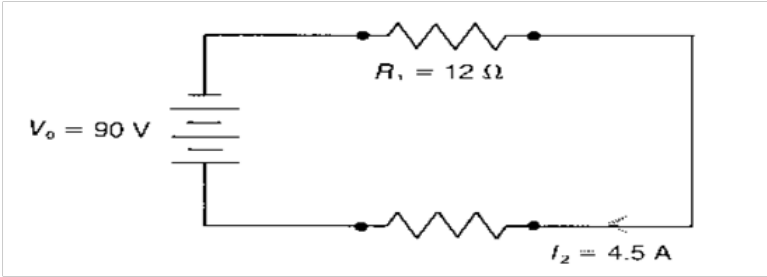
Section 10: Circuit Analysis I (Simple Series and Parallel Circuits)

1. Solve the circuit.



R_1	$12\ \Omega$	I_1	$4.5\ A$ ①	V_1	$54\ V$ ②
R_2	$8\ \Omega$ ④	I_2	$4.5\ A$	V_2	$36\ V$ ⑤
R_3	/	I_3	/	V_3	/
R_T	$20\ \Omega$ ③	I_T	$4.5\ A$ ①	V_T	$90\ V$

① $I_1 = I_2 = I_T = 4.5\ A$

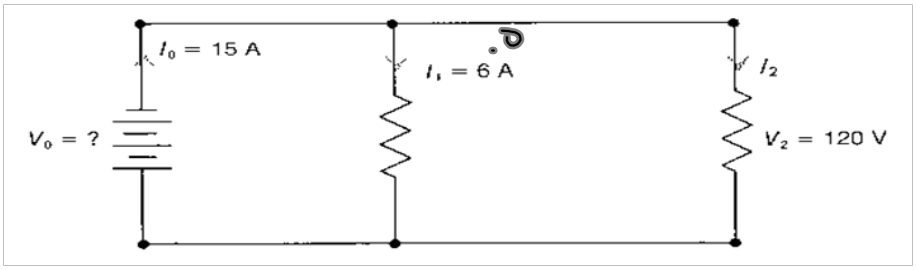
② $V_1 = IR = (4.5\ A)(12\ \Omega) = 54\ V$

③ $R_T = \frac{V}{I} = \frac{90\ V}{4.5\ A} = 20\ \Omega$

④ $R_2 = R_T - R_1 = 20\ \Omega - 12\ \Omega = 8\ \Omega$

⑤ $V_2 = V_T - V_1 = 90\ V - 54\ V = 36\ V$

2. Solve the circuit.



R_1	20Ω ④	I_1	6A	V_1	120V ③
R_2	13Ω ②	I_2	9A ①	V_2	120V
R_3		I_3		V_3	
R_T	8Ω	I_T	15A	V_T	120V ③

① $I_2 = 15A - 6A = 9A$

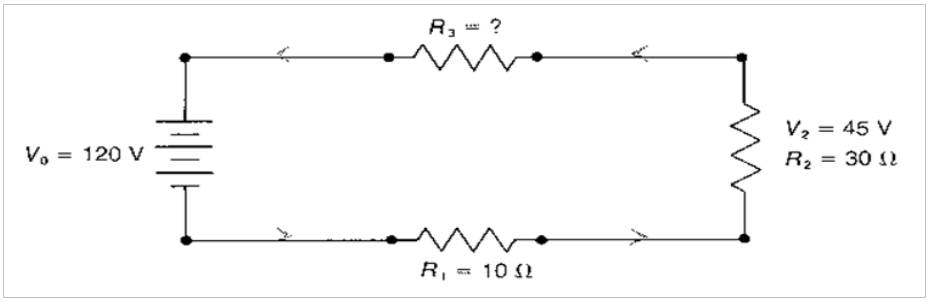
② $R_2 = \frac{V_2}{I_2} = \frac{120V}{9A} = 13.3\Omega = 13\Omega$

