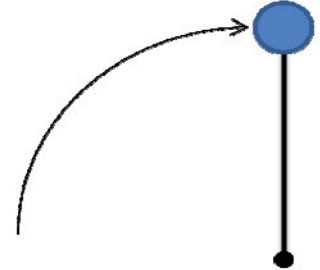


Name:

Student Number:

## Physics Homework Orbital Preparation

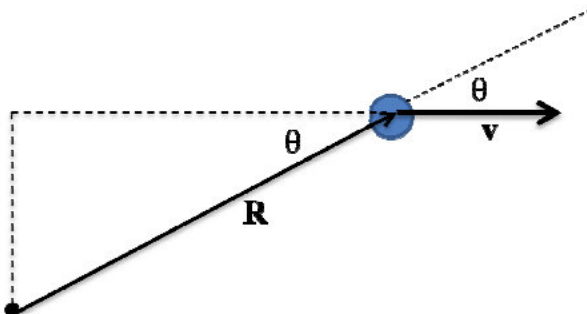
A ball of mass  $M$  swings around a string of length  $r$  at angular velocity  $\omega$ . Assume we are in outer space for this question, so there is no gravity.



- What is the angular momentum of the system in terms of  $M$ ,  $R$ , and  $\omega$ ?
- What is the speed of the ball in terms of  $R$  and  $\omega$ ?
- Express the angular momentum in a) in terms of  $M$ ,  $v$ , and  $R$ .

**This is the formula for the angular momentum of an object about a specific axis if the object's velocity is perpendicular to the vector  $R$  between the axis and the object.**

- If the string is cut just and the instant shown in the figure above, sketch the subsequent trajectory of the ball (remember, no gravity) on the figure.
- After the string is cut, angular momentum is still conserved. Using this fact, express the angular momentum of the ball at a later time in terms of the quantities appearing in the diagram below.



2 a) In the previous question, when the ball is still attached to the string and circling at constant angular velocity  $\omega$ , what is its acceleration (regular, not angular)?

b) What is the force causing this acceleration, and what is the magnitude of this force if the balls mass is  $M$ ?

3) What is the acceleration of a planet of mass  $m$  orbiting another planet of mass  $M$  at a distance  $R$ ?