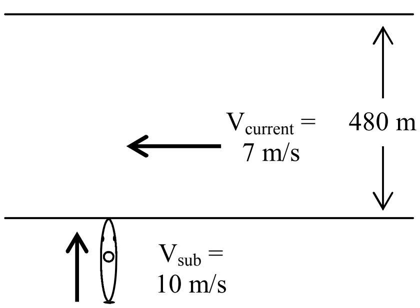
Due Fri., Oct 8 (B-day)
Due Wed., Oct 13 (A-day)

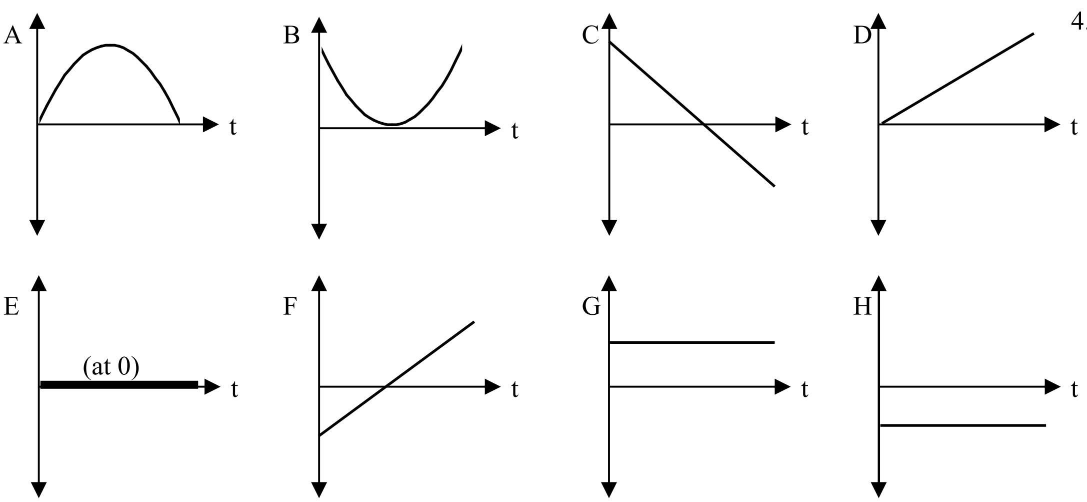
2010-11 PreAP Two Dimensions 6

1. * A person walks 6 m west and 4 m north. What is their displacement? (*Magnitude and direction and check the quadrant.*) [*Help is on third page, today.]*

2. A person walks 85 m south and 97 meters west. Calculate their displacement.

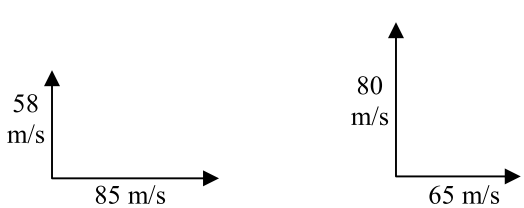


3. * A submarine on patrol comes across an underwater canyon that has a consistent current flowing thru it to the west. (** For help, I put the key to the bird Q from the last HW, p3*)
   A. What is the velocity of the sub relative to the ground, if it turns and moves with the current (west)?
   B. What is the velocity of the sub relative to the ground, if it turns and moves against the current (east)?
   C. * How long would it take to go 100 m west and then return?
   D. If the sub enters the air stream directly perpendicular to the current, what is its velocity and direction relative to the ground?
   E. If the canyon is 480 m wide, how long does it take the sub get across? (*Hint: Is this an x or y-direction question? Then use only the information for that direction to solve*.)
   F. How far along the canyon (west) has the sub drifted by the time it has crossed? (*Again: x or y question?)*
   G. At what direction must the sub have to aim to get directly across the canyon. (*Directly across the canyon is Lazy's path*.)



4. For projectile motion: which graph shows:
   A. ___ The y direction acceleration *.
   B. ___ The horizontal position *.
   C. ___ a_x (x acceleration)
   D. ___ Vertical position (ground to ground)
   E. ___ Vy
   F. ___ Vx

5. The arrows below show initial Vx and Vy for two different projectiles. (*They have already been broken up into components*.)

