Due Thurs., Oct 14 (B-day)
Due Fri., Oct 15 (A-day)

2010-11 PreAP Two Dimensions 7

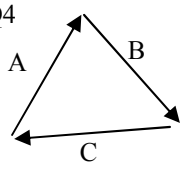
1. (Hint*) Person A walks 55 m at 38°. Then the person turns and walks 20 m directly north. A Person B starts at the same place as Person A. What direction and distance does Person B have to walk to walk straight to Person A's final position (*and what is Person B' s name*)?

Remember: the magnitude of a vector is how long the arrow is. Magnitude can never be negative (but it can be zero). Given 25 m/s at 15°, 25 m/s is the magnitude and 15° is the direction taken from the + x axis.

2. If two vectors have unequal magnitudes (*length of A ≠ length of B*), can their sum (*addition*) ever be zero?

3. If vector A is added to vector B, how is it possible for their sum to = exactly A + B?

Q4



4. Three vectors, A, B, and C, are added together head to tail and form a closed loop, as shown. What is the total displacement of the three vectors?

Remember that a "component" is the x or y part of the triangle.

5. How can a vector have a component equal to zero, but not have a nonzero magnitude (*the arrow does not equal zero*)?

6. A cannon can be shot at various angles, but has the same velocity: 42 m/s. Assume it is shot from the ground to the ground.
   A. * Calculate its range and hang time (*time in the air*) if it is shot at 20°.

   B. Calculate its range and hang time, if it is shot at 45°.

   C. Calculate its range and hang time, if it is shot at 70°.

   D. 20°; 45°; 70°; none; or all?

   i. _____ * Has the fastest initial velocity (*total*).
   j. _____ Has the greatest vertical acceleration.
   k. _____ Has the greatest range.
   l. _____Stays in the air the longest.
   m. _____Moves downrange fastest (*greatest Vx*).
   n. _____Has the smallest initial Vy.

   E. Why is 45° the greatest range for a projectile shot ground to ground?

   F. When the cannon is shot at 20°, what is its final x velocity?

   G. When the cannon is shot at 45°, what is the projectile's velocity at the very top of its path?

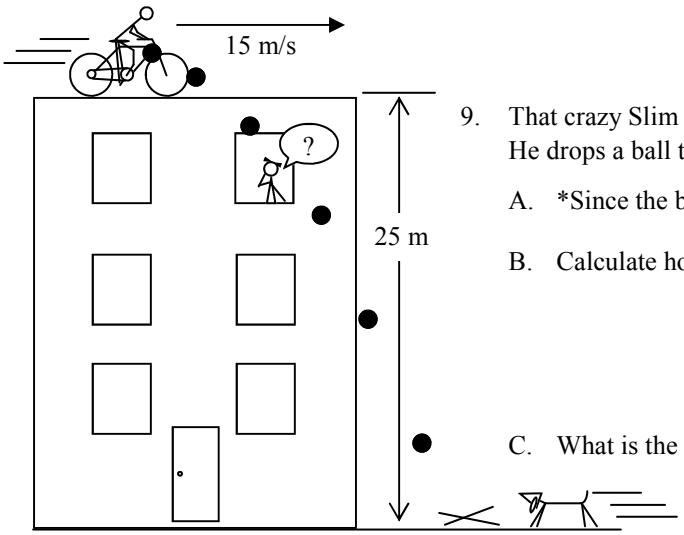
   H. * If you wanted the 20° projectile to pass thru a hoop at the top of its path, where would it be (*x and y coordinates, please*)?

7. A person walks west 128 m and then south for 175 m.
   A. West and south are positive or negative (*in our coordinate system*)?
   B. Realizing that magnitudes CANNOT BE NEGATIVE, calculate their total displacement.

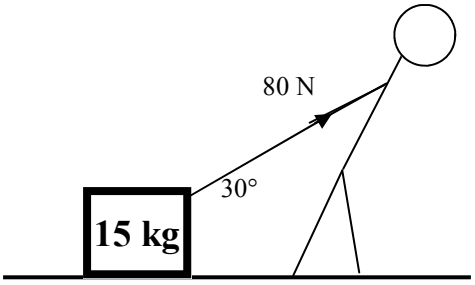
   C. In what quadrant does the person end up?
   D. So, find the direction of the person's displacement.

   I think one of our issues on the vector quiz was big numbers. You don't like big or small numbers. Yet, they work the same.

8. * A plane flies 425 km/hr for 3.5 hours north, then it turns to 130° and flies 510 km/hr for 2 more hours. Calculate its displacement from its original position. (*And remember what you learned in Q7.)*

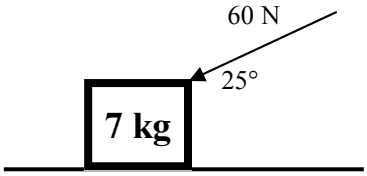


9. That crazy Slim Jim is riding along the top of a 25 m tall building going 15 m/s. He drops a ball to his dog Bim.
   A. *Since the ball is in Jim's hand while he is riding, what is the initial velocity of the ball?
   B. Calculate how far away Bim has to be to catch the ball as it hits the ground.
   C. What is the ball's horizontal velocity as it hits the ground?



10. Slim Jim is pulling with 80N on a 15 kg object at the angle shown.
    A. What is the magnitude of the weight of the object?
    B. Draw and label the weight of the object.
    C. Is the normal force a vertical or horizontal force?
    D. Is Slim Jim pushing down on or lifting up the object?
    E. Is Slim Jim increasing or decreasing the normal force?
    F. *Calculate the normal force on the object.

11. A 7 kg object has a 60 N force pushing on it at an angle of 25°. Calculate the normal force acting on the object from the table.



Q1 Hint: just add vectors: (sin, cos, etc). When it says "*directly north*" the angle is 90°.
Q6A: Vyi = 14.365 m/s; Vxi = 39.467 m/s; t = 2.93 sec; range = 115.7 m. Q6Di—same V = 42 m/s for all angles.
Q6H: Wouldn't x just be half the range? And y = 10.53 m up.
Q8: Mult times time for displacements: D_1 = 1487.5 km; D_2 = 1020 km. X_{total} = -655.6km; Y_{total} = 2268.9km
Total displacement: 2362.7 km at 106.1° It has to be in the 2nd Q. Q9A: 15 m/s (same as the bicycle)
Q10: Normal force is y-direction only, so only 80sin30°=40 N matters. Fw = 147N It reduces (up) so Fn = 147−40 = 107 N

