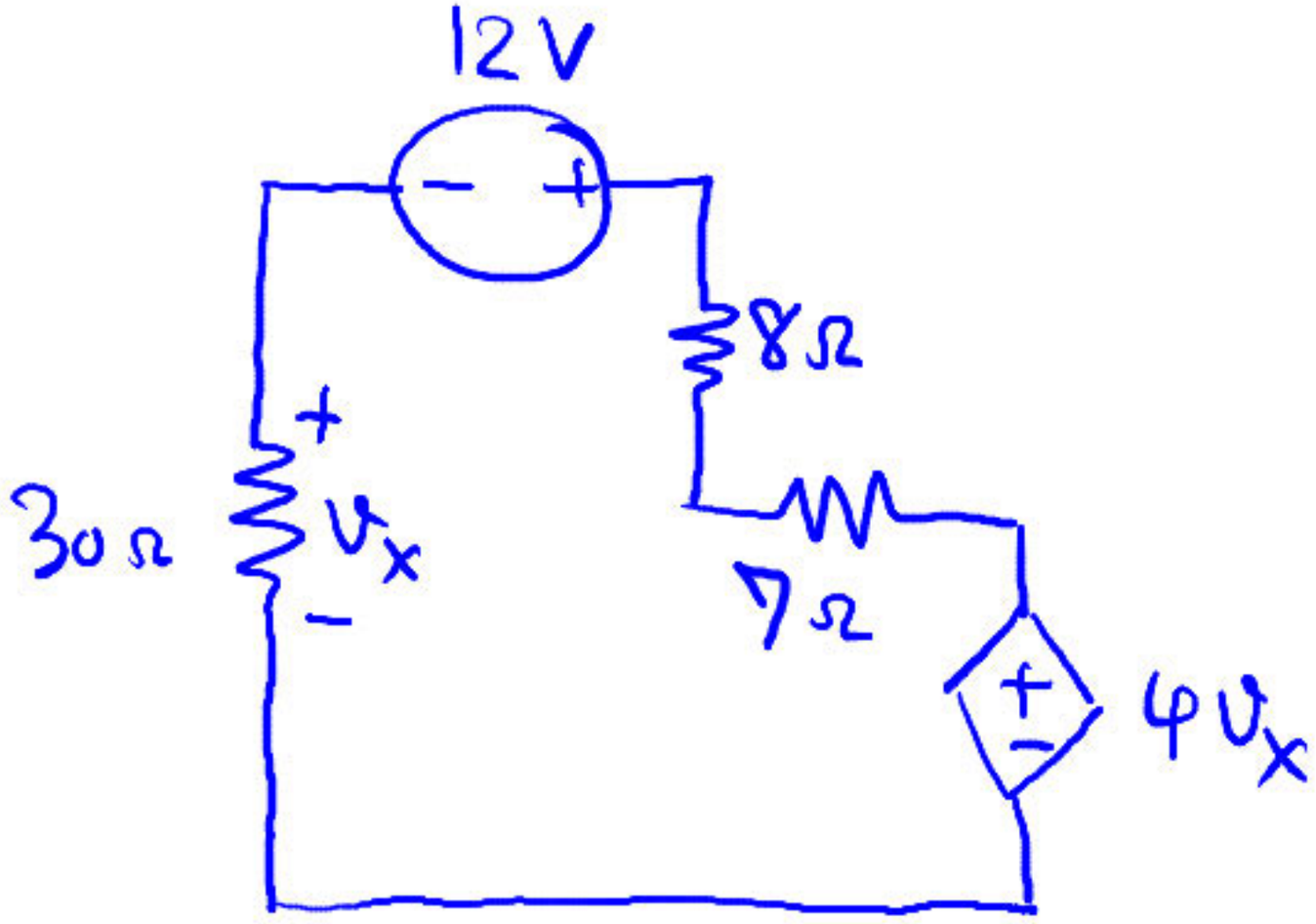
$i_4 = 0.6A$

מתוך ①

$-14 + (0.6)(2) + v_x = 0$

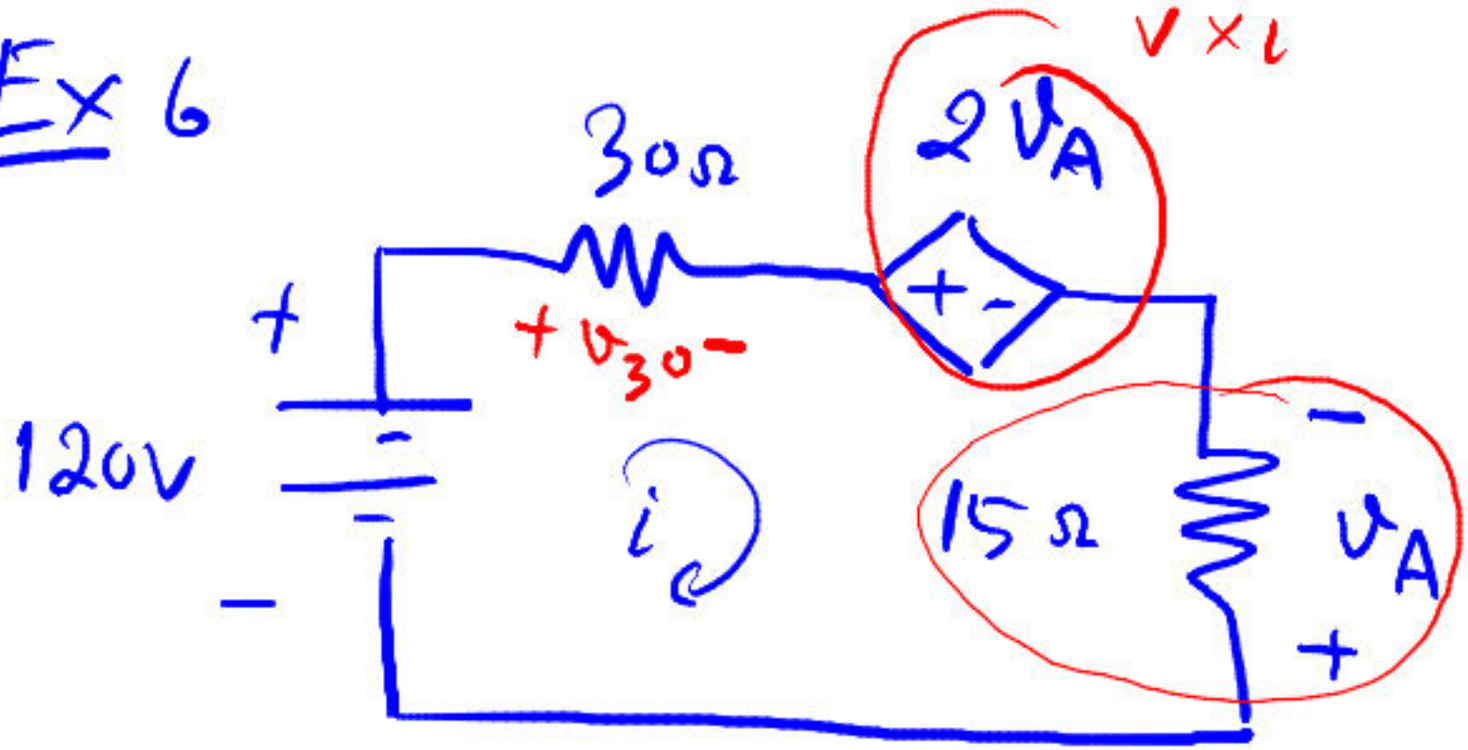
การบ้าน #1

ข้อ. 6 จงหากำลังไฟฟ้าของแต่ละตัวใดบ้าง



คำตอบ (จากซ้าย) 0.768W, 1.92 W, 0.205 W, 0.1792W, -3.07W

Ex 6



$P_{120} = (120)(-8) = -960W$

$P_{30\Omega} = i^2 \cdot R = 8^2(30) = 1920W$

$P_{2v_A} = (2(-15)(8))(8)$

$= -1,920W$

$P_{15\Omega} = (8^2)(15) = 960W$

KVL (#1) $-120 + v_{30} + 2v_A - v_A = 0$ —①

on Ohm's Law $v_{30} = 30i$

$\boxed{v_A = -15i}$ } sub in ①

$-120 + 30i + 2(-15i) - (-15i) = 0$

$-120 + 30i - 30i + 15i = 0$

$\therefore i = 0$ $120/15 = 8A$