Announcements

- Homework
  - Homework 10 due tonight
  - Going with a VHW over the weekend after all. I'll get feedback to you for them by Tuesday morning.
- Test 2
  - Study materials posted on website!
  - Next Wednesday!
  - Today is the last day of content that will be on it
- Teddy is available from 6:30–7:30pm in the physics hearth tonight if you have questions! It might be a great chance to get a start on the study materials!
- Polling: `rembold-class.ddns.net`

Review Question

A 50 g golf ball is traveling with a velocity of $\langle 20, 15, 5 \rangle$ m/s in our standard coordinate system. What is the *magnitude* of the component of the gravitational force parallel to the golf ball's motion at this point in time?

A) 0.29 N

B) 7.35 N

C) 12.49 N

D) 147 N

Recall

- We determined last class that

$$\frac{\mathrm{d}|\vec{\mathbf{p}}|}{\mathrm{d}t}\hat{\mathbf{p}} = \vec{\mathbf{F}}_{\parallel} \quad \text{and} \quad |\vec{\mathbf{p}}|\frac{\mathrm{d}\hat{\mathbf{p}}}{\mathrm{d}t} = \vec{\mathbf{F}}_{\perp}$$

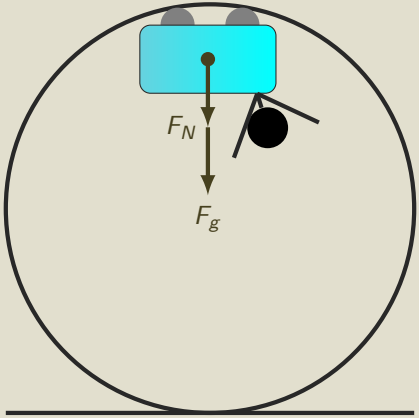
- We also stated (and your book derives) that

$$\left|\frac{\mathrm{d}\hat{\mathbf{p}}}{\mathrm{d}t}\right| = \frac{v}{R}$$

  with a direction that points towards the center of the circle
- Our goal is to know figure out how this plays into our problems

Do the Loop!

Real rollercoasters don't mess around with safety equipment and instead rely purely on physics to provide their thrills. How fast does a 500 kg cart need to be traveling to complete a 10 m loop without leaving the track?



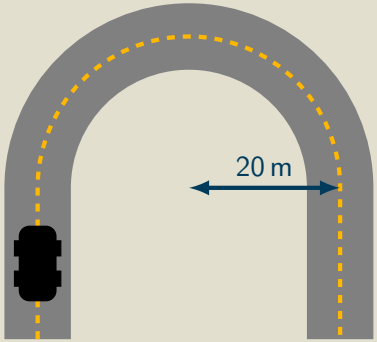
Understanding Check

A 1000 kg car is driving over a large bump which has a radius of curvature of 20 m. What is the fastest the car can travel over the bump while ensuring that it doesn't go airborne?

A) 9.9 m/s
B) 14 m/s
C) 196 m/s
D) 313 m/s

Driving 101

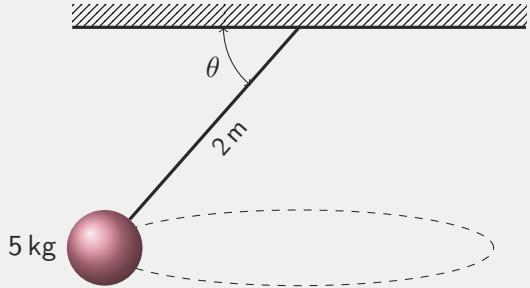
A 2000 kg car driving on a level road goes to make a corner with a radius of curvature of 20 m. The car's tires have coefficients of static and kinetic friction of 0.8 and 0.6, respectively. How fast can the car drive around the corner without slipping?



Banked Curves

A sledder is creating a toboggan run and they want to ensure they can make it around a 5 m radius corner at a top speed of 20 m/s. Being a speed fanatic, they have crafted a frictionless sled. How much must they bank the corner to ensure that they can make the turn without flying off into the unknown? The sledder and sled have a total mass of 80 kg.

Consider the situation below with a ball rotating in a horizontal circle attached via a rope to the ceiling. If the ball completes one revolution every 1.5 s, what angle does the string make with the ceiling? What is the tension on the string?



Group Problem 2

78.8 N, 99.7 N

A small mass (600 g) is spun about a pole by the two ropes shown. The ball revolves in a horizontal circle into and out of the page and completes one revolution every second. What are the tensions on the two ropes?