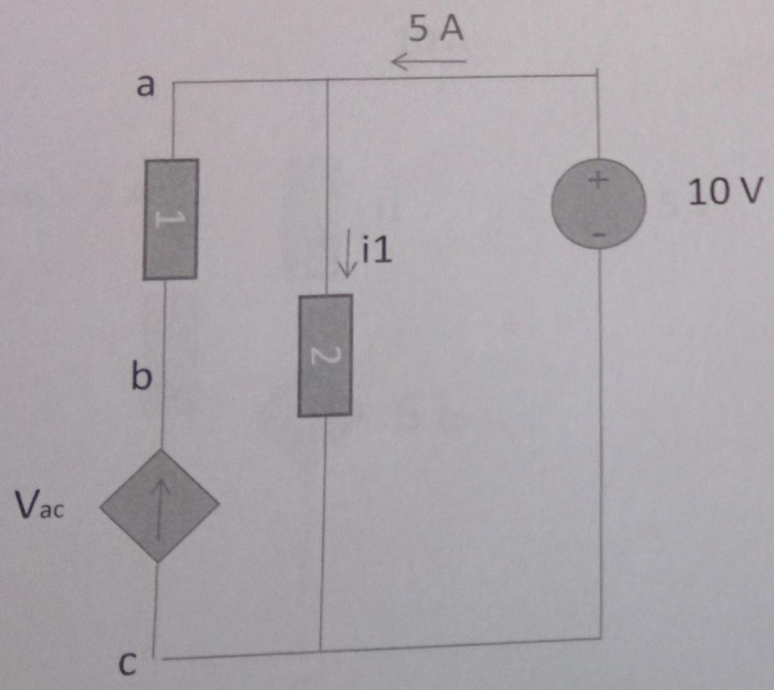
Problem 1: (VCCS) Find i1 . Is current flowing from b to c or from c to b?



$V_{ac} = 10\,V$

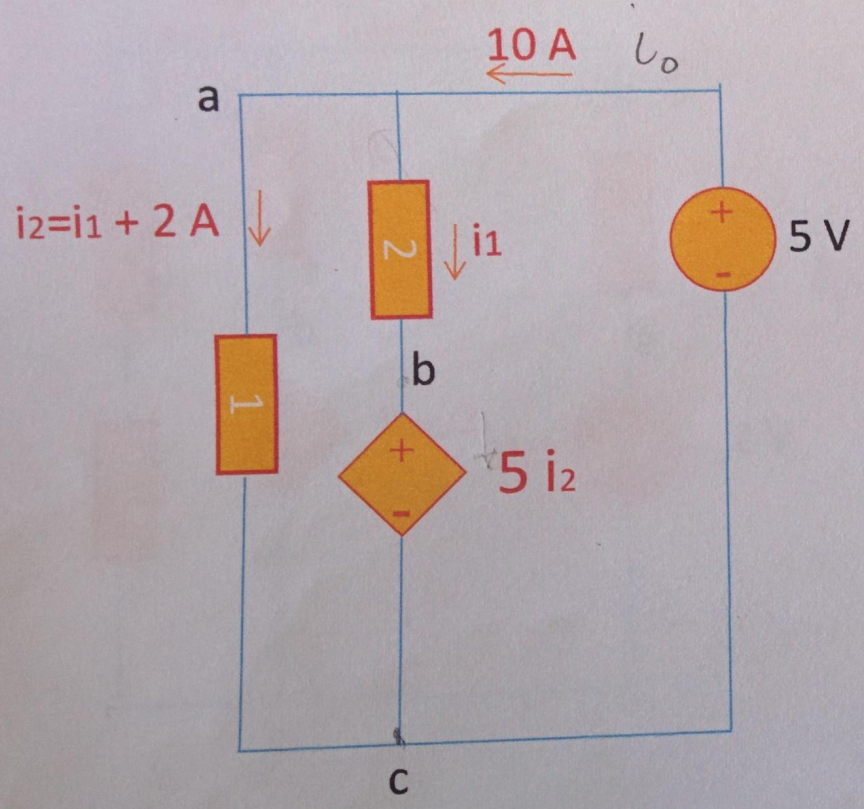
Given the direction of current flow in VCCS, @ node a,

$5 + 10 = i_1$

$i_1 = 15\ A$

The current flows from c to b.