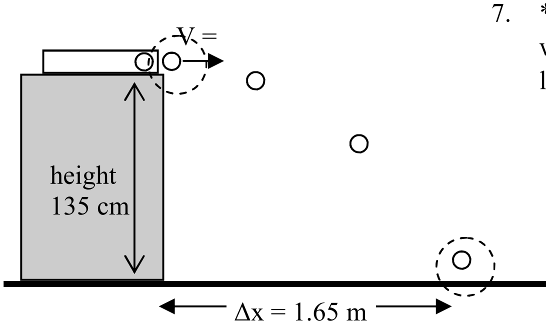


   A. * Calculate the initial velocity and direction for each. *(Find V, which is the hypotenuse.)*
   B. Which one has the greatest vertical acceleration? (R or L?)
   C. Which one will take longer to hit the ground?
   D. Which goes higher?
   E. Which has the greatest initial speed? (*Round to no decimals*)

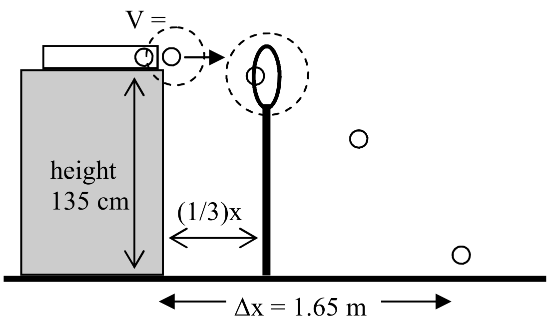
From the "Projectile Concepts" notes:

6. Four projectile are launched from the ground with the same initial velocity. Their angles of fire are: 30°; 45°; 60°; 80°.
   A. Which one has the most hang time (greatest t)?
   B. Which has the greatest Vx?
   C. Put them in order from greatest range to least range. If they are the same, say so.

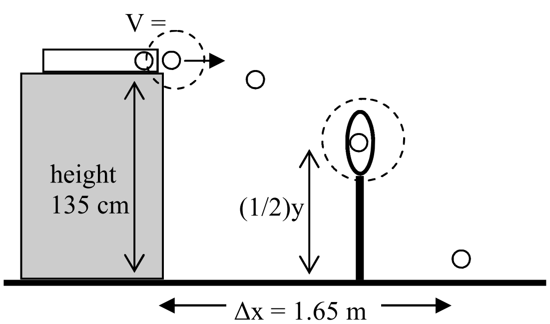
Let's practice for the hoops lab. Again, the example from the in class practice are on the last page. WORK IN METERS!



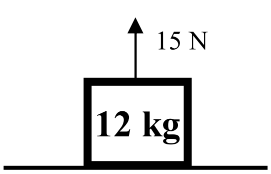
7. * Given the information at the left, calculate the initial velocity of the ball when it leaves the projectile launcher, assuming the ball is horizontally launched. The dotted circles show your initial and final positions for this part.



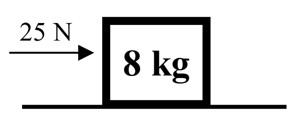
8. Hoop 1 is placed at (1/3)x, where x is your original range. You need to find x and y for the hoop. Notice that one of the circles has been moved and that your initial conditions are the same as before.
   A. What is (1/3)x? *(Put this in your x-direction information.)*
   B. * Solve for the time to Hoop 1.
   C. Solve for Δy (*which is NOT the vertical position of the hoop*).
   D. Since $\Delta y = y_f - y_i$, solve for the vertical position of the hoop.
   E. * So Hoop 1 is at what x and y position?



9. Hoop 2 is placed (1/2)y, where y is your original height of the launcher. You need to find the x and y positions for Hoop 2. Again, only the final circle has moved.
   A. What is (1/2)y? (*Put this into your y-direction information*)
   B. * Solve for the time to Hoop 2 (*realizing Δy is still negative*).
   C. Solve for the x position of Hoop 2.
   D. So, Hoop 2 is at what x and y position?



