

USEFUL RESOURCES

The updates, homework assignments, and useful links for APC can be found on SchoolNova's web page:  
[https://schoolnova.org/nova/classinfo?class\\_id=adv\\_phy\\_club&sem\\_id=ay2021](https://schoolnova.org/nova/classinfo?class_id=adv_phy_club&sem_id=ay2021)

The practical information about the club and contacts can be found on the same web page.

TODAY'S MEETING

Today we discussed projectile motion. Our next topic is circular motion.

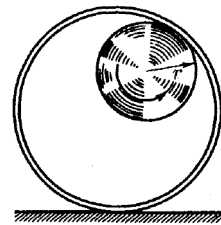
This time again the homework is split in two parts: a simpler part 1 and a more complicated part 2. Solutions of part 1 will be discussed on the next meeting as usual. As for the solutions of part 2 we may not have time to discuss them all. We encourage you to discuss the problems in the Discord channel. Problems marked with a star are in general more difficult than the ones not marked.

HOMEWORK PART 1

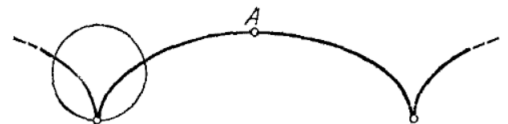
1. While listening to music on a tape a young physicist has noticed that the outer radius of the cassette tape decreased by half in 20 minutes. How long would it take after that for the outer radius to again decrease by half?



2. A wheel of radius  $r$  rolls without slipping on the internal surface of motionless a cylinder of radius  $2r$ . Find the trajectory of a particular point on the rim of the wheel.

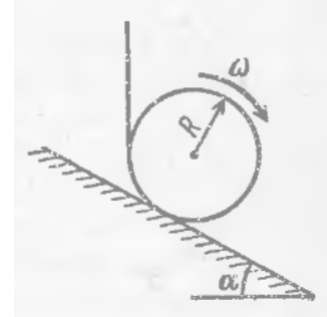


3. Find the radius of curvature of a cycloid in the highest point of its arc. One of definitions of cycloid is that it is the trajectory of a given point on the rim of a wheel which is rolling without slipping on a horizontal surface.



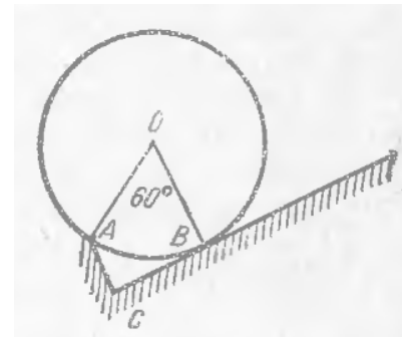
4. A spherical reservoir of radius  $R$  stands on the ground. A rock is thrown from the ground level with initial speed  $v$  in such a way that it just touches the topmost point of the reservoir. What is the smallest possible  $v$ ?
- \*5. A cyclist is riding a bicycle on a wet road after rain. Bicycle's speed is  $v$  and its' wheels have radius  $R$ . What is the maximal height reached by the water droplets flying off the wheel?

- \*6. A cylinder with a thread coiled around it is rolling down a smooth inclined plane making angle  $\alpha$  with the horizon. The upper end of the thread is attached to a fixed point. Radius of the cylinder is  $R$ . At the moment when the thread is vertical, the angular velocity of the cylinder is  $\omega$ . At this moment find
- velocity of the axis of the cylinder,
  - velocity of the point of contact of the cylinder and the plane.



#### HOMEWORK PART 2

- \*7. Because of the finite exposure needed, in a side-on photograph of the front wheel of a moving bicycle, the spokes seem blurred. However, there will be some apparently sharp points in the picture. Where are these sharp points? For the sake of simplicity, suppose that the bicycle spokes are radial.
- \*8. A ball is rolling along the edge of a rectangular gutter  $ACB$  with speed  $v$  without slipping. Distance  $AB$  is equal to the radius of the ball. Which points on the ball have the maximal speed? What is this speed equal to?



#### FOR THE NEXT MEETING

**IMPORTANT:** The next club's meeting is at 3:00pm, via Zoom, on Sunday, **November 14**.