Problem 2 : (CCVS) Find i1 , i2 . Find Vbc



$i_o = i_2 + i_1$

$10A = i_1 + (i_1 + 2A)$

$10A = 2i_1 + 2A$

$8A = 2i_1$

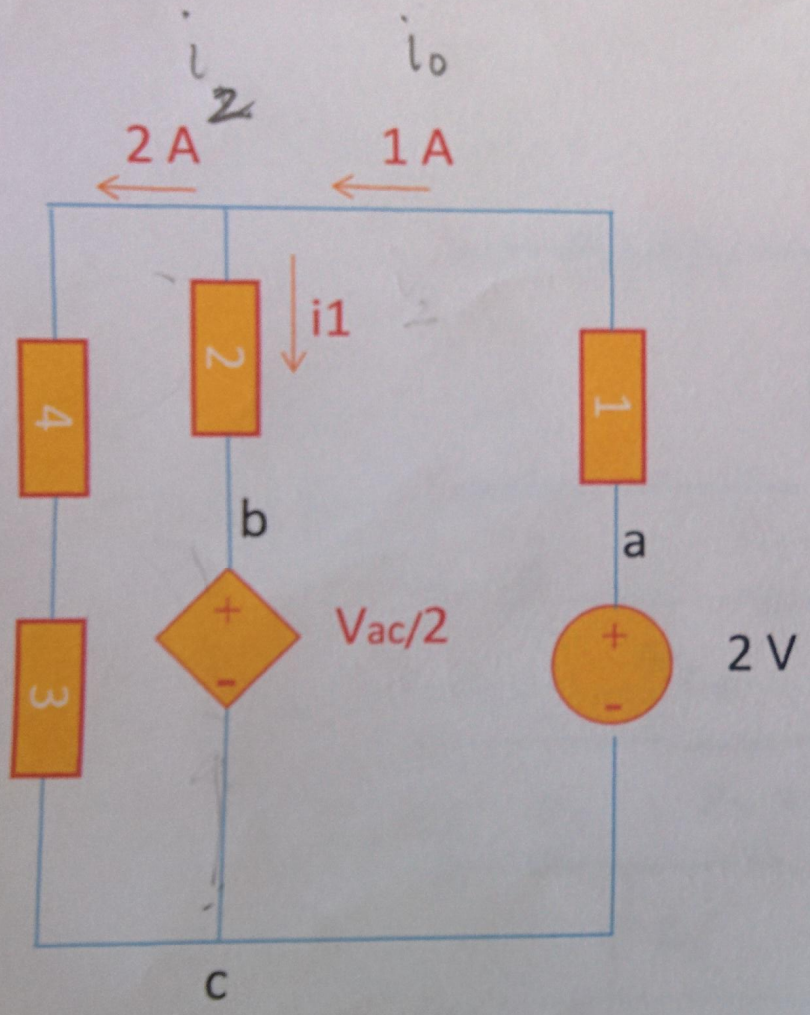
$\boxed{i_1 = 4A}$

$\boxed{i_2 = 6A}$

$V_{bc} = 5i_2 = 5(6A) = 30V$

$\boxed{V_{bc} = 30V}$

Problem 3: (VCVS) Find V_{bc}, i1.