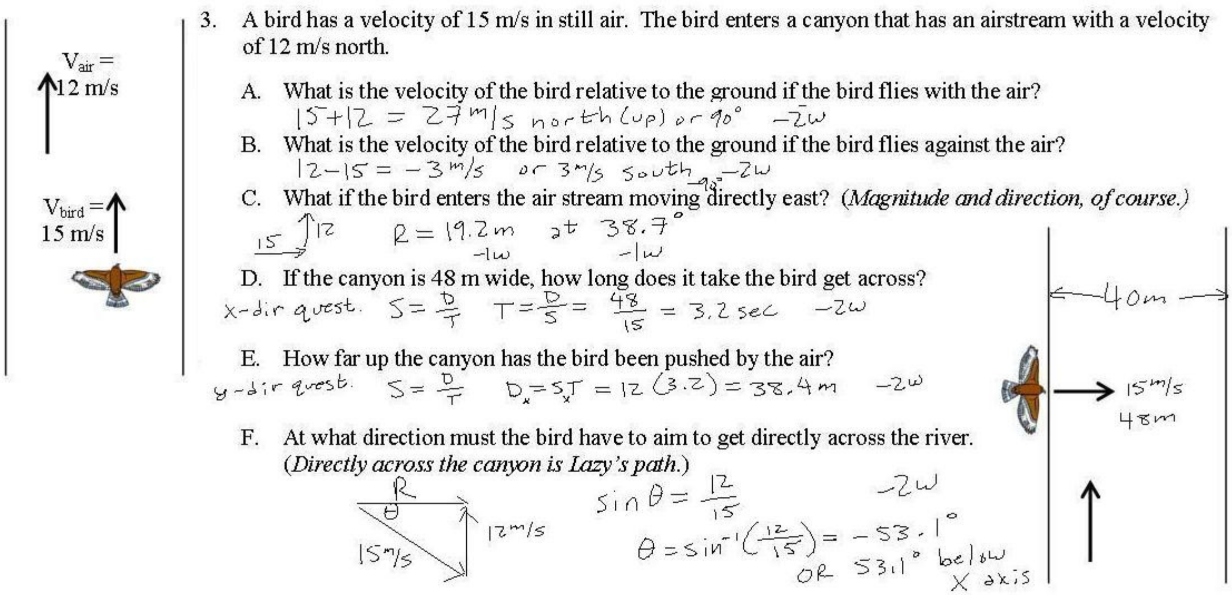
10. Calculate the normal force acting on the mass.



11. A. Is the normal force and x or y direction force?
    B. Calculate the normal force on the mass.

Q1: x = −6m y = +4m, so R = 7.2 m and θ = 146.3°. (Calculator gives −33.7°, but its in the 2nd quadrant)

Q3: Remember that the x and y directions are independent! Follow the example below:



3. A bird has a velocity of 15 m/s in still air. The bird enters a canyon that has an airstream with a velocity of 12 m/s north.

A. What is the velocity of the bird relative to the ground if the bird flies with the air?
15+12 = 27 m/s north (up) or 90° −2W

B. What is the velocity of the bird relative to the ground if the bird flies against the air?
12−15 = −3 m/s or 3 m/s south −2W

