

## Problems and Exercises, DC Circuits

1. For the circuit shown,

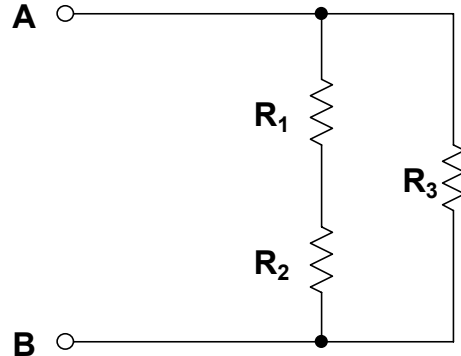
a. Calculate the equivalent resistance  $R_{eq}$  for:  $R_1 = 8k\Omega$ ,  $R_2 = 2k\Omega$ , and  $R_3 = 12k\Omega$ . (Ans.  $R_{eq} = 60k\Omega/11$ .)

b. Calculate the equivalent resistance  $R_{eq}$  for:  $R_1 = 12k\Omega$ ,  $R_2 = 8k\Omega$ , and  $R_3 = 2k\Omega$ . (Ans.  $R_{eq} = 20k\Omega/11$ .)

c. Calculate the equivalent resistance  $R_{eq}$  for:  $R_1 = 2k\Omega$ ,  $R_2 = 12k\Omega$ , and  $R_3 = 8k\Omega$ . (Ans.  $R_{eq} = 56k\Omega/11$ .)

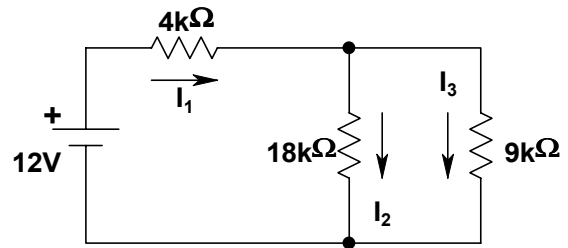
d. Calculate  $R_2$  for:  $R_1 = 10k\Omega$ ,  $R_3 = 15k\Omega$ , and  $R_{eq} = 12k\Omega$ . (Ans.  $R_2 = 50k\Omega$ .)

e. Calculate  $R_1$  for:  $R_2 = 15k\Omega$ ,  $R_3 = 10k\Omega$ , and  $R_{eq} = 7.5k\Omega$ . (Ans.  $R_1 = 15k\Omega$ .)



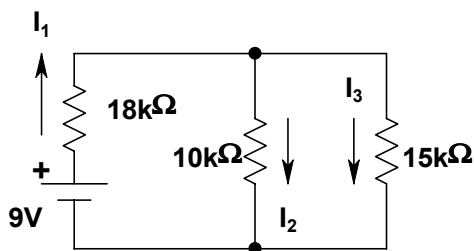
2. Calculate the currents in each resistor in the circuit shown:

(Ans.  $I_1 = +6/5$  ma.,  $I_2 = +2/5$  ma.,  $I_3 = +4/5$  ma.)



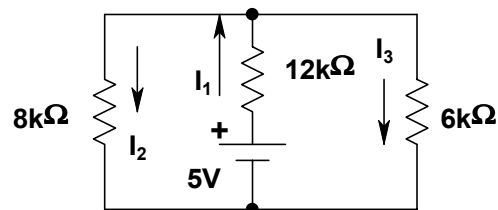
3. Calculate the currents in each resistor in the circuit shown:

(Ans.  $I_1 = +3/8$  ma.,  $I_2 = +9/40$  ma.,  $I_3 = +3/20$  ma.)



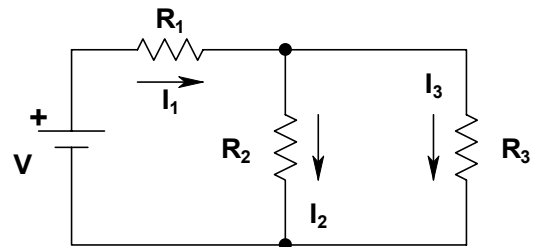
4. Calculate the currents in each resistor in the circuit shown:

(Ans.  $I_1 = +35/108$  ma.,  $I_2 = +5/36$  ma.,  $I_3 = +5/27$  ma.)



