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

Tasks that are rated at zero points are exercises! You don't need to send their solutions!

1. (*0 points*) Determine the position of the center of mass of a uniform semicircle.
2. (*0 points*) Determine the position of the center of mass of a uniform hemisphere.
3. (*5 points*) Point masses are sequentially arranged at the vertexes of a regular N-gon, and their values form a geometric progression m, $2m$, ..., $2^{N-1}m$. The distance from the center of the polygon to any of its vertexes is R. Find the magnitude of the gravitational field strength g (acceleration of gravity) in the center of the polygon.

4. (*5 points*) The rhombus-shaped vessel is filled with water and oriented vertically. At the initial moment, the water temperature changes with the height according to a linear law from $t_1 = 0\,^\circ\mathrm{C}$ at one vertex to $t_2 = 30\,^\circ\mathrm{C}$ at the opposite. Determine the temperature t_x that will settle in the vessel after the heat exchange.