1	2	3	4	Total
/20	/35	/25	/20	/100

DO NOT BEGIN THE EXAM UNTIL YOU ARE TOLD TO DO SO.

PROBLEM ONE: (20 points)

Solve for R_{eq}.

①

②

③

④

$$R_{eq} = \left[R_2 // R_4 // R_6 \right] + \left[R_5 // R_7 \right]$$
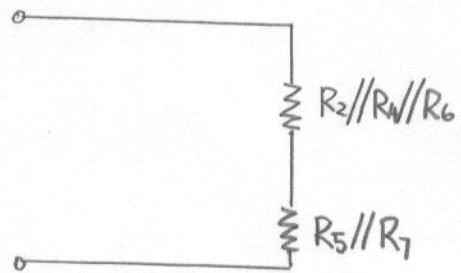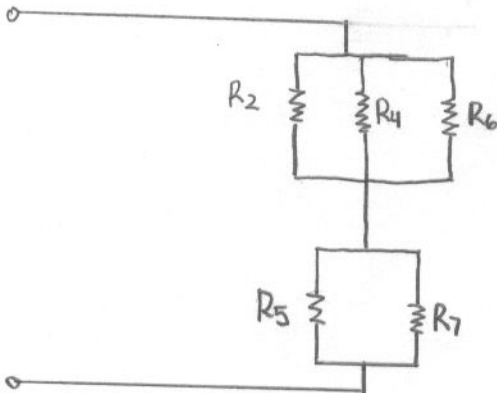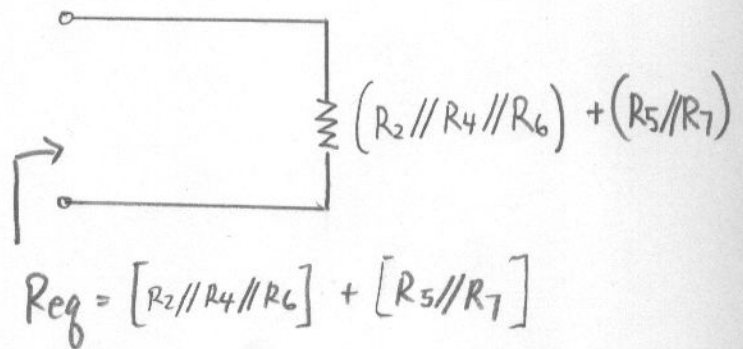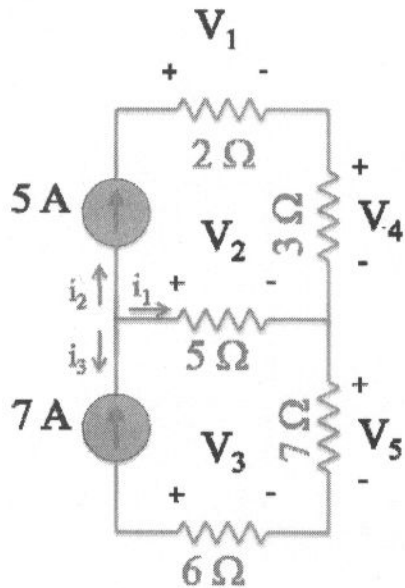
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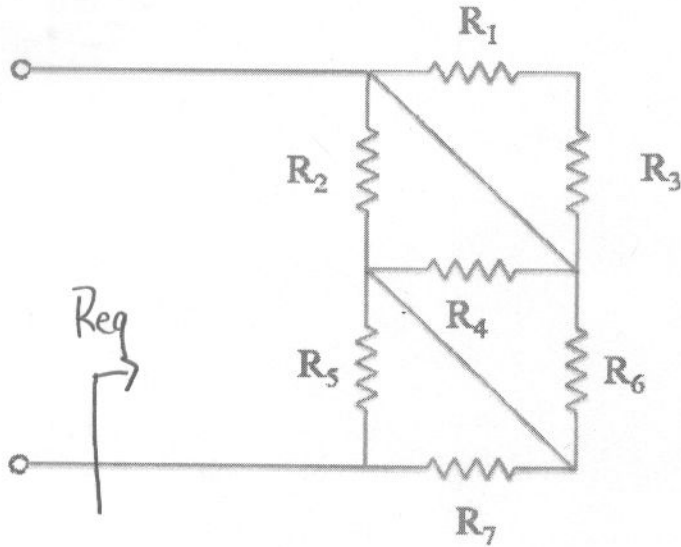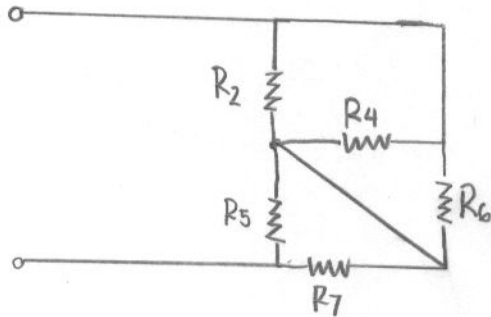
PROBLEM TWO(35 points):

