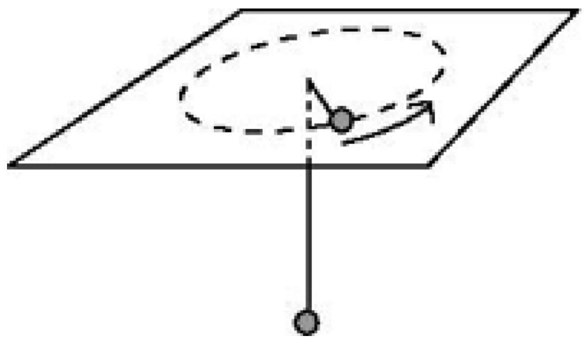
Circular Motion Dynamics
Concept Questions

Problem 1: A puck of mass m is moving in a circle at constant speed on a frictionless table as shown above. The puck is connected by a string to a suspended bob, also of mass m, which is at rest below the table. Half of the length of the string is above the tabletop and half below. What is the magnitude of the centripetal acceleration of the moving puck? Let g be the gravitational constant.



a) The magnitude of the centripetal acceleration of the moving puck is less than g.

b) The magnitude of the centripetal acceleration of the moving puck is equal to g.

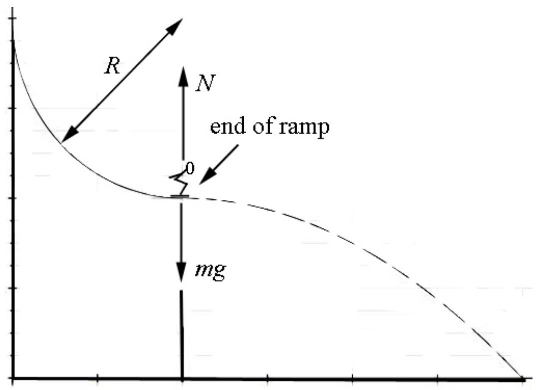
c) The magnitude of the centripetal acceleration of the moving puck is greater than g.

d) The magnitude of the centripetal acceleration of the moving puck is zero.

e) There is not enough information given to determine how the magnitude of the centripetal acceleration of the moving puck compares to g.

Problem 2:

A skier of mass M slides down a ramp shaped as a circle of radius R. At the end point of the ramp just before the skier is in the air, the magnitude of the normal force exerted by the ramp on the skier is N. The gravitational constant is g.



1) The magnitude of the normal force N greater than Mg.

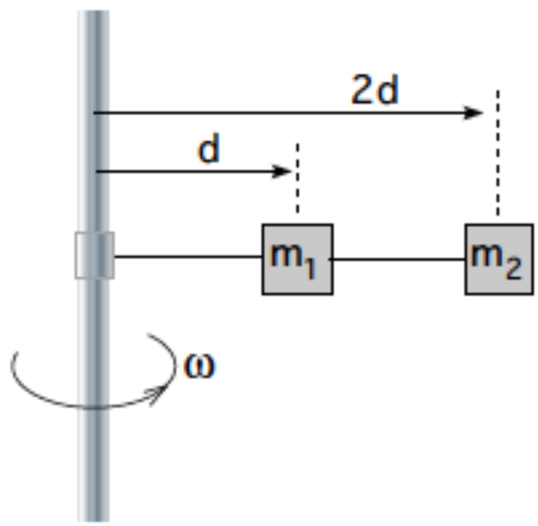
2) The magnitude of the normal force N equal to Mg.

3) The magnitude of the normal force N less than Mg.

4) The magnitude of the normal force N can be greater than, equal to, or less than Mg depending on the speed of the skier.

Problem 3:

Two blocks 1 and 2 of masses m_1 and m_2 are connected by a string. Block 1 is connected to the shaft by an identical string. The blocks are rotating in a circle with constant angular speed ω. Block 1 is a distance d from the central axis, and block 2 is a distance $2d$ from the axis. You may ignore the mass of the strings and neglect the effect of gravity.

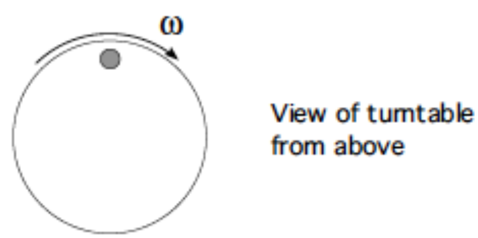


As the angular speed increases

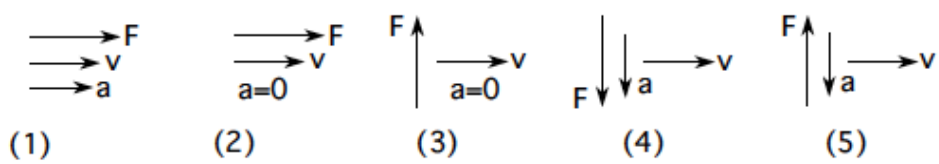
1. The outer string always breaks first.
2. The inner string always breaks first.
3. The outer string only breaks first when $m_1 > m_2$.
4. The outer string only breaks first when $m_1 < m_2$.
5. Both strings always break at the same time.

Problem 4:

A small cylinder rests on a circular turntable, rotating about a vertical axis at a constant angular speed ω as illustrated in the diagram below.



The cylinder rotates with the turntable; it does not slip. Which of the vectors 1-5 above best describes the velocity, acceleration and net force acting on the cylinder at the point indicated in the diagram?



Problem 5

A rider in a “barrel of fun” finds herself stuck with her back to the wall. Which diagram correctly shows the forces acting on her? Explain your reasoning.