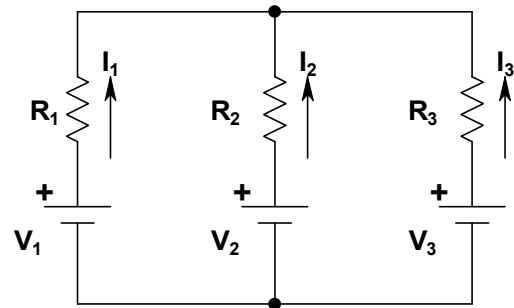
5. Calculate the currents in each resistor in the circuit shown:

- a. For  $V = 12V$ ,  $R_1 = 10k\Omega$ ,  $R_2 = 18k\Omega$ , and  $R_3 = 15k\Omega$ . (Ans.  $I_1 = +33/50$  ma.,  $I_2 = +3/10$  ma.,  $I_3 = +9/25$  ma.)
- b. For  $V = 15V$ ,  $R_1 = 10k\Omega$ ,  $R_2 = 4k\Omega$ , and  $R_3 = 12k\Omega$ . (Ans.  $I_1 = +15/13$  ma.,  $I_2 = +45/52$  ma.,  $I_3 = +15/52$  ma.)



6. See each question relating to the circuit shown:

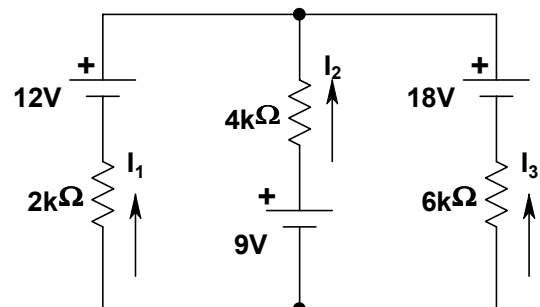
- a. For  $V_1 = 12V$ ,  $V_2 = 5V$ ,  $V_3 = 9V$ ,  $R_1 = 6k\Omega$ ,  $R_2 = 12k\Omega$ , and  $R_3 = 8k\Omega$ ; Calculate  $I_1$ ,  $I_2$ , and  $I_3$ . (Ans.  $I_1 = +23/54$  ma.,  $I_2 = -10/27$  ma.,  $I_3 = -1/18$  ma.)
- b. For  $V_1 = 12V$ ,  $V_2 = 24V$ ,  $V_3 = 9V$ ,  $R_1 = 15k\Omega$ ,  $R_2 = 10k\Omega$ , and  $R_3 = 18k\Omega$ ; Calculate  $I_1$ ,  $I_2$ , and  $I_3$ . (Ans.  $I_1 = -31/100$  ma.,  $I_2 = +147/200$  ma.,  $I_3 = -17/40$  ma.)



- c. For  $V_1 = 12V$ ,  $V_2 = 9V$ ,  $I_3 = -0.75$  ma,  $R_1 = 8k\Omega$ ,  $R_2 = 12k\Omega$ , and  $R_3 = 9k\Omega$ ; Calculate  $I_1$ ,  $I_2$ , and  $V_3$ . (Ans.  $I_1 = +0.6$  ma.,  $I_2 = +0.15$  ma.,  $V_3 = +0.45V$ .)
- d. For  $V_1 = 12V$ ,  $V_2 = 9V$ ,  $I_3 = +0.75$  ma,  $R_1 = 8k\Omega$ ,  $R_2 = 12k\Omega$ , and  $R_3 = 9k\Omega$ ; Calculate  $I_1$ ,  $I_2$ , and  $V_3$ . (Ans.  $I_1 = +0.3$  ma.,  $I_2 = +0.45$  ma.,  $V_3 = +21.15V$ .)
- e. For  $V_1 = 12V$ ,  $I_2 = -4$  ma,  $V_3 = 9V$ ,  $R_1 = 6k\Omega$ ,  $R_2 = 12k\Omega$ , and  $R_3 = 8k\Omega$ ; Calculate  $I_1$ ,  $V_2$ , and  $I_3$ . (Ans.  $I_1 = +2.5$  ma.,  $V_2 = -51V$ .,  $I_3 = +1.5$  ma.)
- f. For  $V_1 = 24V$ ,  $V_2 = 9V$ ,  $V_3 = 12V$ ,  $R_1 = 10k\Omega$ ,  $R_2 = 18k\Omega$ , and  $I_3 = -0.31$  ma; Calculate  $I_1$ ,  $I_2$ , and  $R_3$ . (Ans.  $I_1 = +0.735$  ma.,  $I_2 = -0.425$  ma.,  $R_3 = 15k\Omega$ .)

