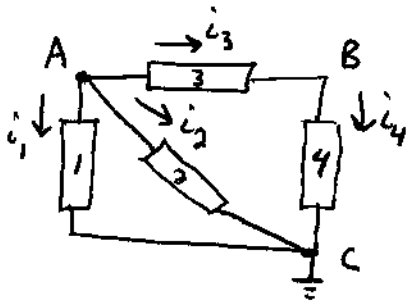
ENGR 210 Spring '05 HW #2 Solutions

**2-12**

$i_1 = 20mA$

$i_3 = -30mA$




KCL @ A: $\sum_{+in} i = 0$

$-i_1 - i_2 - i_3 = 0$

$i_2 = -(i_1 + i_3)$

$\boxed{i_2 = 10mA}$

KCL @ B: $\sum_{+in} i = 0 = i_3 - i_4 = 0$

$i_3 = i_4$

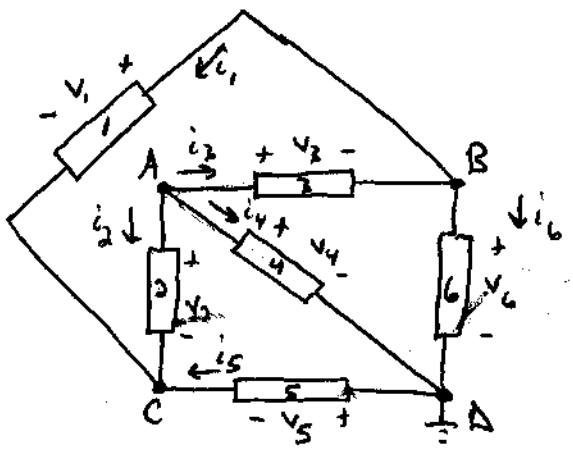
$\boxed{i_4 = -30\,mA}$

Check answer with KCL @ C: $\sum_{+in} i = 0 = i_1 + i_2 + i_3 = 20mA + 10mA - 30mA = 0$

**2-13**

a) Nodes: A, B, C, D

Loops: (1,2,3), (2,4,5), (3,4,6), (1,5,6), (2,3,6,5) and others possible




b) series: None parallel None

c) KCL @ A: $-i_2 - i_3 - i_4 = 0$

@ B: $-i_1 + i_3 - i_6 = 0$

@ C: $i_1 + i_2 + i_5 = 0$

@ D: $i_4 + i_6 - i_5 = 0$

KVL loop (1,2,3): $-v_1 - v_3 + v_2 = 0$

loop (2,4,5): $-v_2 + v_4 + v_5 = 0$

loop (3,6,4) $v_3 + v_6 - v_4 = 0$

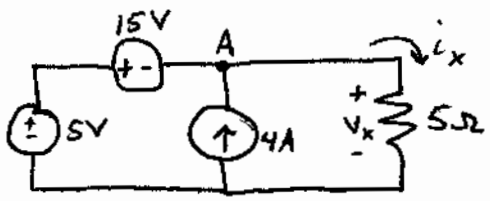
d) $v_3 = -8V$ $v_4 = -8V$ $v_5 = 9V$

$\boxed{v_2 = +v_4 + v_5 = -8 + 9 = +1V}$

$\boxed{v_6 = v_4 - v_3 = -8 - -8 = 0V}$

$\boxed{v_1 = -v_3 + v_2 = +8 + 1 = +9V}$

**2-21** $V_x = 5\, i_x$




KVL around outside: $-5 + 15 + V_x = 0$

$\boxed{V_x = -10V}$

~~Check: top KCL at A~~

$\boxed{i_x = -2A}$

**2-22** KVL around bottom Left loop:

$-5V + V_2 + 10V = 0$

$\boxed{V_2 = -5V}$

KVL around bottom right loop

$-10V + V_3 + 5V = 0$

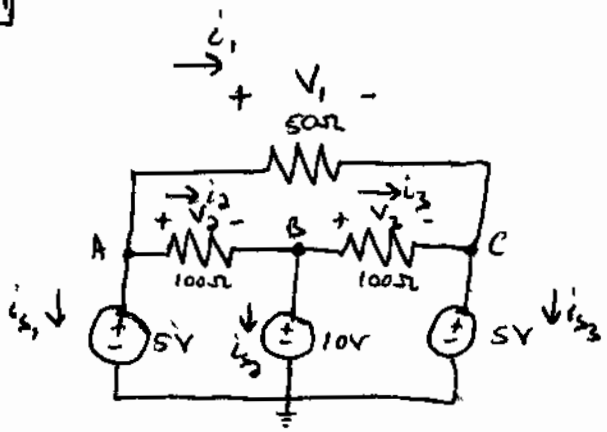
$\boxed{V_3 = 5V}$

KVL around outside loop

$-5V + V_1 + 5V = 0$

$\boxed{V_1 = 0V}$

$\boxed{\begin{aligned} i_1 &= \frac{V_1}{50} = 0A \\ i_2 &= V_2/100 = -50mA \\ i_3 &= V_3/100 = 50mA \end{aligned}}$




KCL @ A $-i_1 - i_2 - i_{s_1} = 0$

$\boxed{i_{s_1} = -i_1 - i_2 = 50mA}$

KCL @ B $i_2 - i_{s_2} - i_3 = 0$

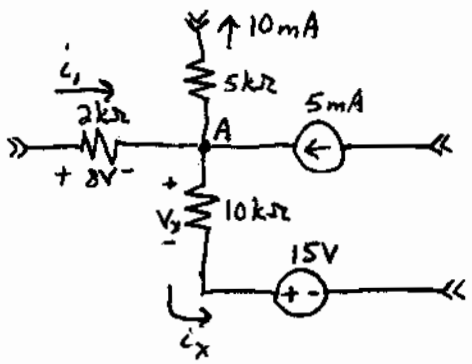
$\boxed{i_{s_2} = i_2 - i_3 = -100mA}$

KCL @ C $i_1 + i_3 - i_{s_3} = 0$

$\boxed{i_{s_3} = i_3 = 50mA}$

* Signs (+ or -) for $V_2$, $V_3$, $i_2$ and $i_3$ could be different if voltages and currents for resistors were defined differently.

2-24




a) KCL @ A:

$i_1 - 10mA + 5mA - i_x = 0$

$i_x = i_1 - 5mA$

$V_1 = i_1 R_1$

$8V = i_1 (2k\Omega)$

$i_1 = 4mA$

$\boxed{i_x = -1mA}$

$V_x = i_x R_x = (-1mA)(10k\Omega)$

$\boxed{V_x = -10V}$

b) $10mA - 5mA - i_1 + i_x \stackrel{?}{=} 0$ KCL using "rest of ckt" as a node

$10mA - 5mA - 4mA - 1mA = 0$ ✓