



## Hint 2

**IMPORTANT!** The next task is both a hint and an alternative to the main task. Three important points:

1. You can continue to send the solution to the main problem.
2. At any moment before the final deadline you can start to solve the Alternative problem. If you do so, at the beginning of the solution write: *I am doing the Alternative problem!* In this case a penalty coefficient for the Alternative problem is

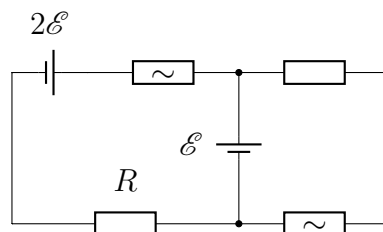
$$0,7 \cdot \sum_i \frac{k_i \cdot p_i}{10},$$

where  $p_i$  is a point for the problem item, and  $k_i$  is a penalty coefficient for the corresponding problem's item at the moment of moving to the Alternative problem. In other words, maximal points for the alternative problem equals to the maximal points you can gain at the moment of moving to the alternative one multiplied by 0,7. Also, we remind you that a penalty coefficient can't be less than 0,1. Solutions of the main problems from that moment will not be checked. Be careful!

3. The task consists of several items. The penalty multiplier earned by **before** is applied to all points. In the future, each item is evaluated as a separate task. If you send a solution without any item, this item's solution is considered as Incorrect. For more information about scoring points for composite tasks, see the rules of the Cup.

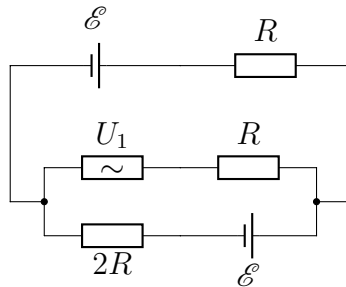
## Alternative problem

1. (3 points) The electrical circuit shown in the figure below contains two identical nonlinear elements (NE). The current-voltage characteristics of the NE are given by the equation  $I = \alpha U^2$ . Consider all parameters indicated in the figure as known. Determine the currents in the circuit.

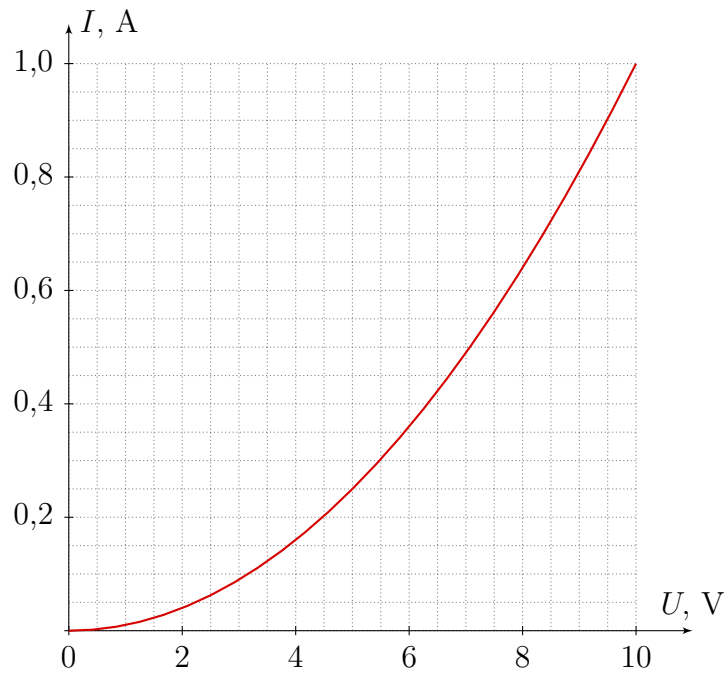


2. The electrical circuit shown in the figure below contains a nonlinear element (NE). Every parameter shown in the figure should be considered as known. Circuit parameters:  $\mathcal{E} = 10 \text{ V}$ ,  $R = 10 \Omega$ .

- a. (2 points) Find the dependency of the current on the voltage  $I(U)$  in the nonlinear element in the given circuit.



The current-voltage characteristic of the NE is shown in the graph below.



- b. (1 point) Find the value of current flowing through the nonlinear element.
3. Determine the readings of the
- a. (2 points) Ammeter
- b. (2 points) Voltmeter

connected to the  $AB$  contacts of the circuit shown in the figure below.

