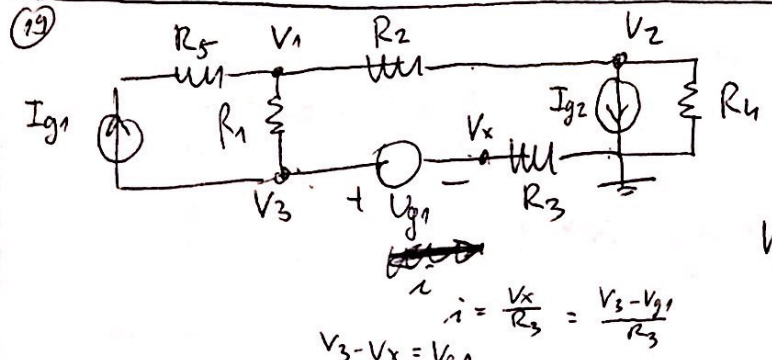


$$i_t = i_2 - i_1(1 + \beta_0)$$

$$i_t = \frac{V_t}{R_2} + \frac{V_t(1 + \beta_0)}{R_1}$$

R_2 R_1



$$V_1: \left(\frac{1}{R_1} + \frac{1}{R_2}\right)V_1 - \frac{1}{R_2}V_2 - \frac{1}{R_1}V_3 = I_{g1}$$

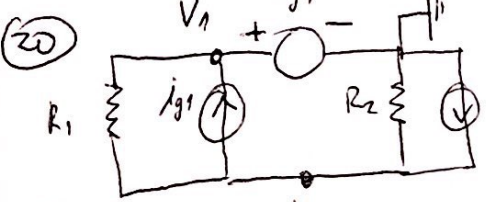
$$V_2: \left(\frac{1}{R_2} + \frac{1}{R_4}\right)V_2 - \frac{1}{R_2}V_1 = -I_{g2}$$

$$V_3: \left(\frac{1}{R_1} + \frac{1}{R_3}\right)V_3 = \frac{1}{R_1}V_1 = -I_{g1} + \frac{V_{g1}}{R_3}$$

$$i = \frac{V_x}{R_3} = \frac{V_3 - V_{g1}}{R_3}$$

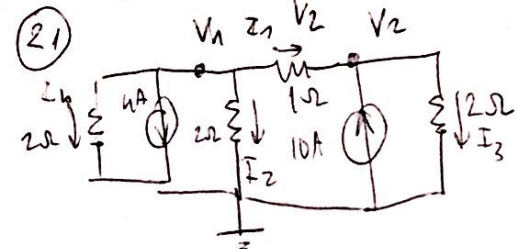
$$V_3 - V_x = V_{g1}$$

$$V_x = V_3 - V_{g1}$$



$$V_1 = V_{g1}$$

$$V_2: \left(\frac{1}{R_1} + \frac{1}{R_2}\right)V_2 - \frac{1}{R_1}V_1 = I_{g2} - I_{g1}$$



$$V_1: V_1 \left(\frac{1}{20} + \frac{1}{20} + \frac{1}{1}\right) - V_2 \cdot \frac{1}{1} = -4A$$

$$V_2: V_2 \left(\frac{1}{1} + \frac{1}{2}\right) - \frac{1}{2}V_1 = 10A$$

$$2V_1 - V_2 = -4V / (4A)$$

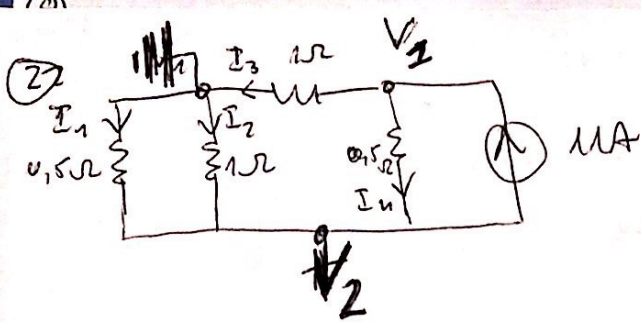
$$3V_2 - 2V_1 = 20V$$

~~2V1 + 2~~

$$2V_2 = 16V$$

$V_2 = 8V$	$V_1 = 2V$
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- $I_1 = -6A$
- $I_2 = 1A$
- $I_3 = 4A$
- $I_4 = 1A$



