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 **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. **Since switching to an alternative selection, there is no opportunity to return to solving the main task.** Also, after switching to an alternative task **the points for the main task are reset**.

Alternative task

The grinding in the corridor begins to subside little by little, but you prudently do not rush to leave the place that was once used as an office. Having carefully examined the videographer, clicking all the toggle switches and examining the map, you wait for the noise in the corridor to subside to zero.

Mechanically opening the lid of the breguet, you see that the watch is standing still. There is a feeling that you need to be surprised, but this place has taught you not to do it. You phlegmatically decide that since time stands still, it must either be spent usefully or killed. In the absence of anything better, you begin to study the cabinet in more detail and soon notice that the breguet's hands move with (or maybe after?) you. After making a few confusing movements around the office and closely following the second hand of the clock, you realize that it does not move by chance, but points to the same place in the office.

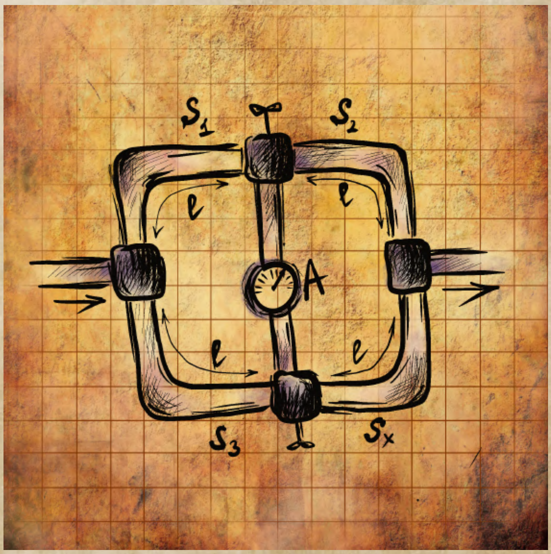
Inside you, everything becomes wobbly from recent memories of what was in the corridor, but you still go to the part of the wall of the office that the clock hands point to. Having carefully examined it, you notice that one of the wall tiles protrudes slightly more than the others. With a trembling hand, you press it and hear an old mechanism triggered, and an ingenious system of levers and counterweights opens a small hiding place.

You turn up the light of the gas-discharge lamp and see an old notebook lying in it. Carefully leafing through it, you realize that these are the drafts of the one who worked here on all these mechanisms that fill this damn tunnel.

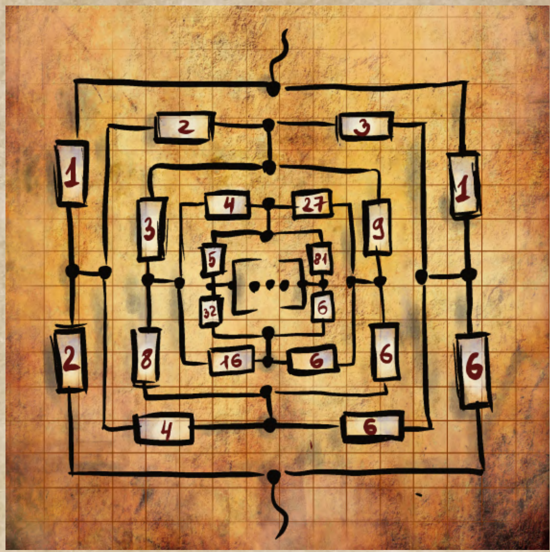
Notes from the notebook

1. *(3 points)* Two very large and wide reservoirs are filled with water to heights h_1 and h_2, respectively. You have 2 pipes with cross-sectional areas S_1 and S_2 and lengths l_1 and l_2, respectively. With what velocities are you able to move water from one reservoir to another at the first moment of time, if you can weld any of the pipes to any of the reservoirs near its bottom, and also weld the pipes together without hindrance?

2. *(3.5 points)* What cross-sectional area of pipe S_x should be used in the system shown in the figure so that for any external pressure distribution, the flow of fluid through the meter on the central pipe A is zero?



3. *(3.5 points)* Find the resistance of the electrical circuit shown in the figure. The nominal values of the resistors are shown in the figure



4. *(0 points)* For the previous problem, draw an equivalent hydrostatic diagram.

You also have found a note on it, written in uneven and nervous handwriting: with a pressure difference Δp between the ends of a pipe with length l and radius R, the mass flow rate of the liquid is

$$Q = \frac{\Delta m}{\Delta t} = A\frac{R^4}{l}\Delta p,$$

where A is a dimensional constant, and Δm is the mass of the unknown liquid passing through the cross-section of the pipe in time Δt.