Announcements 11 Mar 09

- **Homework #6**
  - **Written homework due on Friday in class**
    → check homework #4 solution on blog for a review of how to add several vectors and find the magnitude of the sum
  - **Online homework due on Tue March 24 by 8 am**
    - **Problem 5.22 Part A: give your answer with only 2 significant digits (i.e. round answer and *drop* less significant digits)**
    - **Friction to be discussed during Friday's lecture (2nd and 7th problems)**

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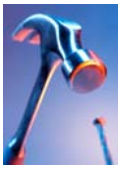
3rd Law: How does the nail move into the wall?

We are dealing with two action-reaction pairs:



Vertical forces are not drawn

Forces on nail

- If gentle tap of the hammer → nail doesn't move → $F_{HonN} = F_{WonN}$

F_{WonN} ⟵ ⟶ F_{HonN} $\qquad \vec{F}_{net} = \vec{F}_{HonN} + \vec{F}_{WonN} = 0$

- If hammer hit hard → nail does move → $F_{HonN} > F_{WonN}$

F_{WonN} ⟵ ⟶ F_{HonN} $\qquad \vec{F}_{net} = \vec{F}_{HonN} + \vec{F}_{WonN} > 0$

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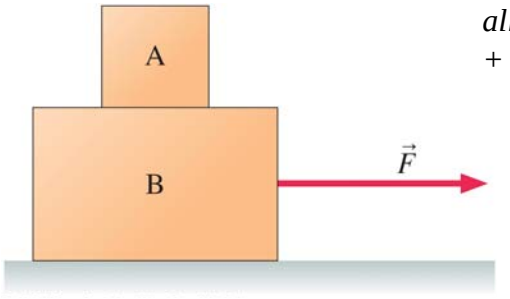
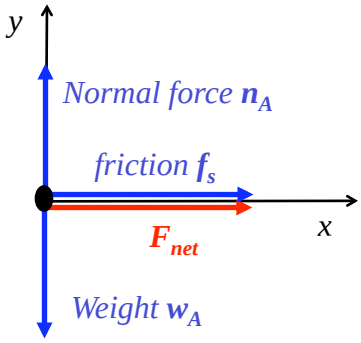
Free-body Diagram Question

Block A sits on top of block B. A constant force F is exerted on block B, causing block B to accelerate to the right. Block A rides on block B without slipping. Draw a free-body diagram of block A.



Make sure to identify all forces acting on A + show them in the diagram



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Chapter 5
Applying Newton's Laws

Topics:

- Equilibrium
- Using Newton's second law
- Mass, weight, and apparent weight
- Static and kinetic friction
- Applying Newton's third law

Sample question:

Before his parachute opens, why does this skydiver fall at a constant speed? And why does he suddenly slow down when his parachute opens?

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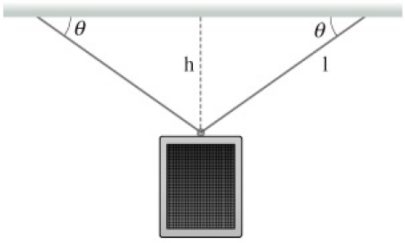
Homework #6 problem: Suspending a speaker

A loudspeaker of mass 25.0 kg is suspended a distance of h = 2.40 m below the ceiling by two cables that make equal angles with the ceiling. Each cable has a length of l = 2.90 m.



What is the tension T in each of the cables?

How should we handle such a problem?

Equilibrium

An object is in *equilibrium* when the net force acting on it is zero. In component form, this is

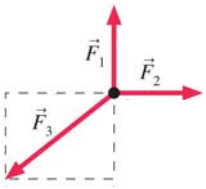
$$\sum F_x = 0 \qquad \text{and} \qquad \sum F_y = 0$$

Reminder: To add force vectors one adds the x-components and y-components of these vectors to find the x- and y-components of the vector sum

$$(F_{net})_x = F_{1x} + F_{2x} + F_{3x} + \ldots$$
$$(F_{net})_y = F_{1y} + F_{2y} + F_{3y} + \ldots$$

The magnitude of the net force vector is $F_{net} = \sqrt{(F_{net})_x^2 + (F_{net})_y^2}$

The net force on each man in the tower is zero.



Approach to follow for vector addition in written homework #6

PROBLEM-SOLVING STRATEGY 5.1 Equilibrium problems

PREPARE First check that the object is in equilibrium: Does $\vec{a} = \vec{0}$?

- An object at rest is in static equilibrium.
- An object moving at a constant velocity is in dynamic equilibrium.

Then identify all forces acting on the object and show them on a free-body diagram. Determine which forces you know and which you need to solve for.

SOLVE An object in equilibrium must satisfy Newton's first law. In component form, the requirement is

$$\sum F_x = 0 \quad \text{and} \quad \sum F_y = 0$$

You can find the force components that go into these sums directly from your free-body diagram. From these two equations, solve for the unknown forces in the problem.

ASSESS Check that your result has the correct units, is reasonable, and answers the question.

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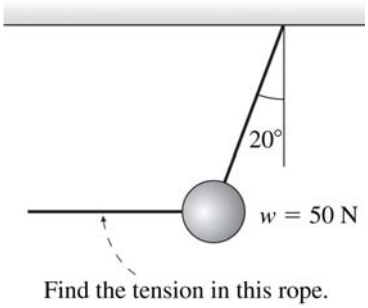
Equilibrium Example

A ball weighing 50 N is pulled back by a rope to an angle of 20°. What is the tension in the pulling rope?



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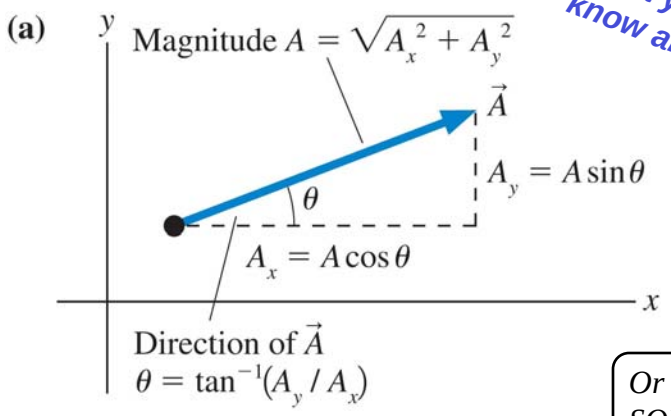
Vector Components

What you need to know about vectors



Or remember SOH CAH TOA

Relating angle and components:

- Angle θ defined relative to the positive x-axis
  (easiest to keep angle positive from 0 to 360 degrees)
- Set your calculator for angles in degrees (if angles given in degrees)

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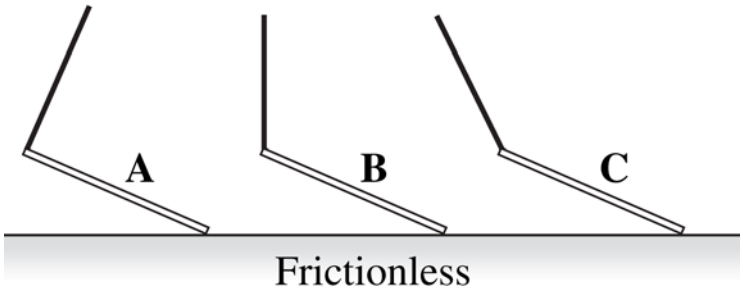
Equilibrium Question

PRS

A rod is suspended by a string as shown. The lower end of the rod slides on a *frictionless* surface. Which figure correctly shows the equilibrium position of the rod?



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