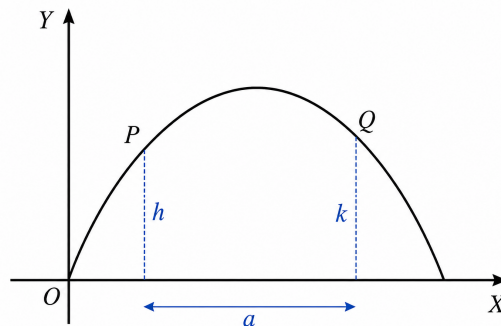


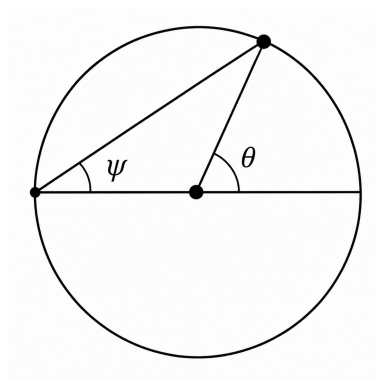
PHY201: Classical Mechanics I

Problem Set I

1. A block of mass m is observed accelerating from rest down an incline that has coefficient of friction μ and is at angle θ from the horizontal. How far will it travel in time t ?
2. A particle motion takes place towards a center of force such that the force acting on the particle obeys $F = -mk^2/x^3$. Find the time taken by the particle to travel from a point at distance d to the center of force.
3. A particle is under the influence of a force $F = -kx + kx^3/\alpha^2$. Determine the potential energy $V(x)$ and discuss the motion. What happens when the total energy $E = (1/4)k\alpha^2$?
4. A heavy particle of mass m is placed on the top of a vertical ring of radius R . Find the reaction of the ring on the particle and also the height at which the particle leaves the ring.
5. Two points P and Q have heights h and k from the horizontal and are distance a apart as shown in the figure. Show that the minimum velocity of a projectile necessary so that it passes through P and Q is $v = \sqrt{g(a + h + k)}$.



6. A point is moving a circle. Show that, at any instant, its angular velocity about a point on the circumference is half its angular velocity about the center (see the figure).



7. Show that the angular momentum of a system of particles about a general origin O is equal to the angular momentum of the system concentrated at the center of mass plus the angular momentum of the system about its center of mass.
8. Consider a particle moving in region $x > 0$ under the influence of the potential

$$V(x) = V_0 \left(\frac{a}{x} + \frac{x}{a} \right)$$

where $V_0 = 1$ J and $a = 2$ m. Plot the potential, find the equilibrium points, and determine whether they are stable or unstable equilibrium.