$$i_o = i_2 + i_1$$

$$i_o = i_2 + i_1$$

$$1A = 2A + i_1$$

$$-1A = i_1$$

$$\boxed{i_1 = -1A}$$

$$V_{bc} = \frac{V_{ac}}{2} = \frac{2V}{2} = 1V$$

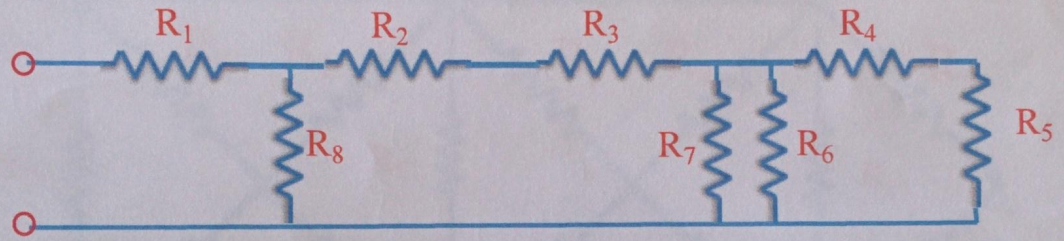
$$\boxed{V_{bc} = +1V}$$

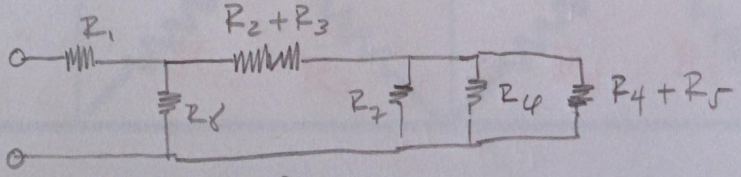
OR

$$\boxed{V_{bc} = 1V}$$

Neptali Toribio

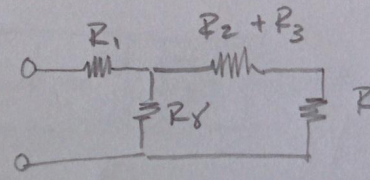
Problem 4: Solve for Req. You may use the parallel notation discussed in class

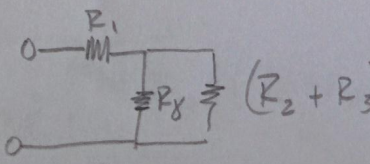


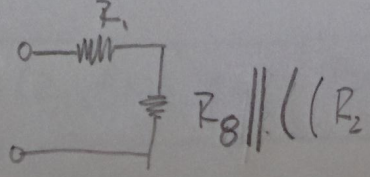


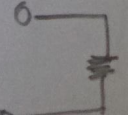
$$R_{eq} = \left(\left[\left((R_4 + R_5) \parallel R_6 \parallel R_7\right) + R_2 + R_3\right] \parallel R_8\right) + R_1$$

OR







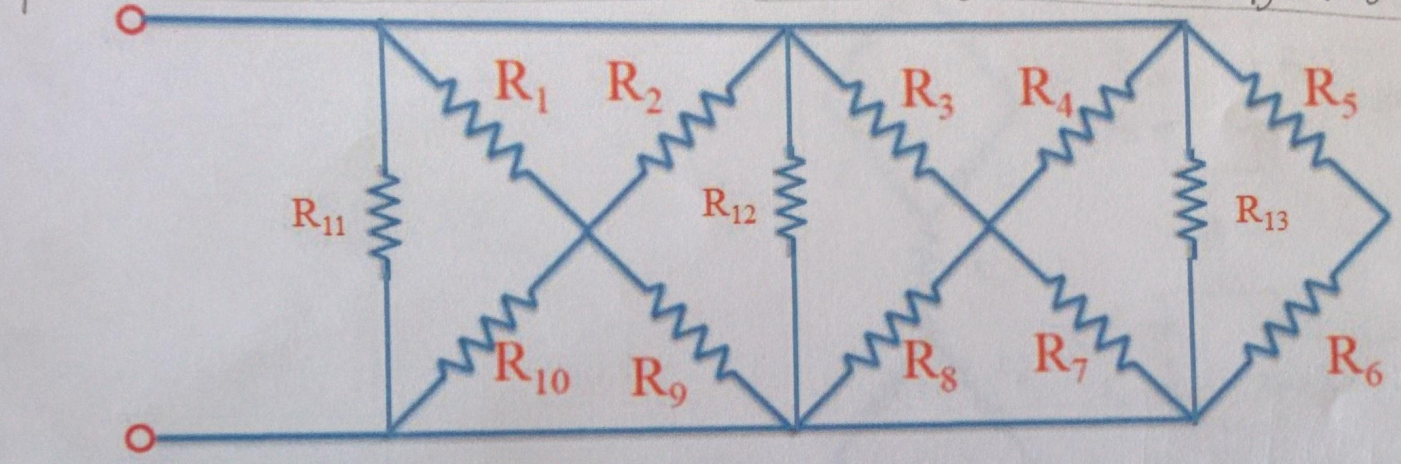


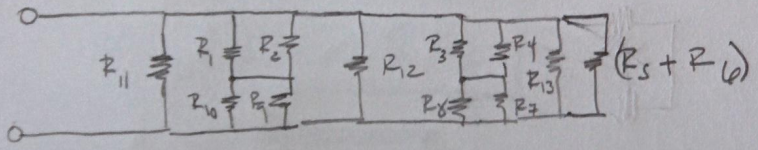
$$R_{eq} = R_1 + \left(R_8 \parallel \left[R_2 + R_3 + \left(R_7 \parallel R_6 \parallel (R_4 + R_5)\right)\right]\right)$$

Problem 5: Solve for Req. You may use the parallel notation discussed in class.