$$V_1 \left(\frac{1}{1\Omega} + \frac{1}{\frac{1}{2}\Omega} \right) - \frac{1}{\frac{1}{2}\Omega} \cdot V_2 = 11A$$

$$V_2 \left(\frac{1}{\frac{1}{2}\Omega} + \frac{1}{\frac{1}{2}\Omega} + \frac{1}{1\Omega} \right) - \frac{1}{\frac{1}{2}\Omega} V_1 = -11A$$

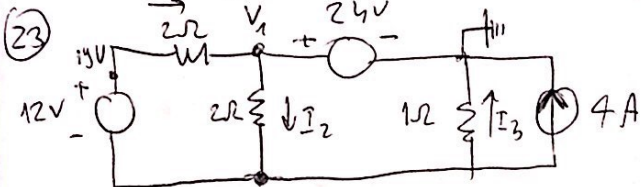
$$3V_1 - 2V_2 = 11 \quad / \cdot 2 \quad 6V_1 - 4V_2 = 22$$

$$-2V_1 + 5V_2 = -11 \quad / \cdot 3 \quad -6V_1 + 15V_2 = -33$$

$$11V_2 = -11 \quad \boxed{V_2 = -1V}$$

$$\boxed{V_1 = 3V}$$

$$I_1 = -\frac{V_2}{\frac{1}{2}\Omega} = 2A \quad I_2 = 1A \quad I_3 = 3A \quad I_4 = 8A$$

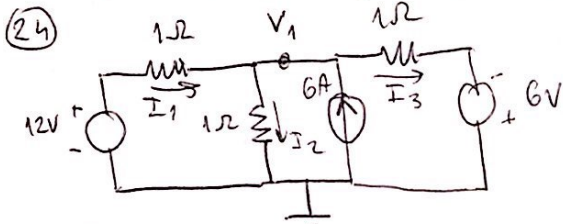


$$V_1 = 24V$$

$$V_2 \left(\frac{1}{2\Omega} + \frac{1}{1\Omega} \right) - V_1 \left(\frac{1}{2\Omega} + \frac{1}{2\Omega} \right) = -4A - 6A$$

$$V_1 = 24V \quad V_2 = 7V \quad \boxed{V_2 = 7V \quad V_1 = 24V}$$

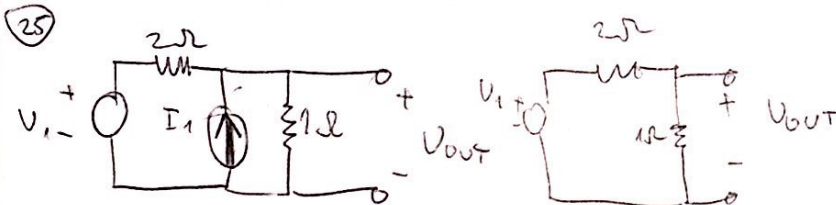
$$I_1 = -2.5A \quad I_2 = 8.5A \quad I_3 = 7A$$



$$V_1 \left(\frac{1}{1\Omega} + \frac{1}{1\Omega} + \frac{1}{1\Omega} \right) = 6A + 12A - 6A$$

