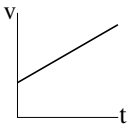
Announcements

If you're new (or weren't paying attention…):

1. Course homepage via: **physics.byu.edu → Class web pages → Physics 105 (Colton J)**
   a. There is a list of what to do to get started and catch up.
2. Tutorial lab in N304 or N361 ESC, 9 am - 9 pm. Get help with homework if needed!
3. Homework:
   a. All retries on the first set of homework are due today.
   b. If you submit corrected homework, it **is only for the problems you missed. But you must submit all parts (a, b, c, etc.) of a missed problem and you must submit all missed problems at once.**
   c. Second homework assignment, **H-2**, is due today at 10:00 pm.
   d. Number of decimal places for homework answers is given by the precision of the numbers on the "Answers range" sheet, not by significant figures as in Chap. 1. Read *Homework Submission* document carefully.
   e. Everyone gets four free late homework submissions. All late submissions for homework on Ch 2,3 are due on the day Exam 1 starts (see schedule).
4. Bryan Packard – your email is still bouncing!

Review Equations

For constant acceleration…



$$v_{ave} = \frac{v_0 + v_f}{2}$$

"Three basic kinematic equations"

velocity-time: $\boxed{v = v_0 + at}$

position-time: $\boxed{x = x_0 + v_0 t + \frac{1}{2} a t^2}$ (x vs. t = parabola)

velocity-position: $\boxed{v_f{}^2 = v_0{}^2 + 2a\Delta x}$

"The Moving Man" applet:

http://phet.colorado.edu/new/simulations/sims.php?sim=The_Moving_Man

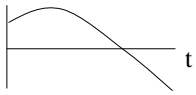
Review Questions

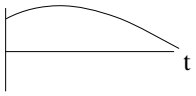
Q4. You drop a ball from the top of a building, and measure the time to hit the ground. You go to a second building, and find that the ball takes *twice* as long to hit the ground.

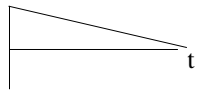
The second building is

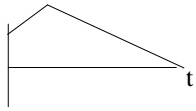
a. less than twice as tall as the first
b. twice as tall as the first
c. more than twice as tall as the first

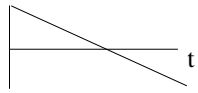
Q5. Which sketch describes **y(t)** for the rock thrown upward from a cliff? y=0 is at the ground level.

A. 

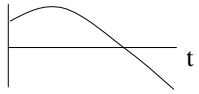
B. 

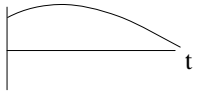
C. 

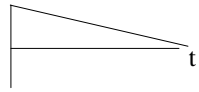
D. 

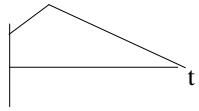
E. 

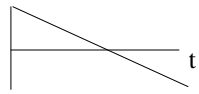
Q6. Which sketch describes **v(t)** for the rock thrown upward from a cliff?

A. 

B. 

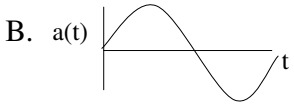
C. 

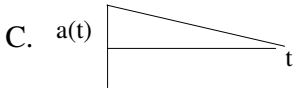
D. 

E. 

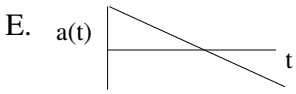
Q7. Which sketch describes **a(t)** for the rock thrown upward from a cliff?

A. 

B. 

C. 

D. 

E. 

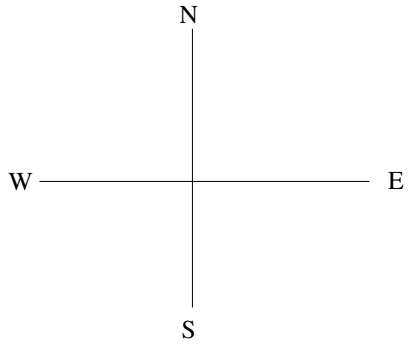
Adding Vectors
The Graphical Method: "Tip to Tail"

For precision, use a protractor to set the angle of the vectors, and a ruler to set the lengths (magnitudes).

