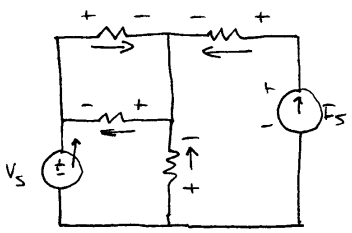
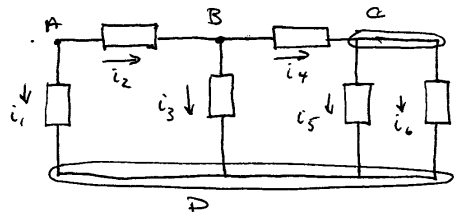
PROBLEM 1



USING THE PASSIVE SIGN CONVENTION, MARK THE POLARITY OF THE CURRENT SOURCE & THE DIRECTION OF THE CURRENT FLOW THROUGH THE VOLTAGE SOURCE & RESISTORS.

PROBLEM 2



KCL NA : $-i_1 - i_2 = 0$
KCL NB : $i_2 - i_3 - i_4 = 0$
KCL NC : $i_4 - i_5 - i_6 = 0$
KCL ND : $i_1 + i_3 + i_5 + i_6 = 0$

GIVEN : $i_1 = -1\,mA$
$i_3 = 0.5\,mA$
$i_6 = 0.2\,mA$

FIND :
- WRITE KCL EQNS. FOR NODES A, B, C, & D
- SOLVE FOR: i_2, i_4, i_5
- USE THE EXTRA EQUATION TO CHECK YOUR ANSWERS.

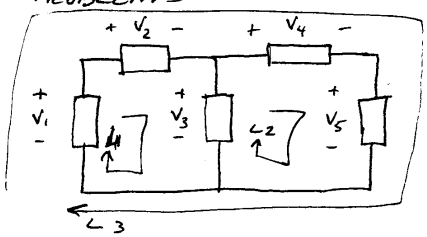
FROM KCL NA: $-i_1 - i_2 = 0$
$i_2 = -i_1 = -(-1)$
$i_2 = 1\,mA$ ←

FROM KCL NB: $i_2 - i_3 - i_4 = 0$
$i_4 = i_2 - i_3$
$i_4 = 1 - 0.5$
$i_4 = 0.5\,mA$ ←

FROM KCL NC: $i_4 - i_5 - i_6 = 0$
$i_5 = i_4 - i_6$
$i_5 = 0.5 - 0.2$
$i_5 = 0.3\,mA$ ←

CHECK: KCL ND: $i_1 + i_3 + i_5 + i_6 = 0$
$-1 + 0.5 + 0.3 + 0.2 = 0$
$0 = 0$ ✓

PROBLEM 3



KVL L1: $-V_1+V_2+V_3=0$

KVL L2: $-V_3+V_4+V_5=0$

KVL L3: $-V_1+V_2+V_4+V_5=0$

GIVEN: $V_1 = 5V,\ V_2 = -3V,\ V_4 = 10V$

FIND:
- WRITE KVL EQUATIONS FOR ALL THREE LOOPS
- SOLVE FOR: V_3 & V_5
- USE THE EXTRA EQUATION TO CHECK YOUR ANSWER

FROM KVL L1: $-V_1+V_2+V_3=0$

$-5+(-3)+V_3=0$

$V_3 = 8V \leftarrow$

FROM KVL L2: $-V_3+V_4+V_5=0$

$-8+10+V_5=0$

$V_5 = -2V \leftarrow$

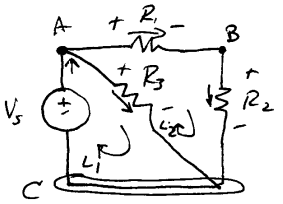
CHECK USING KVL L3

$-5+(-3)+\ \ +(-2)=0$

$0=0$ ✓

EE301/303 SP09 HW #1 SOLUTION

PROBLEM 4



GIVEN: $V_s = 30V$, $R_1 = 100\Omega$, $R_2 = 200\Omega$, $R_3 = 300\Omega$

FIND: OHM'S LAW EQNS. FOR EACH RESISTOR
WRITE KVL EQNS. FOR EACH LOOP
WRITE KCL EQNS. FOR EACH NODE
SOLVE FOR $i_{VS}, i_{R1}, i_{R2}, i_{R3}$
V_{R1}, V_{R2}, V_{R3}