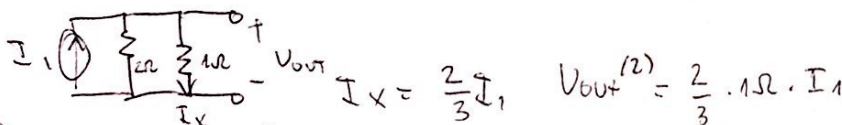
$$\boxed{V_1 = 4V}$$

$$I_1 = 8A \quad I_2 = 4A \quad I_3 = 10A$$



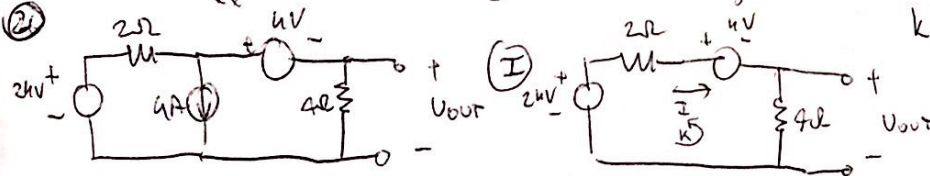
$$V_{out}^{(1)} = \frac{1}{3} V_1$$

$$V_{out} = \frac{1}{3} V_1 + \frac{2}{3} I_1$$



$$I_x = \frac{2}{3} I_1 \quad V_{out}^{(2)} = \frac{2}{3} \cdot 1\Omega \cdot I_1$$

$$\frac{30}{10} = \frac{16}{24}$$



$$k: 6I = 20$$

$$I = \frac{10}{3}$$

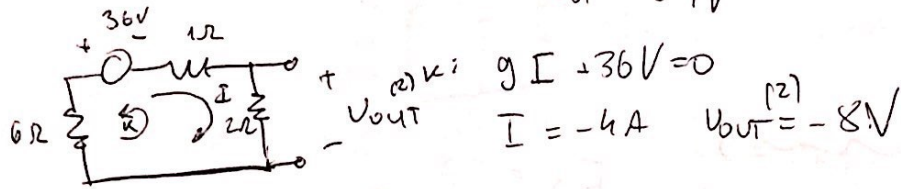
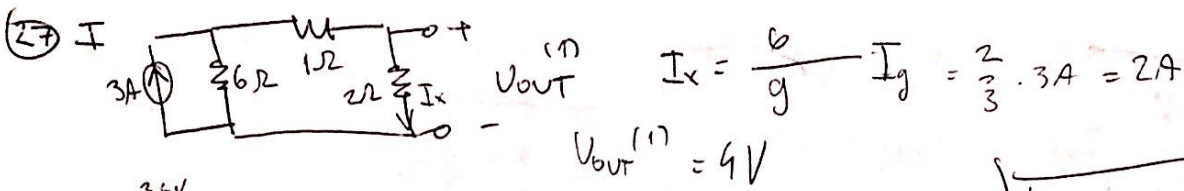
$$V_{out}^{(1)} = \frac{40}{3} V$$



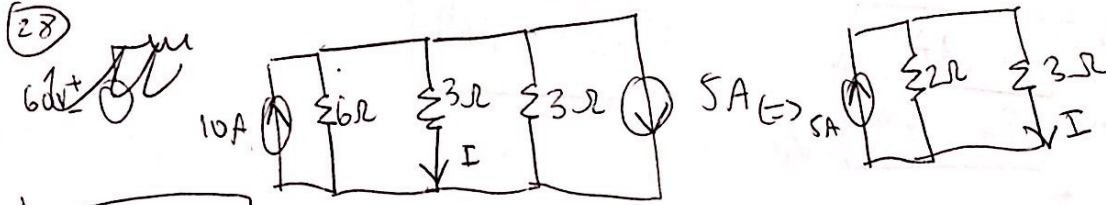
$$I_x = -\frac{2}{6} \cdot I = -\frac{4}{3} A$$

