Announcements

1. **Exam 1**
   a. Covers Ch. 2,3
   b. Available in Testing center starting on Friday, Sept. 29 (opening time), up to Monday, Oct. 2 at 4:00 pm.
      i. Mon 4 pm to closing has a late fee.
   c. Sample Exam 1 is posted on the web site and Sample Exam 1 Solutions also.
      i. Don't look at the solutions until you've *worked* the sample exam...or you won't find out where you are weak.
      → It's easy to fool yourself!
   d. Exam is computer graded—we'll go over how to record answers in the review session next Thurs.
   e. The exam is timed, 3 hours max.
   f. Don't forget about calculator requirements
2. **Discussion quiz questions**—should be discussed!
   a. Final question: "Did you discuss at least half of the discussion questions today with a neighbor?"

Elevator Problem: Review

Mary has a mass of 40 kg (weight = 392 N), and stands on an SI-unit scale in the elevator.

a. The elevator is at rest. What is the scale reading?

b. The elevator accelerates **downward** at 2 m/s^2. What is the scale reading?

c. After a while the elevator moves down at a constant speed of 8 m/s. What is the scale reading?

Newton's 3rd Law, revisited

$$\vec{F}_{12} = -\vec{F}_{21}$$

"For every force, there is an equal and opposite partner force"

Demo: Force-sensing carts

Newton's 1st Law, revisited

"Objects will continue to move at *constant velocity* unless acted upon by an outside force."

Video: Shifted Air track

Demo: Tablecloth jerk

Demo: Inertia Hoop and Balance

Video: Eggs and pizza pan

Demo: David and Goliath ball

Accelerating Reference Frames

Demo: Rotating chair

To be able to ascribe accelerations to *real* forces, you must be observing the motion from a **constant velocity reference frame**.

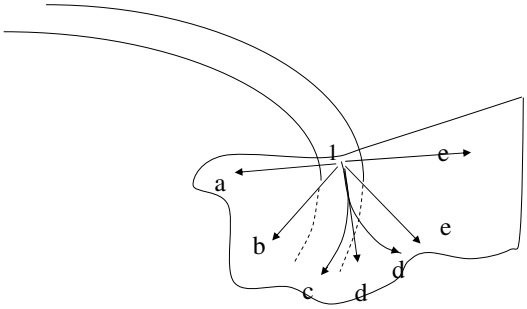
Amusement Park Ride

If in an **accelerating** reference frame, we tend to invent fictitious forces.

Q4. A car rounds a curve while maintaining a constant speed. Is there a net force on the car as it rounds the curve?

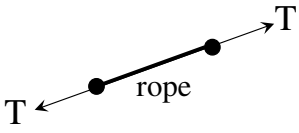
a. No, because its speed is constant.
b. No, because the normal force is balanced by gravity.
c. Yes, because it's changing direction.
d. Could be either yes or no, depending on the sharpness of the curve and the speed of the car.

Q5. A car hits an icy spot on the road at point 1. What is the path of the car if there is no friction on the ice?



Ropes and pulleys

When we pull on a rope, we create tension (T) everywhere in it.

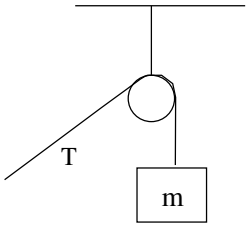


Same on both ends, so no net force on the rope.

Direction of force that a rope exerts on an object?

Role of fixed pulleys
(frictionless, massless)