③ $V_T = V_1 = V_2 = 120V$

④ $R_1 = \frac{V}{I} = \frac{120V}{6A} = 20\Omega$

⑤ $R_T = \frac{V}{I} = \frac{120V}{15A} = 8\Omega$

3. Solve the circuit.



R_1	10 Ω	I_1	1.5 A	V_1	15 V
R_2	30 Ω	I_2	1.5 A	V_2	45 V
R_3	40 Ω	I_3	1.5 A	V_3	60 V
R_T	80 Ω	I_T	1.5 A	V_T	120 V

① $I_2 = \frac{V_2}{R_2} = \frac{45V}{30\Omega} = 1.5A$

② $I_1 = I_2 = I_3 = I_T = 1.5A$

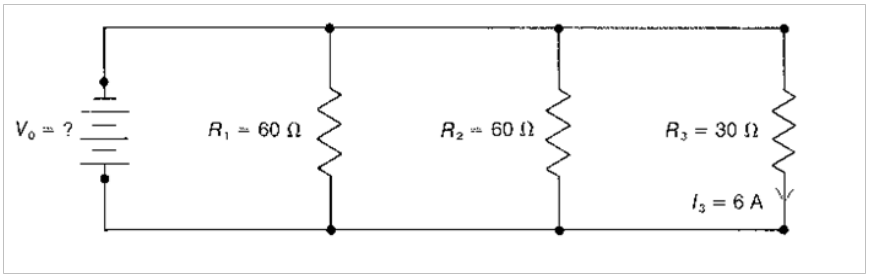
③ $V_1 = IR = (1.5A)(10\Omega) = 15V$

④ $R_T = \frac{V}{I} = \frac{120V}{1.5A} = 80\Omega$

⑤ $R_3 = 80\Omega - 10\Omega - 30\Omega = 40\Omega$

⑥ $V_3 = 120V - 15V - 45V = 60V$

4. Solve the circuit.



R_1	60 Ω	I_1	3 A	V_1	180 V
R_2	60 Ω	I_2	3 A	V_2	180 V
R_3	30 Ω	I_3	6 A	V_3	180 V
R_T	15 Ω	I_T	12 A	V_T	180 V

① $\frac{1}{R_T} = \frac{1}{60\Omega} + \frac{1}{60\Omega} + \frac{1}{30\Omega}$

$R_T = 15\Omega$

② $V_3 = IR = (6A)(30\Omega) = 180V$

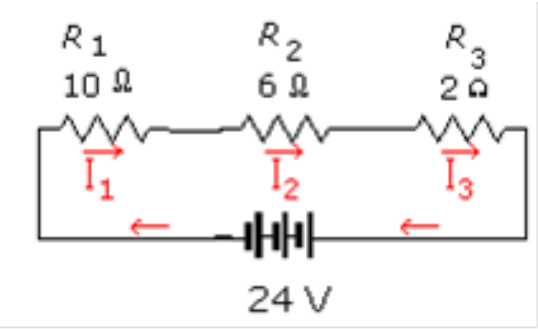
③ $V_T = V_1 = V_2 = V_3 = 180V$

④ $I_1 = \frac{V}{R} = \frac{180V}{60\Omega} = 3A$

⑤ $I_2 = \frac{180V}{60\Omega} = 3A$

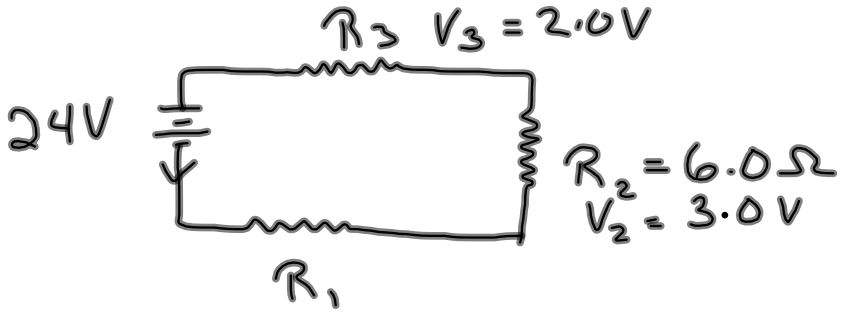
⑥ $I_T = \frac{180V}{15\Omega} = 12A$

5. Three resistors of 10.0 Ω, 6.0 Ω and 2.0 Ω are connected in series across a 24 V battery. Find the current through and the voltage drop across each resistor.