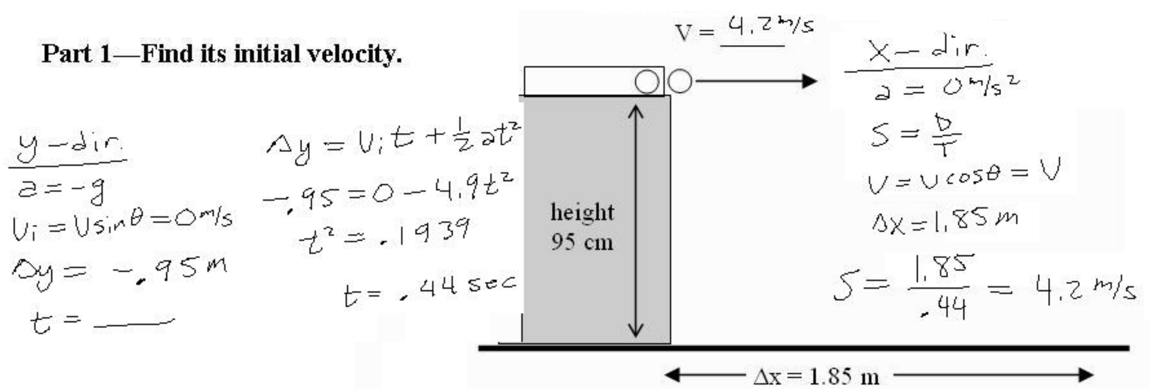
C. What if the bird enters the air stream moving directly east? (*Magnitude and direction, of course.)*
R = 19.2 m −1w at 38.7° −1w

D. If the canyon is 48 m wide, how long does it take the bird get across?
x-dir quest. $S = \frac{D}{T}$ $T = \frac{D}{S} = \frac{48}{15} = 3.2$ sec −2W

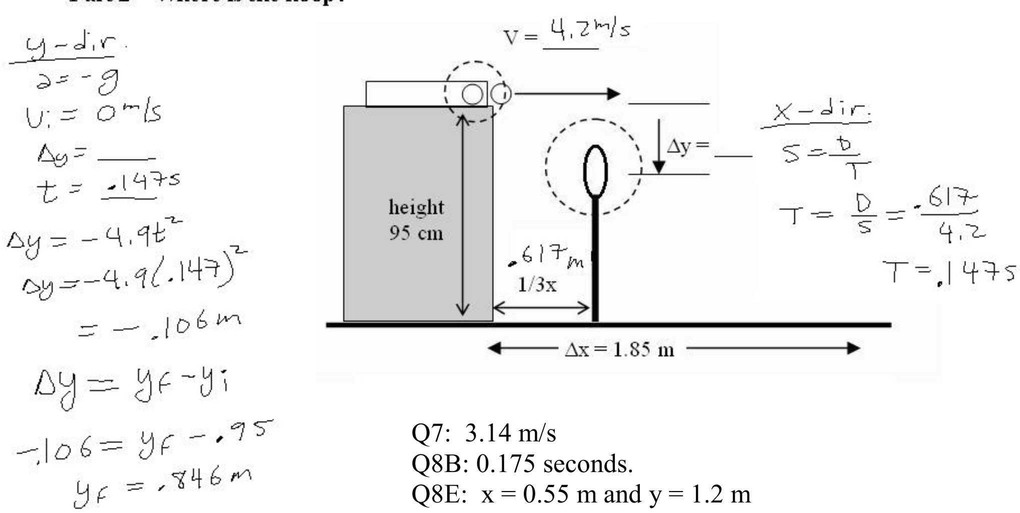
E. How far up the canyon has the bird been pushed by the air?
y-dir quest. $S = \frac{D}{T}$ $D_x = S_xT = 12(3.2) = 38.4$ m −2W

F. At what direction must the bird have to aim to get directly across the river. (*Directly across the canyon is Lazy's path.*)
$\sin\theta = \frac{12}{15}$ −2W
$\theta = \sin^{-1}\left(\frac{12}{15}\right) = -53.1°$ below OR 53.1° X axis

Q3C: 100/17 = 5.9 sec; 100/3 = 33.3 sec. Total time = 39.2 sec.
Q4A: Graph H, which shows a constant negative value; Q4B: Graph D. It starts at zero and has a constant slope, which shows a constant velocity.
Q5A: Just use Pythagorean theorem and inverse tan.



Part 1—Find its initial velocity.



Part 2—Where is the hoop? Do x direction first (since you are given x direction information)

Q7: 3.14 m/s
Q8B: 0.175 seconds.
Q8E: x = 0.55 m and y = 1.2 m
Q9B: t = 0.371 sec

