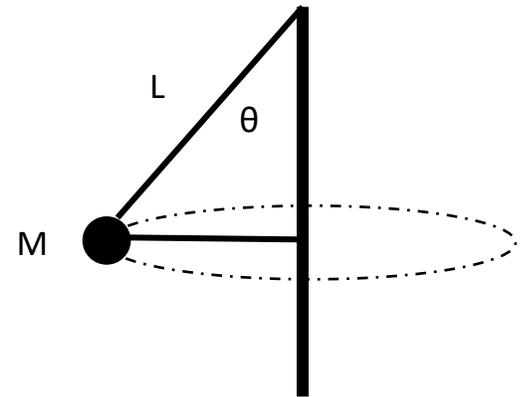


Physics 1135: Homework for Recitation 8: Circular Motion

1. A toy car of mass 1.2 kg is driving vertical circles inside a hollow cylinder of radius 2.0m. It is moving at a constant speed of 6 m/s.

- a) Calculate the magnitude of the normal force acting on the car when it is on the top of the circle and when it is on the bottom of the circle, respectively.
- b) What is the minimum speed the car needs to go around the circle without falling off?

2. In an amusement park ride, a person of mass M sits on a seat that is connected to a central vertical shaft by means of **two** massless cables. One cable of length L is attached to the top of the shaft, making an angle θ with the vertical. The other cable is horizontal, as shown in the figure. The seat rotates in a horizontal circle with speed v .



Derive expressions for the tensions in both cables.

3. A car is driving on a road which makes a curve of radius R . The road is banked at an angle θ with the horizontal. The coefficient of static friction between tires and roadway is μ .

- a) Derive an expression for the minimum speed V the car can have before **sliding down** the banking.
- b) What would change in the setup of your problem if you had to find the maximum speed at which the car can go around the curve?

4. A portion of a frictionless roller coaster track is shown. The circular section has radius R . A roller-coaster car of mass M has speed V when it is at angle θ from the vertical.

a) Derive an expression for the magnitude of the normal force acting on the roller-coaster car when it is at the position shown, in terms of relevant system parameters

b) In terms of system parameters, derive an expression for the rate at which the car's speed is changing, i.e. dv/dt , at this instant.

