

# Review problems

Physics 211  
Syracuse University, Physics 211 Spring 2016  
Walter Freeman

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- Today: just practice problems
- No office hours tomorrow morning
- Exam 2: one week after you come back from Spring Break
- Poll on practice exam and homework: would you prefer...
  - A: separate homework and practice exams, where you work the practice exam in recitation, and the homework on your own, or...
  - B: Combined practice exam and homework, where you will turn in the practice exam at the end of recitation Friday for credit

(Whichever you pick will be posted today)

## Sample problems: a 1D collision

A train car with a mass  $m$  is at rest on a track. Another train car also of mass  $m$  is moving toward it with a velocity  $v_0$  when it is a distance  $d$  away. The first car hits the second and couples to it; the cars roll together until friction brings them to a stop.

If the coefficient of rolling friction is  $\mu_r$ , how far do they roll after the collision?

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Method: use conservation of momentum to understand the collision; use other methods to understand before and after!

## Sample problems: a rocket-powered car...

If the car has mass  $m$  and the fire extinguisher expels gas at a rate  $\beta$  (measured in kilograms per second), what is the acceleration of the car?

## Sample problems: a 2D collision

A sedan of mass 2000 kg is traveling north at 25 miles per hour. A Mini Cooper of mass 1000 kg is traveling east at 30 miles per hour, runs a stop sign, and collides with the sedan.

- If the two cars stick together after the collision, what is their velocity?

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- If the coefficient of friction between the cars and the pavement is 0.6, how far do they travel?

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## Sample problems: pulling a trailer uphill

A truck (with four wheel drive) has a mass of  $m = 2000$  kg and its tires have a coefficient of friction with the ground of  $\mu_s=0.8$ . What is the steepest hill it can drive up?

## Sample problems: pulling a trailer uphill

A truck (with four wheel drive) has a mass of  $m = 2000$  kg and its tires have a coefficient of friction with the ground of  $\mu_s = 0.8$ . What is the steepest hill it can drive up?

Suppose now that it is towing a trailer of mass  $M = 4000$  kg. Now what is the steepest hill that it can drive up?

## Sample problems: traction in curves

Suppose that the coefficient of static friction between a car's tires and the pavement is  $\mu_s = 0.8$ .

- If a curve has a radius of curvature  $r = 50\text{m}$ , what is the fastest that a car can travel around it?

## Sample problems: traction in curves

Suppose that the coefficient of static friction between a car's tires and the pavement is  $\mu_s = 0.8$ .

- If a curve has a radius of curvature  $r = 50\text{m}$ , what is the fastest that a car can travel around it?
- Formula 1 race cars have wings on them designed to generate an extra force pointing downward. If this force equals half the car's weight, what is the tightest curve that such a car can negotiate at  $150\text{ mph} = 67\text{ m/s}$ ?

## Sample problems: foom!

If the table has height  $h$  and the car recoils at speed  $v$ , how far does the cork travel, assuming that the cars have a mass ten times that of the cork?