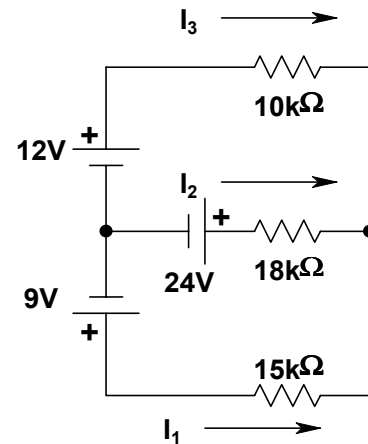
7. For the circuit shown:

- a. Calculate the currents in each resistor: (Ans.  $I_1 = -3/22$  ma.,  $I_2 = -9/11$  ma.,  $I_3 = +21/22$  ma.)
- b. Calculate the resistance instead of the  $6k\Omega$  to make  $I_1 = 0$ : (Ans.  $8k\Omega$ .)
- c. Calculate the resistance instead of the  $4k\Omega$  to make  $I_1 = 0$ : (Ans.  $3k\Omega$ .)

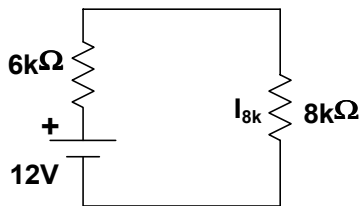


7. Calculate the currents in each resistor in the circuit shown:

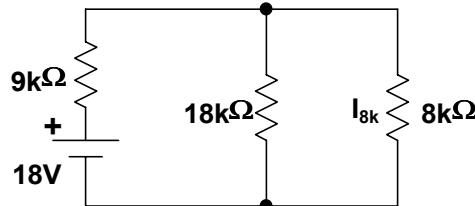
(Ans.  $I_1 = -0.34 \text{ ma.}$ ,  $I_2 = +0.55 \text{ ma.}$ ,  $I_3 = -0.21 \text{ ma.}$ )



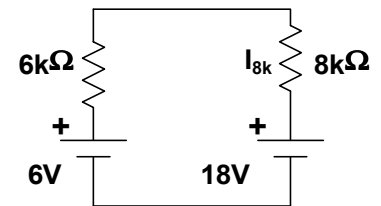
8. For which of the circuits shown below is the current in the  $8k\Omega$  resistor **NOT** the same? (Ans. c.)



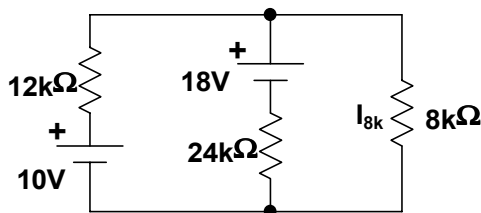
a.



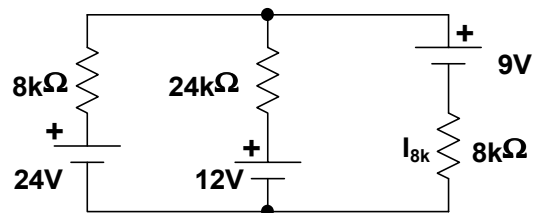
b.



c.



d.



e.

9. Calculate the current in the  $8k$  resistor for the circuits shown in #8. (Ans.  $6/7 \text{ ma.}$  “down” in all cases but c. where it is  $6/7 \text{ ma.}$  “up.”)