R_1	10 Ω	I_1	1.3 A	V_1	13 V
R_2	6Ω	I_2	1.3 A	V_2	7.8 V
R_3	2 Ω	I_3	1.3 A	V_3	2.6 V
R_T	18 Ω	I_T	1.3 A	V_T	24 V

6. Three resistors are connected in series. $R_2 = 6.0\ \Omega$. The battery is 24 V and the voltage drop across resistor 2 is 3.0 V and the voltage drop across resistor 3 is 2.0 V. Draw a diagram of the circuit and find R_1, R_3, V_1 and I_1.



R_1	38 Ω	I_1	0.50A	V_1	19 V
R_2	6.0Ω	I_2	0.50A	V_2	3.0V
R_3	4.0Ω	I_3	0.50A	V_3	2.0V
R_T	48 Ω	I_T	0.50A	V_T	24V

① $V_1 = 24V - 3V - 2V = 19V$

② $I_2 = \frac{V}{R} = \frac{3V}{6\Omega} = 0.50A$

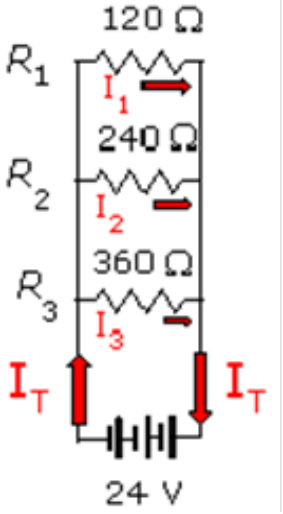
③ $I_1 = I_2 = I_3 = I_T = 0.50A$

④ $R_1 = \frac{V}{I} = \frac{19V}{0.5A} = 38\Omega$

⑤ $R_3 = \frac{2V}{0.5A} = 4.0\Omega$

⑥ $R_T = \frac{24V}{0.5A} = 48\Omega$

7. A parallel combination of 120 Ω, 240 Ω, and 360 Ω is connected across a 24.0 V power supply. Find the total current supplied by the battery.

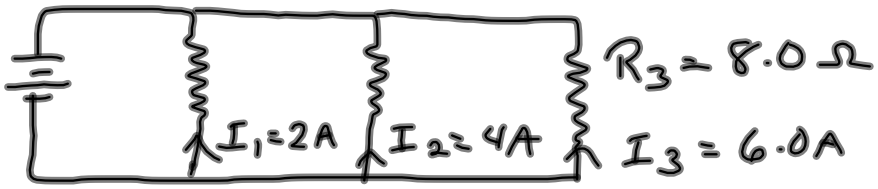


R_1	120 Ω	I_1	0.20 A	V_1	24 V
R_2	240 Ω	I_2	0.10 A	V_2	24 V
R_3	360 Ω	I_3	0.067 A	V_3	24 V
R_T	65 Ω	I_T	0.37 A	V_T	24 V

8. Three resistors are connected in parallel

$R_3 = 8.0\Omega,\ I_1 = 2.0A,\ I_2 = 4.0A,\ I_3 = 6A$

Draw the circuit and find $V_T, V_1, I_T, R_1, R_2, and\ R_T$



R_1	24Ω	I_1	2A	V_1	48V
R_2	12Ω	I_2	4A	V_2	48V
R_3	8Ω	I_3	6A	V_3	48V
R_T	4Ω	I_T	12A	V_T	48V

① $V_3 = IR = (6A)(8\Omega) = 48V$

② $V_1 = V_2 = V_3 = V_T = 48V$

③ $I_T = 2A + 4A + 6A = 12A$