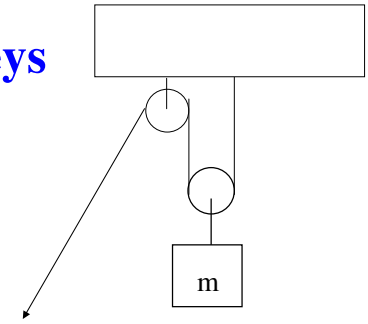
Tension when mass is not accelerated



Tension with acceleration

Moveable pulleys

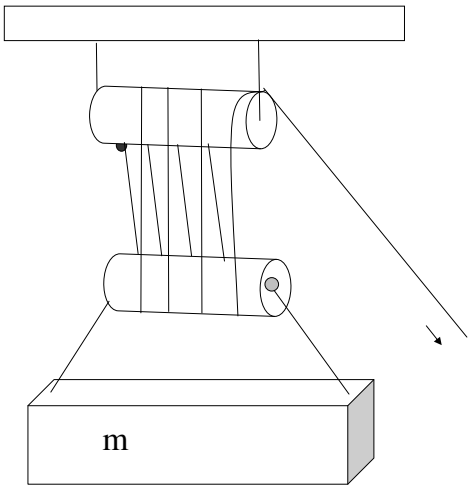
Image credit: wikipedia



(One of six "simple machines")

Gives *mechanical advantage*
tension required to hold or slowly lift is *lower*

- Draw FBD of the moveable pulley
- See how many T-vectors are pulling upward
- Solve Newton's 2nd law



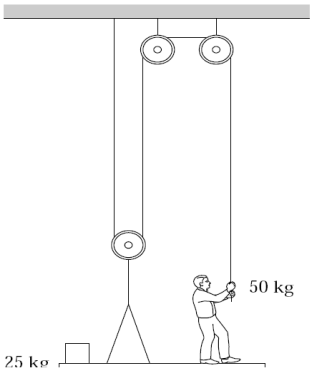
Q6. Assume frictionless, massless string and pulleys, and negligible acceleration. The tension in the string you pull is:

a. 8 mg
b. 4 mg
c. mg
d. mg/4
e. mg/8

Demo: Mechanical advantage 6-pulley demo

Q7. A 100-kg man stands on a 25-kg platform. He pulls on the rope that is attached to the platform via the frictionless pulley system shown here. If he pulls the platform up at a **steady rate**, with how much force is he pulling on the rope? Ignore friction and **assume** $g = 10\ m/s^2$.

A. 750 N
B. 500 N
C. 250 N
D. 125 N
E. 100 N

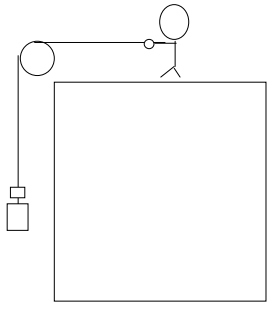


Demo: Equilibrium Paradox

Demo: Atwood machine with airtrack

Worked Problem: Gilbert (100 kg) is lifting the 50 kg group of boxes over a frictionless pulley while on top of a building. He then steps on some frictionless ice.

a. If we treat Gilbert and the boxes as one group what is the magnitude of the force (from outside) that accelerates the group?



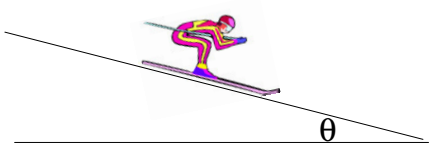
b. What is the acceleration of the group?

c. What is the tension in the rope above the two boxes?

Inclined planes!

(another of the "simple machines")

A skiier is on a hill with no friction. What is her acceleration?



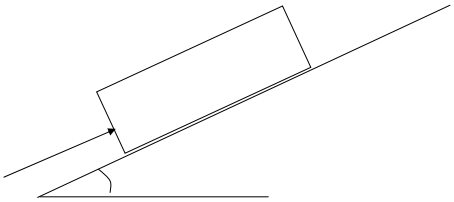
Concept first:

What force is it that accelerates her?
What is the acceleration?
Two extremes:
level ground
infinite slope

a for any angle:

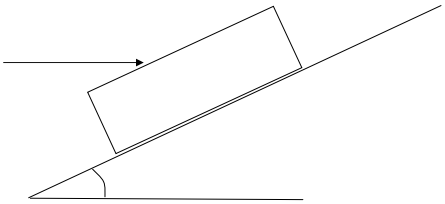
Worked Problem:

You push with a force of 200 N on a 25 kg frictionless ice block which is on a hill sloping 30° above the horizontal. What is the acceleration of the block?



Same setup:

If you push with the same force, but horizontally what will the acceleration be?
(hint: qualitatively, will it be more, less or the same)



Q8. Did you discuss at least half of the discussion quiz questions today with a neighbor?

a. Yes
b. No