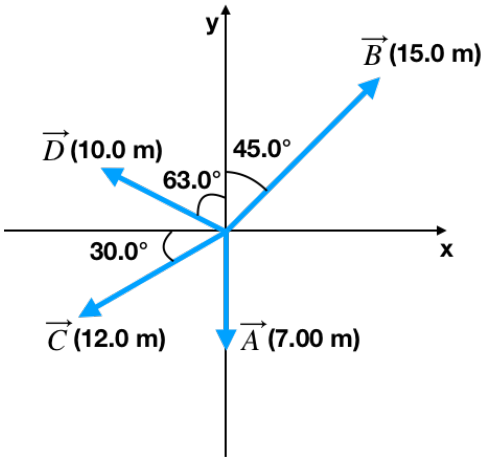
PY211 PY211 Problem Set 1
Due: Friday, 31 January 2020 at 5:00 pm

Student Name_____

Discussion Session _____

The following problems are to be written out and turned in to the homework boxes near SCI 121. You must show your work to receive credit!

Use the figure below for questions 1 – 3



1. Use a scale drawing to:
    a. Find the magnitude of the vector sum $\vec{A} + \vec{B}$.
    b. Find the direction of the vector sum $\vec{A} + \vec{B}$.
    c. Find the magnitude of the vector difference $\vec{A} - \vec{B}$.
    d. Find the direction of the vector difference $\vec{A} - \vec{B}$.
    e. Use your answers to find the magnitude of $-\vec{A} - \vec{B}$.
    f. Find the direction of $-\vec{A} - \vec{B}$.
    g. Find the magnitude of $\vec{B} - \vec{A}$.
    h. Find the direction of $\vec{B} - \vec{A}$.

2. Compute the x- and y-components of the vectors $\vec{A}$, $\vec{B}$, $\vec{C}$, and $\vec{D}$ in the figure.

3. Use the method of components to:
    a. Find the magnitude of the vector sum $\vec{A} + \vec{B}$.
    b. Find the direction of the vector sum $\vec{A} + \vec{B}$.
    c. Find the magnitude of the vector difference $\vec{A} - \vec{B}$.
    d. Find the direction of the vector difference $\vec{A} - \vec{B}$.
    e. Use your answers to find the magnitude of $-\vec{A} - \vec{B}$.

f. Find the direction of $-\vec{A} - \vec{B}$.
g. Find the magnitude of $\vec{B} - \vec{A}$.
h. Find the direction of $\vec{B} - \vec{A}$.

4. Find the angle between each of the vector pairs $\vec{A} = A_x\hat{\imath} + A_y\hat{\jmath}$ and $\vec{B} = B_x\hat{\imath} + B_y\hat{\jmath}$.
   a. $A_x = -2.70$, $A_y = 6.40$; $B_x = 1.10$, $B_y = -7.10$
   b. $A_x = 2.40$, $A_y = 7.80$; $B_x = 9.2$, $B_y = 5.20$

5. A car is stopped at a traffic light. It then travels along a straight road so that its distance from the light is given by $x(t) = bt^2 - ct^3$, where b = 2.40 m/s^2 and c = 0.220 m/s^3.
   a. Calculate the average velocity of the car for the time interval t = 0 s to t =10.0 s.
   b. Calculate the instantaneous velocity of the car at t = 0 s.
   c. Calculate the instantaneous velocity of the car at t = 5.00 s.
   d. Calculate the instantaneous velocity of the car at t = 10.0 s.
   e. How long after starting from rest is the car again at rest?
6. At the instant the traffic light turns green, a car has been waiting at an intersection starts ahead with a constant acceleration of 3.0 m/s^2. At the same instant a truck, traveling with constant speed of 21.0 m/s, overtakes and passes the car.
   a. How far beyond its starting point does the car overtake the truck?
   b. How fast is the car traveling when t overtakes the truck?
   c. Sketch an x-t graph of the motion of both vehicles. Take x = 0 at the intersection.
   d. Sketch a v_x-t graph of the motion of both vehicles.
7. You throw a ball vertically upward and catch it after 20.0 s.
   a. Find the initial velocity of the ball.
   b. Find the maximum height it reaches.
   c. Determine the velocity and position of the ball at 4.0 s.
8. A test rocket s fired vertically upward from a well. A catapult gives it an initial velocity of 80.0 m/s at ground level. Subsequently, its engines fire and it accelerates upward at 4.00 m/s^2 until it reaches an altitude of 1000 m. At that point its engines fail, and the rocket goes into free fall, with an acceleration of -9.8 m/s^2.
   a. How long is the rocket in motion above the ground?
   b. What is its maximum altitude?
   c. What s its velocity just before it collides with the earth?
9. A tennis ball on Mars, where the acceleration due to gravity is 0.379 of a g and air resistance is negligible, is hit directly upward and returns to the same level 5.10 s later.
   a. How high above its original point did the ball go?
   b. How fast was it moving just after being hit?