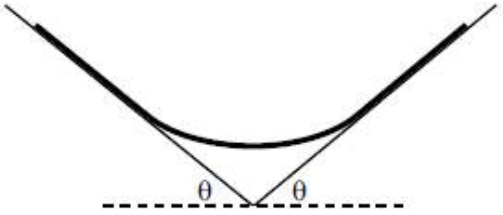
[BAUPC 2002 3번]

3. A brick is thrown (from ground level) at an angle θ with respect to the (horizontal) ground. Assume that the long face of the brick remains parallel to the ground at all times, and that there is no deformation in the ground or the brick when the brick hits the ground.

   If the coefficient of friction between the brick and the ground is μ, what should θ be so that the brick travels the maximum total horizontal distance before finally coming to rest?

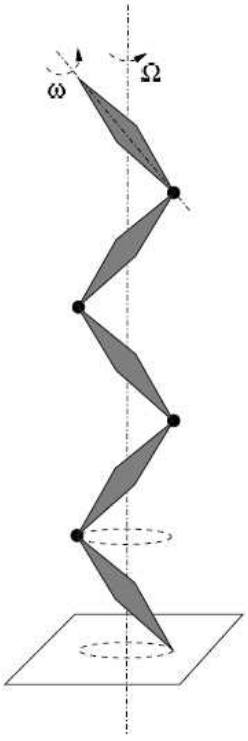
[BAUPC 2004 2번]

2. A rope rests on two platforms which are both inclined at an angle θ (which you are free to pick), as shown. The rope has uniform mass density, and its coefficient of friction with the platforms is 1. The system has left-right symmetry. What is the largest possible fraction of the rope that does not touch the platforms? What angle θ allows this maximum value?



[BAUPC 1998 5번 - 선발고사 3(3)]

5. Consider the setup of N identical cylindrically symmetric tops in the figure.

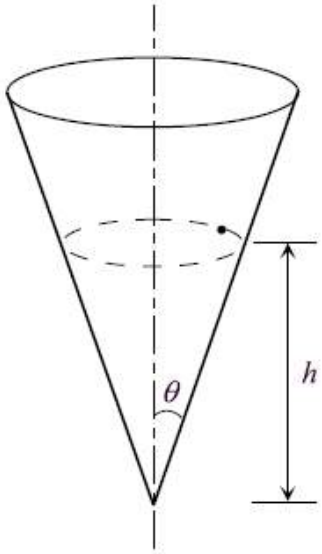


The bottom one rests on a frictionless table. Each top is connected to the one above it by a free pivot. The inclination angles of the tops are the same. The center of mass of each top is at the midpoint of its symmetry axis.

You wish to set up a very slow circular precession of the tops, where the CM of each top stays fixed while the ends travel in circles. The angular speed of the top top is ω. Find the angular speeds of all the other tops as functions of ω. (You may work in the approximation where these speeds are very large.)

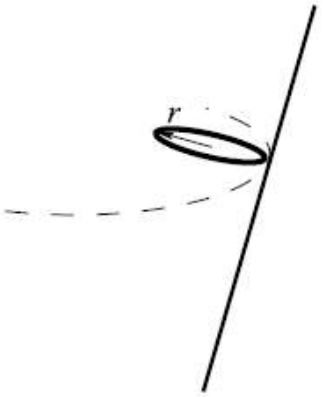
[BAUPC 1997 5번 - (b)이 선발고사 3(2)로 출제]

5. (a) (2 points) A fixed cone stands on its tip, with its axis in the vertical direction.



When viewed from the side, the cone subtends an angle of 2θ. A particle of negligible size slides on the inside surface of the cone. This surface is frictionless.
Assume conditions have been set up so that the particle moves in a circle at a height h above the tip.
What is the frequency, ω, of this circular motion?

(b) (8 points) Assume now that the surface has friction, and a small ring of radius r rolls on the surface without slipping.



Assume conditions have been set up so that (1) the point of contact between the ring and the cone moves in a circle at a height h above the tip, and (2) the plane of the ring is at all times perpendicular to the line joining the point of contact and the tip of the cone.
What is the frequency, ω, of this circular motion? How does it compare to the answer in part (a)?

Note: You may work in the approximation where r is much smaller than the radius of the circular motion, $h \tan\theta$.