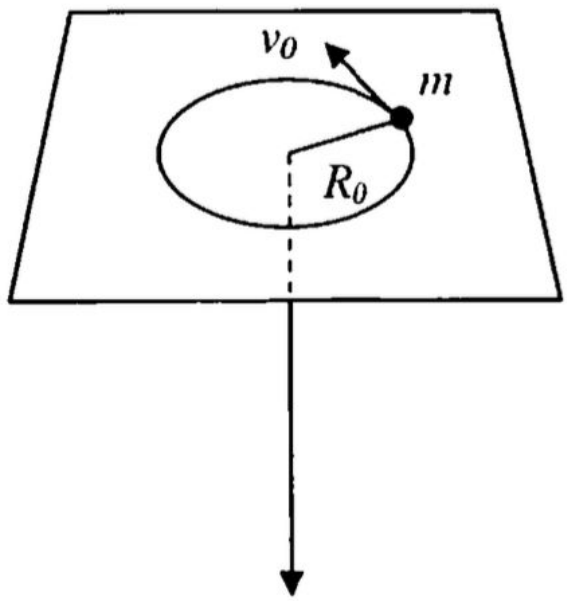
Problem 1: Newtonian Mechanics

A mass m moves in a circle on a smooth horizontal plane with velocity v_0 at a radius R_0. The mass is attached to a (massless) string which passes through a smooth hole in the plane as shown in the figure below. ("Smooth" means frictionless.)



a) What is the tension in the string?
b) What is the angular momentum of m?
c) What is the kinetic energy of m?
d) The tension in the string is increased gradually and finally m moves in a circle of radius $R_0/2$. Determine the final value of the velocity v_f.
e) Why is it important that the string be pulled gradually?