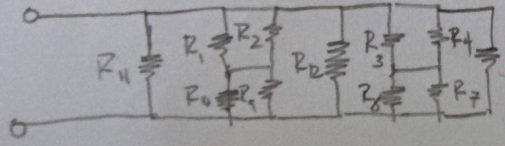
$$R_{eq} = R_{11} \parallel [(R_1 \parallel R_2) + (R_9 \parallel R_{10})] \parallel R_{12} \parallel [(R_3 \parallel R_4) + (R_7 \parallel R_8)] \parallel [R_{13} \parallel (R_5 + R_6)]$$

OR





$R_{13} \parallel (R_5 + R_6)$

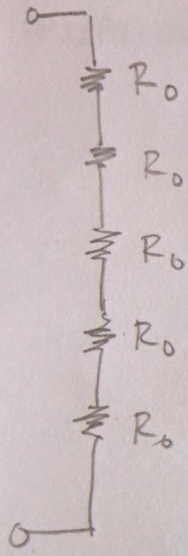


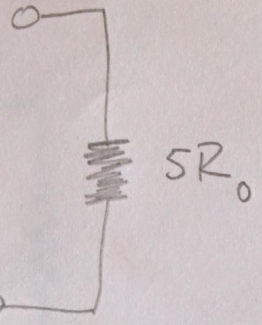
$$(R_1 \parallel R_2) + (R_{10} \parallel R_9) \quad R_{12} \quad (R_3 \parallel R_4) + (R_8 \parallel R_7) \quad R_{13} \parallel (R_5 + R_6)$$

R_{11}

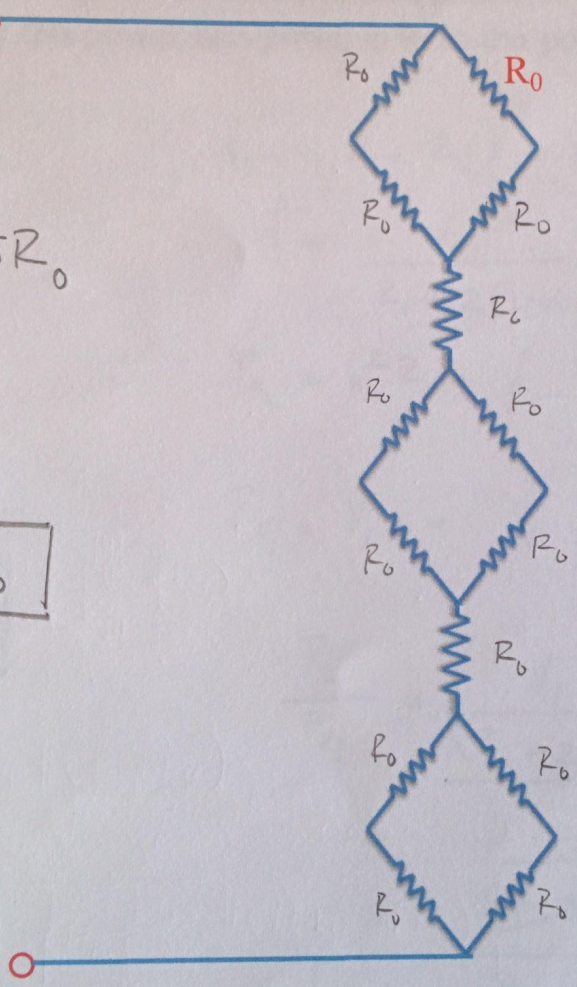
$$R_{eq} = R_{11} \parallel ((R_1 \parallel R_2) + (R_{10} \parallel R_9)) \parallel R_{12} \parallel ((R_3 \parallel R_4) + (R_8 \parallel R_7)) \parallel (R_{13} \parallel (R_5 + R_6))$$

