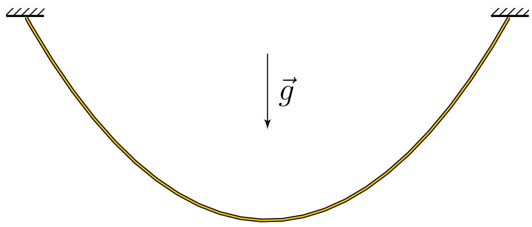
Hint 2

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.

Alternative problem

1. *(0 points)* A particle of mass m with a charge q flies into a uniform magnetic field of induction B at an angle α to the field with a speed v. Find the radius and pitch of the helix along which the particle moves.
Answer: $R = \frac{mv\sin\alpha}{qB}$, $h = \frac{2\pi mv\cos\alpha}{qB}$.
2. *(1 point)* Prove that the projection of the tensile force of a heavy string, the ends of which are fixed, on the horizontal axis does not depend on the point of the string.



3. *(4 points)* Let's consider a uniformly charged weightless string in equilibrium in a potential that depends only on the z coordinate. Let at some point the tension force of the string be equal to T_0, and the angle between the tangent to the string and the z-axis be equal to α_0. Find the tension force T at the point where the angle between the tangent to it and the z-axis is α.

4. *(5 points)* Let's consider a uniformly charged weightless string in equilibrium in a spherically symmetric potential that depends only on the distance r from the center of symmetry of the medium. Let the string tension force at a point located at a distance R_0 from the center of symmetry of the medium be equal to T_0, and the angle between the tangent to the string and the radius vector is equal to α_0. Find the tension force T at a point located at a distance R from the center of symmetry of the medium, at which the angle between the tangent to it and its radius vector is equal to α.