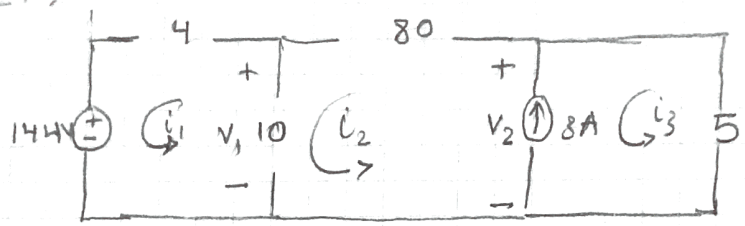
Problem #1:

Given:

Abdul Popal



$-i_3 + i_2 = 3$

$i_2 - i_3 = 3$ --- (1)

KVL1: $14 i_1 - 10 i_2 + 0 i_3 + 0 V_2 = -144$ --- (2)

KVL2: $-10 i_1 + 90 i_2 + 0 i_3 - V_2 = 0$ --- (3)

KVL3: $0 i_1 + 0 i_2 + 5 i_3 + V_2 = 0$ --- (4)

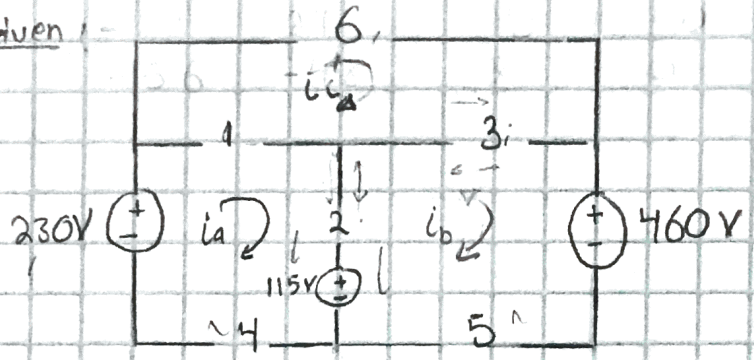
$i_1 = -11A$, $i_2 = -1A$, $i_3 = -4A$, $V_2 = \underline{\underline{20V}}$

$V_1 = i_1 (10\Omega) = \underline{\underline{110V}}$

Problem #5

Problem # 2:

Given:



Find: P_{230V}, P_{115V}, P_{460V}

Solution:

KVL(a): $7i_a - 2i_b - i_c = 115$ ---- (1)

KVL(b): $-2i_a + 10i_b - 3i_c = -345$ ---- (2)

KVL(c): $-i_a - 3i_b + 10i_c = 0$ ---- (3)

Using Matrices: $i_a = 4.4\,A$, $i_b = -36.8A$, $i_c = -10.6A$

$P_{230V} = -(4.4A)(230V) = -1012w$ ✓

$P_{115V} = (i_a + i_b)(115V) = (41.2A)(115V) = 4738w$ ✓

$P_{460V} = (-36.8A)(460V) = -16928$ ✓

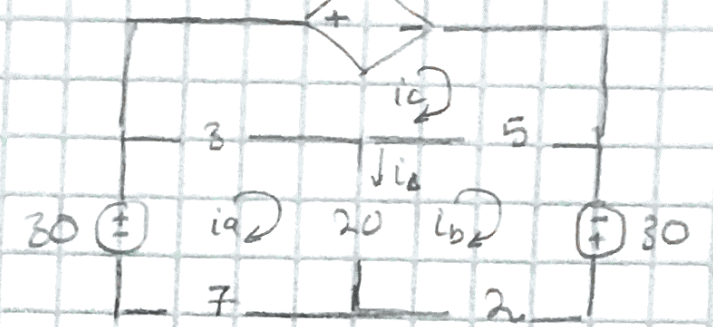
$P_{delivered} = 17940$ watts

$P_{dissp} = (4.4 + 10.6)^2 + (4.4 + 36.8)^2(2) + (4.4)^2 4$

$+ (10.6)^2 6 + (-36.8 + 10.6)^2(3) + (-36.8)^2(5)$

$+ 4738 = 17940$ watt

Circuit:



Find: $P_{(30)_a}$, $P_{(30)_b}$, P_{53i_Δ}

Solution:

$$i_b - i_a + i_\Delta = 0$$

$$i_\Delta = i_a - i_b$$

$$i_a - i_b + 0 i_c - i_\Delta = 0 \quad \text{---- (1)}$$

KVL(a): $10 i_a + 0 i_b - 3 i_c + 20 i_\Delta = 30$ ---- (2)

KVL(b): $0 i_a + 7 i_b - 5 i_c - 20 i_\Delta = 30$ --- (3)

KVL(c): $-3 i_a - 5 i_b + 8 i_c + 53 i_\Delta = 0$ --- (4)

