# ADVANCED PHYSICS CLUB

FEBRUARY 7, 2021

## 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=ay2020`
The practical information about the club and contacts can be found on the same web page.

## Today's meeting

Today's homework continues the topic of rigid body rotation. Moreover, for those of you taking the $F = ma$ exam (and others, if interested) there is an additional assignment.

## Homework, $F = ma$ part

*If you participate in $F = ma$ exam this year:*

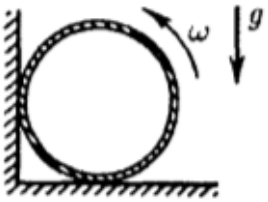
Solve the 2015 $F = ma$ exam and time yourself. Try to bring the time closer to the one at a real exam. The exam could be found here:

`https://www.aapt.org/physicsteam/2015/upload/exam1-2015-1-8.pdf`

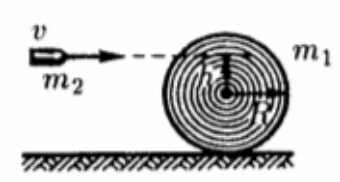
After checking your answers contact us (using Discord or the email apc@schoolnova.org) with any questions.

## Homework, the usual part

**1.** A thin-walled cylinder of radius $R$ rotating with initial angular velocity $\omega$ is placed in a corner, as shown on a picture. Friction coefficient between the sides of the corner and the cylinder is $\mu$. Find how many times will the cylinder rotate around its' axis before stopping.

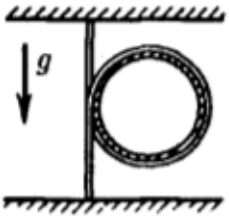



**2.** A cylinder of mass $m_1$ and radius $R$ is at rest on a horizontal plane. A bullet of mass $m_2$ flying horizontally with velocity $v$ at the height $h < R$ above the cylinder axis hits the cylinder. Assuming the collision is absolutely inelastic and $m_2 \ll m_1$, calculate the axis velocity and angular velocity of the cylinder after the collision.




**3.** A man of mass $m$ stands on the edge of a disk, rotating without friction around a vertical axis with angular velocity $\omega$. The disk has radius $R$ and moment of inertia $I$. How will the angular velocity change if the man moves from the edge to the center of the disk? How will the kinetic energy of the system change? Neglect man's size compared to the disk size.

***4.** A uniform heavy rope with ends fixed along the same vertical line is grasped around a weightless ring. What is the acceleration of the ring if it's just let go from the rest?




***5.** A uniform rod of length $l$ initially stands at rest vertically on a horizontal frictionless plane. Then it starts to fall. Find the velocity of the top part of the rod just before it hits the surface.

## For the next meeting

**IMPORTANT:** The next club's meeting is at 3:00pm, via Zoom, on Sunday, **February 21**. Good luck at the $F = ma$ exam!