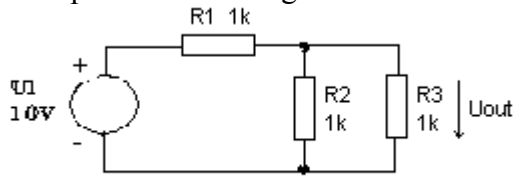
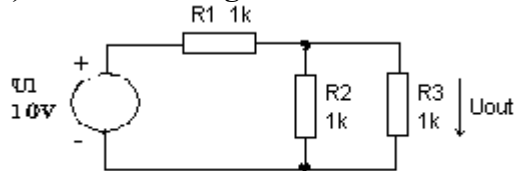


## Electric circuits solution

Example: Find voltage  $U_{out}$  in the following circuit!



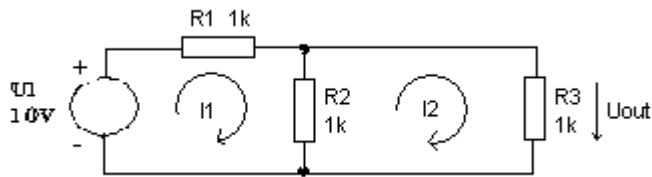
### a) Solution using Thevenin theorem



Circuit is simplified to voltage divider

$$\text{Result is } U_{out} = (0.5 \cdot 10^3 / 1.5 \cdot 10^3) 10 \text{ [V]} = 3.33 \text{ [V]}$$

### b) Solution using method of the loop currents



For each loop we write one equation using Kirchhoff's voltage law.

$$U_1 = R_1 I_1 + R_2 (I_1 - I_2)$$

$$0 = R_2 (I_2 - I_1) + R_3 I_2$$

$$U_1 = (R_1 + R_2) I_1 - R_2 I_2$$

$$0 = -R_2 I_1 + (R_2 + R_3) I_2$$

We can write determinants

$$\begin{vmatrix} R_1 + R_2 & -R_2 \\ -R_2 & R_2 + R_3 \end{vmatrix} = 3 \cdot 10^6 \quad \begin{vmatrix} R_1 + R_2 & U_1 \\ -R_2 & 0 \end{vmatrix} = 10^4$$

$$I_2 = 10^4 / (3 \cdot 10^6) = 3.33 \cdot 10^{-3} = 3.33 \text{ [mA]}$$

$$\text{Result is } U_{out} = R_3 I_2 = 3.33 \text{ [V]}$$