

Announcements

There is **no APC meeting on Sunday, October 11**. Our next meeting is **Sunday, October 18**, when this assignment is due. We discussed all problems from Assignment 2 except problem 8, which is reassigned here as problem 2. Problem 1 revisits Assignment 2's problem 7 using a different method. Updates, assignments, and useful links are on the [SchoolNova webpage](#). Bring written work and be ready to present at least one solution.

How to work

For each problem, show your assumptions and reasoning, not only the final answer. When relevant, check limiting cases and the dimensions of your formulas. For projectile motion, neglect air resistance and take the gravitational acceleration g to be constant.

Problems

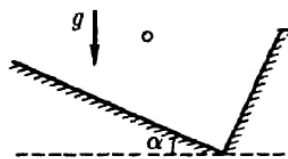
Starred problems are challenge problems.

- Two balls are launched vertically upwards from the same point with the same initial velocity v , with a relative delay Δt . How much time passes after the second ball is launched until the balls collide?
Hint: A freely falling reference frame may be helpful.
- ★ You are standing on a platform next to a train scheduled to depart at 12:00:00. It is precisely 12:00:00 by your watch, and the second-to-last carriage is already starting to pass you, going past you completely in 10 s. Then the last carriage goes past you in 8 s. The train has departed on time and it is moving with a constant acceleration. How much does your watch fall behind?
- Solve problem 11 of the 2021 F=ma exam, available on the official AAPT website:
https://www.aapt.org/Common2022/upload/2021_Fma_exam.pdf
- A ball is launched on a smooth plane inclined at 45° to the ground. The initial velocity of the ball is v , and it makes a 45° angle with the horizontal edge of the plane. What distance along the horizontal will the ball travel before hitting the ground?



- A rock is thrown with initial speed v in some direction. What will be its speed at a point with elevation h with respect to the initial point?
- A ball is initially held at height H above an infinitely long inclined plane with the inclination angle α to the horizon. The ball is released with no initial velocity. Find the distances between the points of impact between the ball and the inclined plane in the subsequent motion. Assume that all collisions are perfectly elastic.

7. A ball is bouncing back and forth between two walls of a rectangular box along the same trajectory. One of the walls makes an angle α to the ground. The time interval between two consecutive bounces is Δt . Find the speed of the ball right after the collision for both of the collision points.



- 8.★ What minimum velocity should a ball have in order to go over a rectangular house of height H and width L , if it is thrown by a teenager of height h who can choose an arbitrary position on the ground to make the throw?