$$V_{out} = \frac{24}{3} = \underline{\underline{8V}}$$

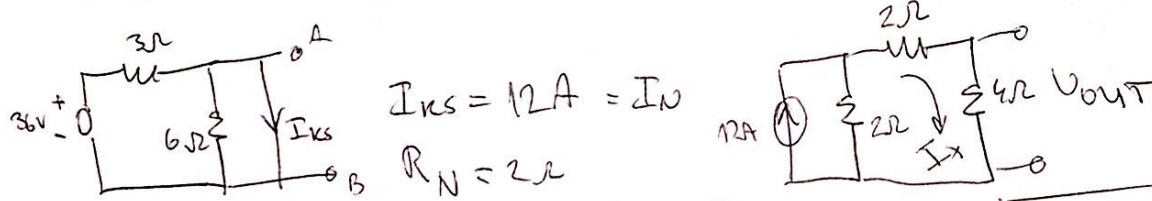
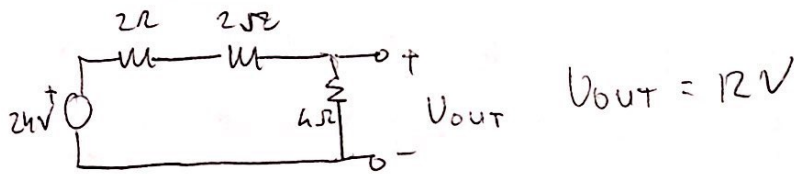
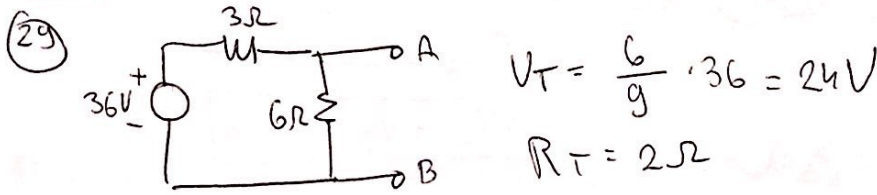
$$V_{out}^{(2)} = -\frac{16}{3} V$$



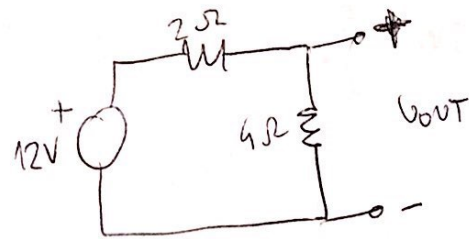
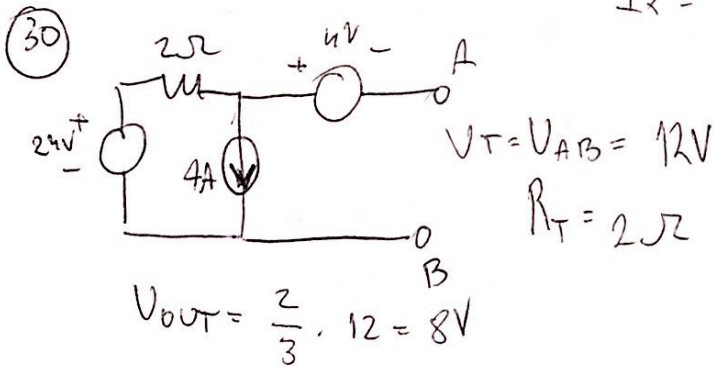
$V_{out} = -4V$



$I = 2A$



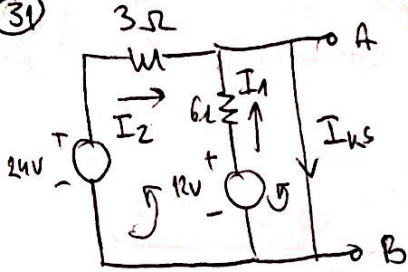
$I_x = \frac{2}{8} \cdot 12A = 3A$ $V_{out} = 12V$



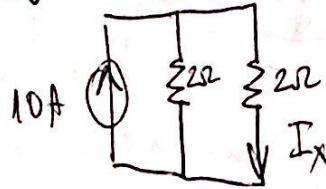
2

5

31



$I_{ks} = 8A = I_N$
 $R_N = 2\Omega$



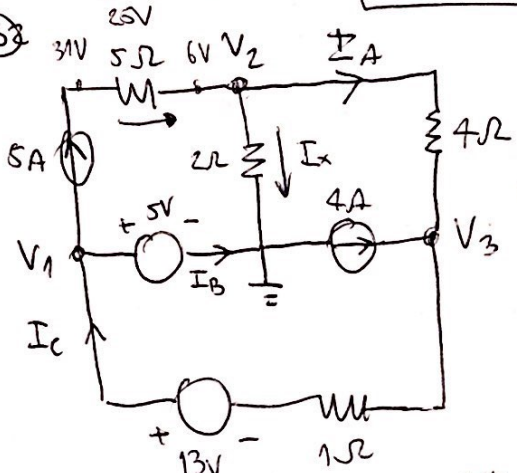
$12V - 6\Omega \cdot I_1 + 3\Omega I_2 - 24V = 0$