* Using Matrices :- $i_a = 52A$, $i_b = 60A$, $i_c = 110A$

$$P_{(30)_a} = -(52A)(30V) = \underline{-156 \text{ watt}}$$

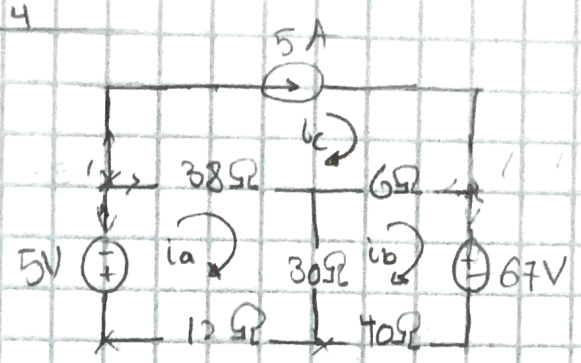
$$P_{(30)_b} = -(60A)(30V) = \underline{-1800 \text{ watt}}$$

$$P_{(53i_\Delta)} = (110A)(53(-8A)) = \underline{-46.64 \text{ k watt}}$$

deli
pow

Problem # 4

Given:



Find: a) P_{5A} , P_{5V} , P_{67V}

b) $P_{38\Omega}$, $P_{6\Omega}$, $P_{12\Omega}$, $P_{30\Omega}$, $P_{40\Omega}$, $P_{6\Omega}$.

Solution:-

a) constraint equation : $i_c = 5A$

(1) KVL A: $5V + (i_a - i_c)\,38\Omega + (i_a - i_b)30 + 12 i_a = 0$

(2) KVL B: $(i_b - i_a)\,30 + (i_b - i_c)6 + 67 + 40 i_b = 0$

(1) $38 i_a + 30 i_a + 12 i_a - 38(5) - 30 i_b = 0$

$80 i_a - 30 i_b = 185$

(2) $30 i_b + 40 i_b + 6 i_b - 30 i_a - 36 = -67$

$76 i_b - 30 i_a = -37$

$i_a = 2.5A$

$i_b = .5A$

KVL C: $V_{5A} + 6(i_c - i_b) + 38(i_c - i_a) = 0$

$V_{5A} = -6(5 - .5) - 38(5 - 2.5)$

$V_{5A} = -27 - 95 = -122\,V$

Problem #5

$P_{5A} = -122V(5A) = -610$ watts delivers

$P_{5V} = 5V(2.5A) = 12.5$ watts : absorbs

$P_{67V} = .5A(67V) = 33.5$ watts : absorbs

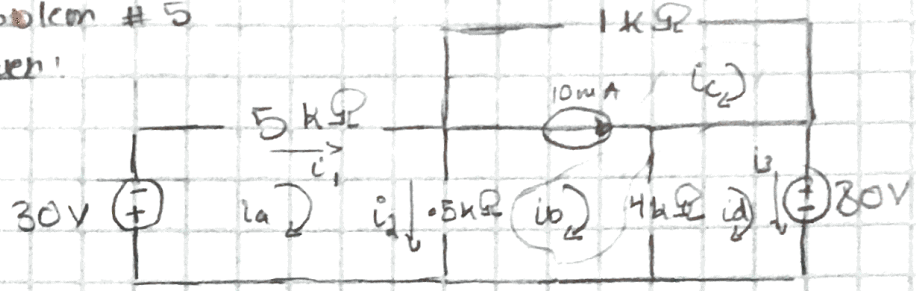
$P_{dissipated} = (2.5)^2(12) + (2.5)^2 38 + 2^2(6) + .5^2(40) + P_{5V} + P_{67V}$

$= 584$ watts $+ 12.5$ watts $+ 33.5$ watts

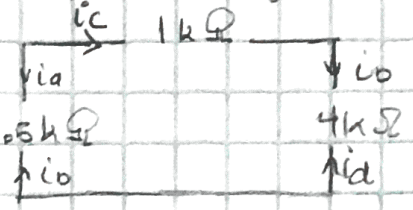
$= 610$ watts

Problem #5

Given:



Super node diagram



Find: i_1, i_2 and i_3

Solution:

① KVL A: $80 + 5k\Omega\, i_a + (i_a - i_b)\cdot 5k\Omega = 0$

$5.5k\Omega\, i_a - 0.5k\Omega\, i_b = -80$

② KVL D: $80k\Omega - (i_d - i_b)\,4k\Omega = 0$

$4k\Omega\, i_d - 4k\Omega\, i_b = -80$

$-4k\Omega\, i_b + 4k\Omega\, i_d = -80$

③ $-5k\Omega\, i_a + 1k\Omega\, i_c + 4.5k\Omega\, i_b - 4 i_d = 0$ => supermesh

④ constraint equation:

$i_b - i_c = 10\ mA$

i_a	i_b	i_c	i_d	
5500	500	0	0	-80
0	-4000	0	4000	-80
-500	4500	10^3	-4000	0
0	1	-1	0	0.01

$i_a = -0.01$

$i_b = -0.05$

$i_c = -0.06$

$i_d = -0.07$

$i_1 = i_a = -0.01A = \underline{0.01A \text{ to left}}$.

$i_2 = i_a - i_b = -0.01 - (-0.05)$

$= \underline{0.04\ A}$

$i_3 = i_d = \underline{-0.07\ A}$