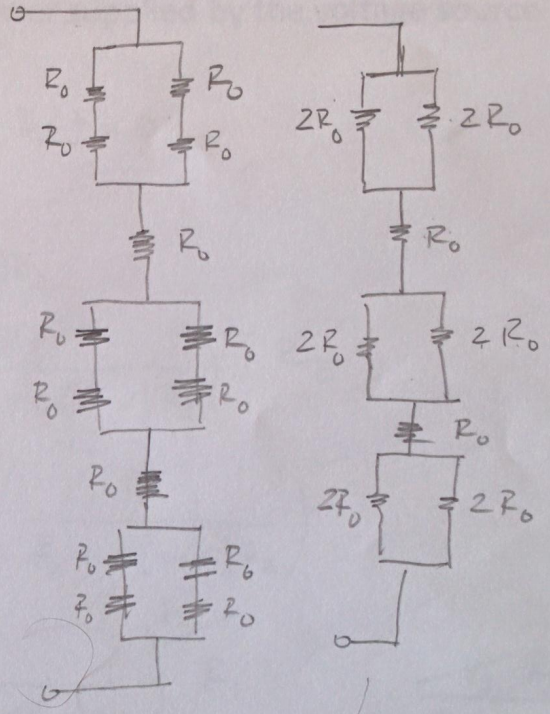
Problem 6: Solve for Req. Each resistor is R0 ohms.





$R_{eq} = 5R_0$





$\frac{1}{2R_0} + \frac{1}{2R_0}$

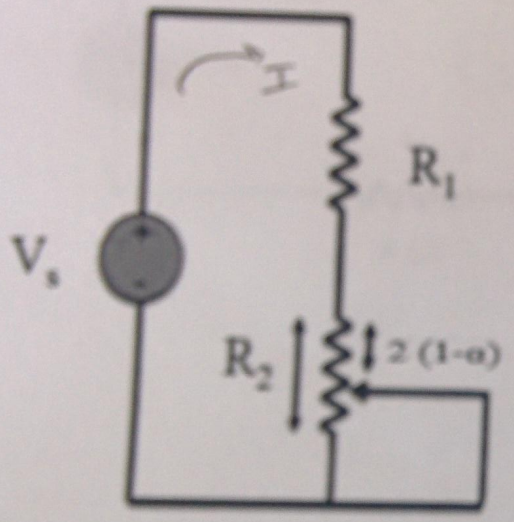
$\frac{2}{2R_0} = \frac{1}{R_0} = \frac{1}{R_{eq}}$

$R_{eq} = R_0$

$R_{eq} = 5R_0$

Problem 7: Potentiometer.

In the circuit below, the wiper divides the potentiometer resistance between $2(1-\alpha)R_2$ and $2\alpha R_2$, where $0 < \alpha < 1$. Find the ratio of the power dissipated in R_1 to the power supplied by the voltage source (P1/Ps) as a function of α.



Applying KVL,

$$-V_s + I(R_1 + 2(1-\alpha)R_2) = 0$$

$$\text{or } I = \frac{V_s}{R_1 + 2(1-\alpha)R_2}$$

$$V_{R_1} = IR_1 = \frac{V_s \cdot R_1}{R_1 + 2(1-\alpha)R_2}$$

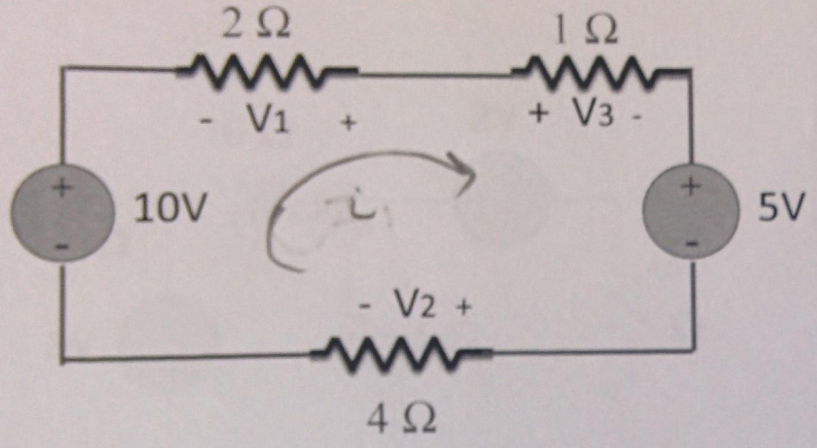
$$P_{R_1} = V_{R_1} \cdot I$$

$$P_s = V_s \cdot I$$

$$\therefore \frac{P_{R_1}}{P_s} = \frac{V_{R_1} \cdot I}{V_s \cdot I} = \frac{V_s \cdot R_1}{R_1 + 2(1-\alpha)R_2} \times \frac{1}{V_s}$$

$$= \frac{R_1}{R_1 + 2(1-\alpha)R_2}$$

Problem 8: KVL & Ohm law. Find V1 ,V2 and V3 and the current flowing in the circuit below



