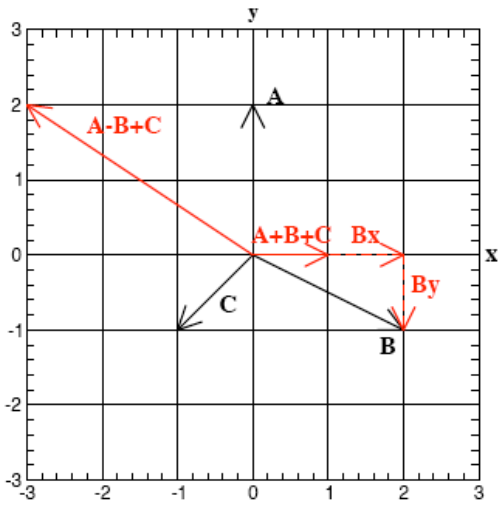
Physics 131.01 Monday September 20, 2010 Quiz number 2

Cooperative Learning: work together

1. **Vectors.**



In the graph to the right, using 2 significant figures:

a. Specify vector $\vec{B}$ in terms of components (B_x,B_y).
$\vec{B}$=(2.0,-1.0)

b. Specify $\vec{B}$ in terms of direction and magnitude.
$|\vec{B}| = \sqrt{5.0}$=2.2, angle = $\tan^{-1}(-0.50)$=-27°.

c. Draw the vector $\vec{A} - \vec{B} + \vec{C}$.

d. Specify $\vec{A} - \vec{B} + \vec{C}$ in terms of components.
$\vec{A} - \vec{B} + \vec{C}$=(-3.0,2.0)

e. Specify $\vec{A} + \vec{B} + \vec{C}$ in terms of components.
$\vec{A} + \vec{B} + \vec{C}$=(1.0,0.0)

f. What is the angle from $\vec{B}$ to $\vec{C}$ (clockwise). $\tan^{-1}(2.0)+\tan^{-1}(1.0)=63+45=108°$.

2. **Projectile in 2d**

A projectile is shot from ground level, at an angle of 60.0 degrees above horizontal, and at a speed of 90.0 m/s. The ultimate aim is to find where it lands. Here is a logical way of breaking it into small easy steps.

a. What is the vertical component of the initial velocity? $v_{y0}=v_0\sin(60°)$=77.9m/s

b. What is the horizontal component of the initial velocity? $v_{x0}=v_0\cos(60°)$=45.0m/s

c. How long will it take the projectile to reach the top of its trajectory? $t_t=v_{y0}/g$ = 7.95s

d. How far does it go horizontally in this time? $v_{x0}t_t$ = 358 m.

e. Why are the time to land and the horizontal distance, twice the previous two answers?
$|v_y|$ depends only on height (y); positive going up, negative going down, symmetric.

f. Graph the trajectory (as usual, vertical is y, horizontal is x.)

3. **Another projectile in 2d**

You need to throw a ball over a fence that is 20.0 m high and 30.0 m away. You launch the ball from an initial height of 2.0 m.

a. What is the minimum v_y needed to make the ball go as high as the fence?
$v_{y0}=\sqrt{(2g\Delta h)}$ = 18.8 m/s (using Δh = 20.0m – 2.0m).

b. How much time does it take to reach this height? (18.8m/s)/(9.8m/s²)=1.91 s.

c. What is the correct v_x needed to make the ball clear the fence? 30.0m/1.91s=15.6m/s

d. What is the angle (above horizontal) at which you need to throw the ball?
$\tan^{-1}(18.8/15.6)$=50.2°

e. What is the initial speed the ball needs to have? $\sqrt{((15.6)^2+(18.8)^2)}$=24.4m/s

f. What is the average velocity of the ball from time t=0 until is hits the ground?
The x-component of the average velocity is just v_{x0}=15.6m/s. The y component is the y distance (-2.0m) divided by the time (2 x 1.91s plus an extra 0.1 s to fall an extra 2m); v_{avg}=(15.6,-0.52)m/s.