Find V_1 through V_4 and i_1 through i_3 in the circuit below.

$$i_1 + i_2 + i_3 = 0$$

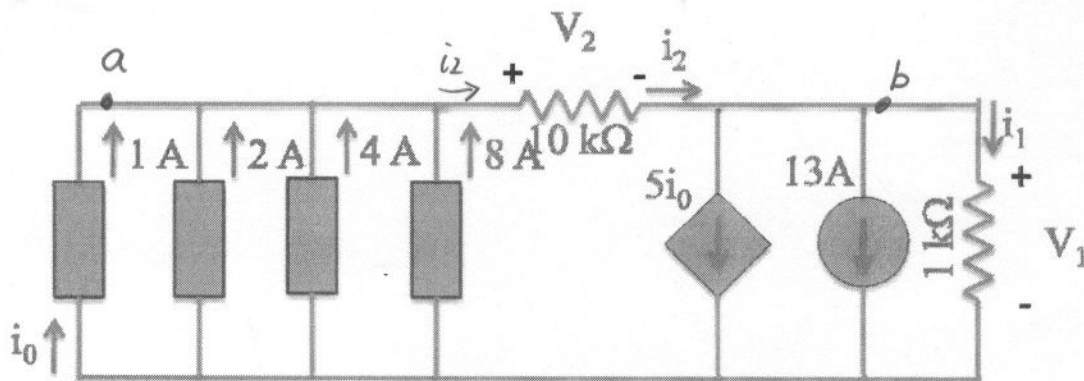$$i_1 + 5A + -7A = 0$$

$$i_1 = 2A$$

$$i_2 = 5A$$

$$i_3 = -7A$$

$$V = IR$$

$V_1:\quad 5A \cdot 2\Omega = 10V$

$V_2:\quad 2A \cdot 5\Omega = 10V$

$V_3:\quad -7A \cdot 6\Omega = -42V$

$V_4:\quad 5A \cdot 3\Omega = 15V$

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PROBLEM THREE(25 points):

Find V_1, V_2, i_1, and i_2. Be careful about the sign!

KCL @ node a:

$$1A + 2A + 4A + 8A = i_2$$

$$\boxed{i_2 = 15A}$$

$$i_0 = 1A$$

KCL @ node b:
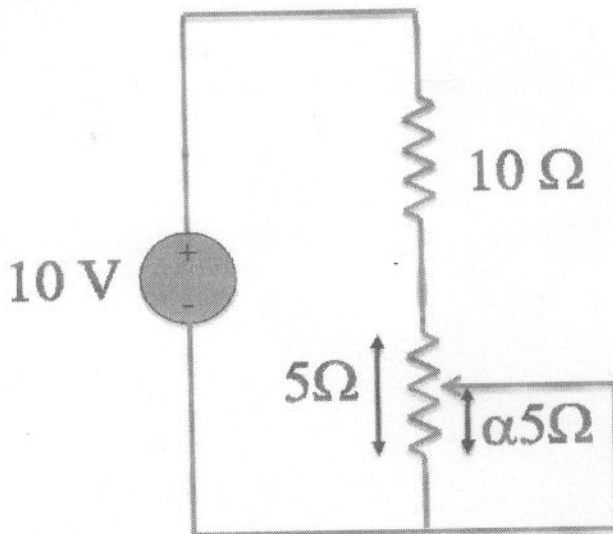
$$i_2 = 5i_0 + 13A + i_1$$

$$15A = 5A + 13A + i_1$$

$$\boxed{-3A = i_1}$$

$$V_1 = 1k\Omega \cdot i_1 = 1k\Omega \cdot (-3A)$$

$$\boxed{= -3kV}$$

$$V_2 = 10k\Omega \cdot 15A = \boxed{150kV}$$

PROBLEM FOUR(20 points):

In the circuit below, the wiper divides the potentiometer resistance between a 5 Ω and (1-α) 5 Ω, where 0<α<1. Find the power dissipated in the 10 Ω resistor as a function of α.

Power Dissipation : $P = IV = I^2 \cdot R$

$$I = \frac{V}{R} = \frac{10V}{10\Omega + (1-\alpha)5\Omega}$$

$$P = I^2 \cdot R$$

$$\boxed{P_{10\Omega} = \left(\frac{10V}{10\Omega + (1-\alpha)5\Omega}\right)^2 \cdot 10\Omega}$$

$$\text{where } 0 < \alpha < 1$$