Applying KVL,

$$-10 + 2.i + 1.i + 5 + 4.i = 0$$

$$\therefore 7i = 5$$

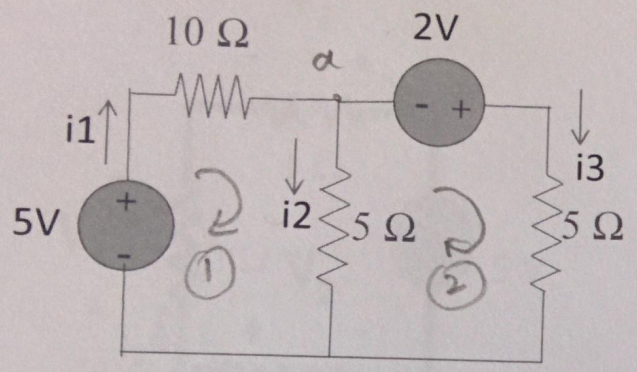
$$i = \frac{5}{7} \text{ A}$$

$$V_1 = -2.i = \frac{-10}{7} \text{ V}$$

$$V_2 = 4.i = \frac{20}{7} \text{ V}$$

$$V_3 = 1.i = \frac{5}{7} \text{ V}$$

Problem 9: KVL, KCL & Ohm Law .
Find i1 through i3 in the circuit below.



(5) node a

$$i_1 = i_2 + i_3$$

(1) $-5 + 10 i_1 + 5 i_2 = 0$

$$10 i_1 + 5 i_2 = 5 \quad - (a)$$

(2) $-2 + 5 i_3 - 5 i_2 = 0$

$$5 i_3 - 5 i_2 = 2 \quad - (b)$$

substituting for i_1 in (a)

$$15 i_2 + 10 i_3 = 5 \quad - (c)$$

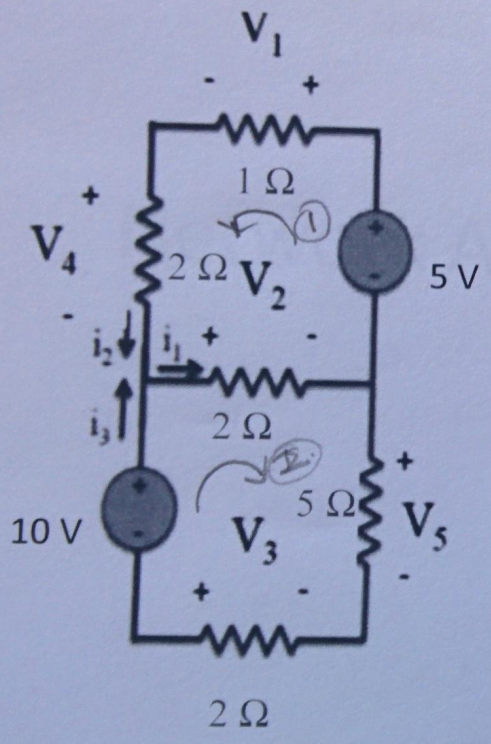
solving equations (b) & (c)

we get $i_2 = 0.04\ A$

$i_3 = 0.44\ A$

$i_1 = 0.48\ A$

Problem 10: KVL, KCL & Ohm Law.
Find V1 through V4 and i1 through i3 in the circuit below.



$V_1 = 1 \cdot i_2 = 0.609$ V

$V_2 = 2 \cdot i_1 = 3.168$ V

$V_3 = -2 \cdot i_3 = -1.95$ V

$V_4 = 2 \cdot i_2 = 1.218$ V

$V_5 = 5 \cdot i_3 = 4.875$ V

$i_1 = i_2 + i_3$

Applying KVL in loop (1).

$-5 + 1 \cdot i_2 + 2 \cdot i_2 + 2 i_1 = 0$

$2 i_1 + 3 i_2 = 5$

substituting for i_1,

$5 i_2 + 2 i_3 = 5$ — (a)

$-10 + 2 i_1 + 5 i_3 + 2 i_3 = 0$

$2 i_1 + 7 i_3 = 10$ — (b)

Substituting for i_1,

$2 i_2 + 9 i_3 = 10$ — (c)

Solving (a) & (c)

$i_2 = 0.609 \Rightarrow i_1 = 1.584$

$i_3 = 0.975$