- Choose an appropriate **scale** (e.g. 1 cm = 5 N or whatever is appropriate for your case) and **axes**.
- Draw the first vector with the proper length and angle, starting from the origin.
- **Begin the second vector with its tail at the tip of the previous vector**—hence the phrase "tip-to-tail"
- To draw in the second vector, **measure its angle from the coordinate axes**, not from the previous vector's direction.
- If you are adding more than two vectors, continue the same procedure, draw each vector's start at the previous vector's end.
- When you have drawn all of the vectors in the sum, draw a vector **from the origin to the end of the final vector** in your sum. That's the answer!
- A **negative vector** points in the opposite direction.

Worked Problem

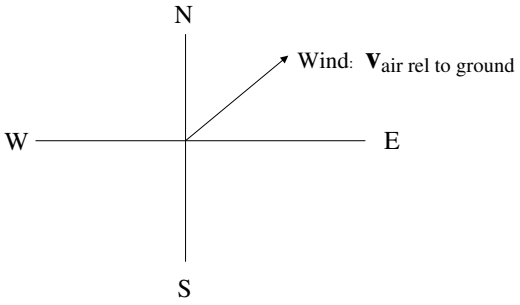
<u>Adding displacements as vectors</u>
A student runs 100 m north, then 200 m south-east, then 200 m west. What is her final displacement relative to the origin?



Website demo:
http://www.glenbrook.k12.il.us/gbssci/phys/mmedia/vectors/ao.html
Vector addition animation; order doesn't matter

Relative Velocities: $v_{ab} = v_{ac} + v_{bc}$
"velocity of a with respect to b"
→ *Demo*: cart on board

A jet pointed N at 100 mph airspeed (v of plane w.r.t. air) flies in a 200 mph wind (air w.r.t. ground) going NE.



Q8. What is the jet's true bearing (velocity w.r.t. ground)?

a. 
b. 
c. 
d. 

e. none of the above (*nota*).

Q9. What is the magnitude of the jet's velocity (approx.)?

a. 200 mph b. 240 mph
c. 280mph d. 300 mph e. *nota*

The "OK Go" guys
http://www.youtube.com/watch?v=pv5zWaTEVkI

$v_{man\text{-}ground} = v_{man\text{-}treadmill} + v_{treadmill\text{-}ground}$

Follow-up experiment
http://www.youtube.com/watch?v=x49WZRyXGe0

Adding Vectors
The Component Method

- Use this to get an exact numerical answer
- Break the vectors into *x*- and *y*-components, and then add the components separately to get the components of the sum.
- Then, the *x*- and *y*-components you end up with can be put back together to form the final vector.

Trigonometry Reminders:
- The *x*-component of a vector **A** is $A\cos\theta$.
- The y-component is $A\sin\theta$.
  → θ measured from positive x-axis!
- The magnitude and direction of the resulting force vector are given by the usual polar coordinate formulas:*
  - $A = \sqrt{A_x^{\,2} + A_y^{\,2}}$
  - $\theta = \tan^{-1}(y/x)$

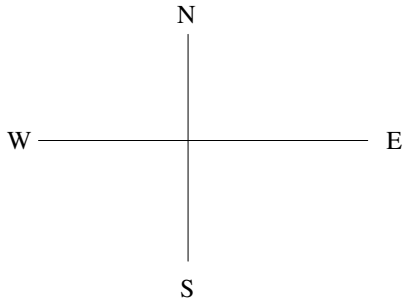
* You need to be careful with the $\tan^{-1}$ formula—as you may remember from trigonometry, 2nd and 3rd quadrant angles won't come out correctly on your calculator when you take their inverse tangent. Stay safe by always checking your answer with a picture.

Q10. If a boat wishes to sail exactly **E** on a map, with a speed relative to the *earth* of 10 mph, **what direction** should the boat point (relative to the water), in a 10 mph current to the **N**?

a. 30° north of east b. 45° north of east
c. 30° south of east d. 45° south of east e. *nota*

Hint: Start with an approximate picture

$\mathbf{v_{bg}} = \mathbf{v_{bw}} + \mathbf{v_{wg}}$



Q11. **How fast** will the boat have to go?
a. 5 mph b. 7.1 mph c. 10 mph d. 14.1 mph e. *nota*