

PHYS 5310
CLASSICAL MECHANICS - 2025

HOMEWORK 7

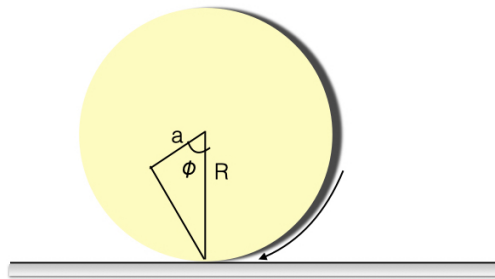
Exercise 1.

Determine the principal moments of inertia for the following homogeneous bodies:

- a) A thin rod of length l ,
- b) A sphere of radius R ,
- c) A circular cylinder of radius R and height h ,
- d) A rectangular parallelepiped of sides a , b and c ,
- e) A circular cone of height h and base radius R ,
- f) An ellipsoid of semiaxis a , b and c .

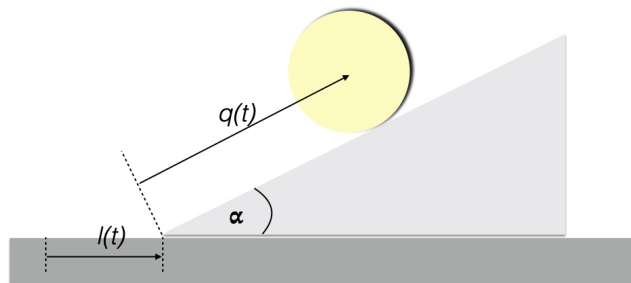
Exercise 2.

Find the kinetic energy of a non-homogeneous cylinder of radius R rolling on a plane, if the mass of the cylinder is distributed such that one of the axis of inertia is parallel to the axis of the cylinder and at a distance a from it, and the moment of inertia of that principal axis is I .



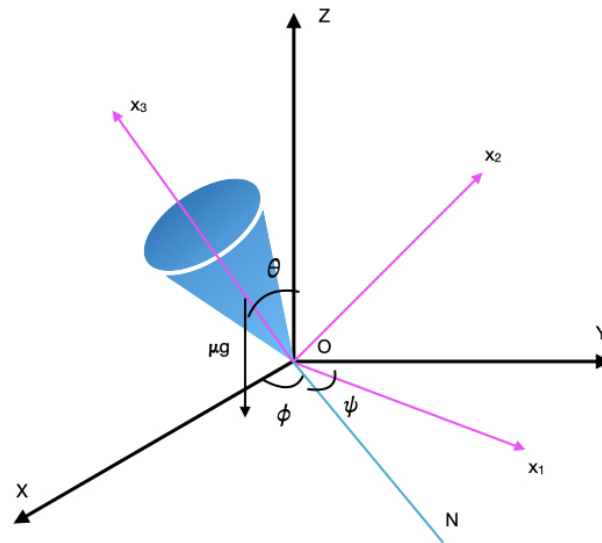
Exercise 3.

A disc is able to roll down an inclined plane without slipping under the influence of gravity. Describe the motion of the disc for a horizontal displacement imparted to the inclined plane.



Exercise 4.

Integrate the equations of motion of a heavy symmetrical top whose contact point with the ground is fixed (see figure).

**Exercise 5.**

Find the condition for the rotation of the top about a vertical axis to be stable.

Exercise 6.

Fast top.

Determine the motion of a top when the kinetic energy of its rotation about its axis is large compared with its energy in the gravitational field.