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. In a far system, two planets are moving in round orbits around the Sun. Their year durations are 250 and 1000 Earth's days. At the moment of the planets' opposition, the distance between them is equal to 300 million kilometers.
   a) (*1 point*) Find the radiuses of the planets' orbits.
   b) (*1 point*) In how many days the conjunction of the planets will occur if they move in one direction; in opposite directions?
2. (*4 points*)A light-emitting object `PSR B0531+21` is located at the center of the Crab Nebula. Based on the dependency of the object's radiation power on time scientists observed that it rotates around its axes with a period of 29,6 seconds. Find the average density of the object `PSR B0531+21`.

3. (*4 points*) Winnie-the-Pooh and Piglet are located on two point-like meteorites connected by the weightless rob and moving around the common center of masses (masses of the meteorites are much bigger than masses of the bear and the hog). The length of the rob is 50 m, and the period of the meteorites' rotation is 100 s. The pig shot a gun into the bear. The speed of the bullet is 300 m/s. Find the angle α to the rob that the pig should shoot in order to hit (and impress) the teddy. You can neglect the gravitational influence. Consider the bullet speed much bigger than the speed of the meteorites' rotation.