$I_1 \cdot 6\Omega = -12V \Rightarrow I_1 = 2A$

$I_2 \cdot 3\Omega = 24V \Rightarrow I_2 = 8A$

$I_x = 5A$
 $P_{2\Omega} = 50W$

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$\frac{1}{4\Omega} V_1 - \frac{1}{4\Omega} V_3 = (\frac{1}{4\Omega} + \frac{1}{1\Omega}) V_3 - \frac{1}{4\Omega} V_2 - \frac{1}{1\Omega} V_1 = 4 - 13A$

$V_1 = 5V$

$\frac{5}{4} V_3 - \frac{1}{4} V_2 = -4$

$5V_3 - V_2 = -16$

$(\frac{1}{2\Omega} + \frac{1}{4\Omega}) V_2 - \frac{1}{4\Omega} V_3 = 5A$

$\frac{3}{4} V_2 - \frac{1}{4} V_3 = 5 \Rightarrow 3V_2 - V_3 = 20$

$5V_3 - V_2 = -16$
 $-V_3 + 3V_2 = 20 \cdot 5$

0 9 10
100
16
84

$I_x = 3A$

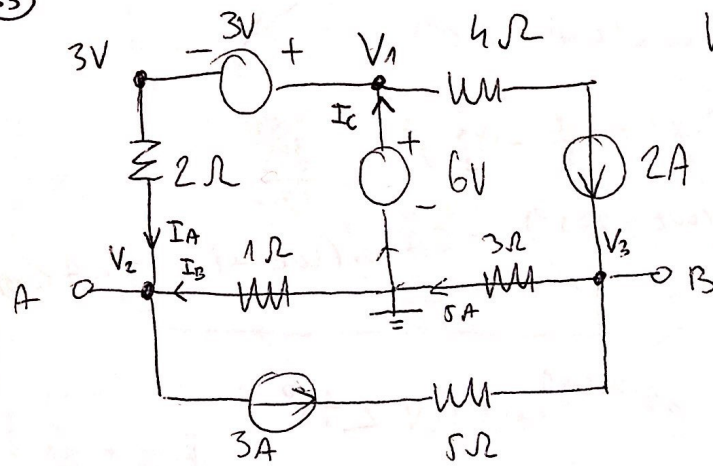
$14V_2 = 84$

$V_1 = 5V \quad V_2 = 6V \quad V_3 = -2V$

$I_x + I_A = 5A$
 $I_A = 2A \quad I_C = 6A \quad I_B = 1A$

$P_{5V} = -5W \quad P_{4A} = -8W \quad P_{13V} = 78W \quad P_{5A} = 26.5 = 130W$

23



$$V_1 = 6V$$

$$V_2 \cdot \left(\frac{1}{1\Omega} + \frac{1}{2\Omega} \right) - \frac{1}{2\Omega} V_1 = -3A - 2A$$

$$V_3 \left(\frac{1}{3\Omega} \right) = 5A$$

$$\frac{3}{2} V_2 = -\frac{3}{2}$$

$$V_3 = 15V$$

$$V_2 = -1V$$

$$V_1 = 6V$$

$$I_A = 2A \quad I_B = 1A \quad I_C = 4A$$

$$U_{AB} = -16V = U_T$$

$$\frac{2}{3}\Omega + \frac{9}{3}\Omega = \frac{11}{3}\Omega$$

$$R_T = \frac{11}{3}\Omega$$

B2

B3