OHM'S LAW

$V_{R1} = R_1 i_{R1}$

$V_{R2} = R_2 i_{R2}$

$V_{R3} = R_3 i_{R3}$

KVL L1: $-V_S + V_{R3} = 0$

KVL L2: $-V_{R3} + V_{R1} + V_{R2} = 0$

KVL OUTER LOOP: $-V_S + V_{R1} + V_{R2} = 0$

KCL NA: $i_{VS} - i_{R1} - i_{R3} = 0$

KCL NB $i_{R1} - i_{R2} = 0$

KCL NC: $-i_{VS} + i_{R3} + i_{R2} = 0$

USING OHM'S LAW

$V_{R1} = R_1 i_{R1} = 100(0.1)$

$V_{R1} = 10V$ ←

$V_{R2} = R_2 i_{R2} = 200(0.1)$

$V_{R2} = 20V$ ←

USING KCL NA

$i_{VS} - i_{R1} - i_{R3} = 0$

$i_{VS} = i_{R1} + i_{R3}$

$i_{VS} = 0.1 + 0.1$

$i_{VS} = 0.2A = 200mA$ ←

USING KVL L1: $-V_S + V_{R3} = 0$

$V_{R3} = V_S$

$V_{R3} = 30V$ ←

USING OHM'S LAW

$i_{R3} = \frac{V_{R3}}{R_3} = \frac{30}{300} = 0.1A$

$i_{R3} = 0.1A = 100mA$ ←

USING KVL L2:

$-V_{R3} + V_{R1} + V_{R2} = 0$

$30 = V_{R1} + V_{R2}$

USING OHMS LAW

$30 = R_1 i_{R1} + R_2 i_{R2}$

USING KCL NB: $i_{R1} - i_{R2} = 0$

$i_{R1} = i_{R2} = i_{R12}$

$30 = R_1 i_{R12} + R_2 i_{R12}$

$30 = (R_1 + R_2) i_{R12}$

$30 = (100 + 200) i_{R12}$

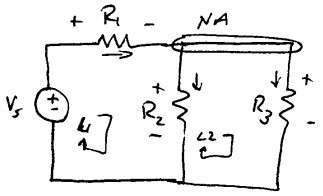
$i_{R12} = \frac{30}{300} = 0.1A$

$i_{R1} = i_{R2} = i_{R12} = 0.1A = 100mA$

$i_{R1} = 100mA$ ←

$i_{R2} = 100mA$ ←

PROBLEM 5



GIVEN: $V_S = 30V$
$R_1 = 500\Omega, R_2 = 500\Omega$
$R_3 = 500\Omega$

FIND USING KVL, KCL & OHM'S LAW

1. VOLTAGE ACROSS EACH RESISTOR
2. CURRENT THROUGH EACH RESISTOR
3. THE POWER ADDED BY THE SOURCE
4. THE POWER DISSIPATED BY EACH RESISTOR.
5. IS $P_S = P_{R1} + P_{R2} + P_{R3}$?

(NOTE: SOLUTIONS MAY VARY)

KCL NA: $i_{R1} - i_{R2} - i_{R3} = 0$

KVL L1: $-V_S + V_{R1} + V_{R2} = 0$

KVL L2 $-V_{R2} + V_{R3} = 0$

USING OHM'S LAW IN KVL'S

$V_S = R_1 i_{R1} + R_2 i_{R2}$

$-R_2 i_{R2} + R_3 i_{R3} = 0$

3 EQN'S, 3 UNK:

$$i_{R1} - i_{R2} - i_{R3} = 0$$
$$500 i_{R1} + 500 i_{R2} + 0 i_{R3} = 30$$
$$-500 i_{R2} + 500 i_{R3} = 0$$

SOLVING EQUATIONS:

$i_{R1} = 0.04A = 40mA$
$i_{R2} = 0.02A = 20mA$
$i_{R3} = 0.02A = 20mA$ ←

$V_{R1} = R_1 i_{R1} = 500(0.04)$

$V_{R1} = 20V$ ←

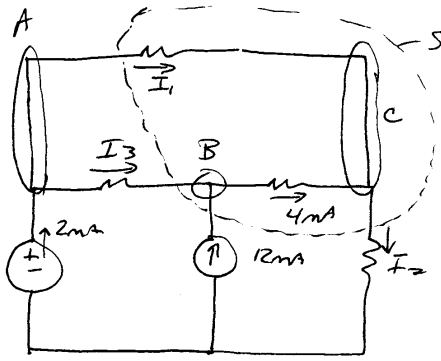
$V_{R2} = R_2 i_{R2} = 500(0.2)$

$V_{R2} = 10V$ ←

$V_{R3} = R_3 i_{R3} = 500(0.2)$

$V_{R3} = 10V$ ←

PROBLEM 6



- SOLVE FOR I_1, I_2, & I_3
- SHOW THAT KCL IS VALID FOR THE SUPERNODE

KCL NB

$I_3 - 4 + 12 = 0$

$I_3 = -8mA \leftarrow$

KCL NA

$2mA - I_3 - I_1 = 0$

$2mA - (-8) - I_1 = 0$

$I_1 = 10mA \leftarrow$

KCL NC

$I_1 + 4mA - I_2 = 0$

$I_2 = I_1 + 4mA = 10 + 4$

$I_2 = 14mA \leftarrow$

KCL SUPERNODE

$I_1 - I_2 + 12mA + I_3 \stackrel{?}{=} 0$

$10 - 14 + 12 + (-8) = 0$

$22 - 22 = 0$

$0 = 0$ ✓ SO KCL IS VALID AT THIS SUPERNODE