Vector Hunt

Group # ____________ Group Members: ____________________

Flag #'s ____________ ____________________

____

____

Each team will find a series of flags that represent a path from the lowest number to the highest number. Your task is to completely and accurately describe the motion using vector notation.

A. Sketch the positions of the flags in the field. On your diagram, indicate the directions for North and East. Also label the angle that you measure for each of the vectors.

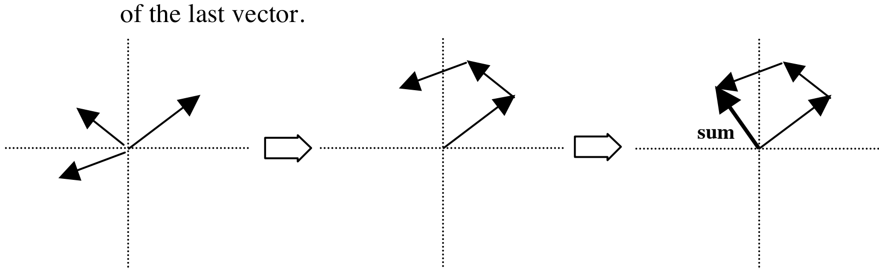
Measure the magnitude and direction for each vector.	**Diagram**
s_{1-2}= ______________________ @ ____________________________	
s_{2-3}= ______________________ @ ____________________________	
s_{3-4}= ______________________ @ ____________________________	
s_{4-5}= ______________________ @ ____________________________	
Measure the magnitude and direction for the vector from the first flag to the last flag	
s_{1-5}= ______________________ @ ____________________________	

B. Use a ruler and a protractor to draw a scale diagram of each of the vector. Each vector should be drawn on with the same origin because they each represent a displacement from a point. Label each of the individual vectors and indicate what your scale represents.

C. On a second piece of graph paper, add the vectors graphically using tip-to-tail addition.

<u>Tip-to Tail Addition</u>: (Example shown below.)

Start by drawing one vector starting at the origin.
At the tip of that vector, draw the next vector, starting with the tail.
Repeat this process until all of the vectors have been used.
The sum of the vectors is a vector with its tail on the origin and the tip on the tip of the last vector.



Start by drawing one vector starting at the origin.	At the tip of that vector, draw the next vector, starting with the tail. Repeat this process until all of the vectors have been used.	The sum of the vectors is a vector with its tail on the origin and the tip on the tip of the last vector

Use your diagram to answer the following questions.
1. How far would you have to walk from start to finish following the path designated?

2. How far would you have to walk from start to finish following a straight line?

3. What direction (include an angle) would you have to walk to follow a straight line from start to finish?

4. How far would you have to walk from finish to start following a straight line?

5. What direction (include an angle) would you have to walk to follow a straight line from finish to start?

The answer to question one gives the total distance traveled along a path. The answers to questions two and three combine to give the **resultant** of the vectors. Notice that this is the same as the sum of the vectors. Vectors that represent the change in the position of the object are called **displacement vectors**. The answers to questions four and five combine to give the **equilibrant** for the vectors. This is the vector that would bring the sum to zero.

6. Why does it take two answers to find the resultant?

7. What is the difference between the resultant and the equilibrant?

8. Write the resultant vector in magnitude-direction form.

$\mathbf{R_{Scaled}}$ = ____________________________@______________________________________

D. Suppose you could only travel along the N-S E-W "gridlines". Each individual vector can be written as two (or three if needed) parts or components that represent only the parts of a vector that are along an axis.

<u>Finding Components</u>

Sketch the vector, labeling the length and the angle.
Draw the components as ***dashed*** vectors.
Choose the trigonometric tools for each component.
Solve the trig equations.
Identify whether each component is positive or negative.

1. What are the trigonometry functions for finding legs of a right triangle if you are given the hypotenuse and one angle?

2. What is the difference between a positive component and a negative component?

3. Show the work to find the components of each of the vectors.

Write the components of each of the individual vectors. Be careful with your directions and signs.

	E-W *(positive :* *)*	***N-S*** *(positive :* *)*
s_{1-2}:	____________________	____________________
s_{2-3}:	____________________	____________________
s_{3-4}:	____________________	____________________
s_{4-5}:	____________________	____________________

4. Add the individual components together to get the components of your resultant vector. (Be careful to keep track of positives and negatives.)

$R_{Calculated}$: ____________________ ____________________

5. When components of the resultant are added together as vectors, they produce the resultant vector.

a. Sketch the tip-to-tail addition of the resultant's components.

b. The components are the legs of a right triangle that has the resultant as the hypotenuse. Use the Pythagorean theorem to find the length of the resultant vector.

c. Since the components are the legs of the right triangle you created, you can use the tangent function to find the angle from an axis. (Be careful. Use your diagram to determine which angle you are using.)

d. Write the resultant vector in magnitude-direction form.

$R_{Calculated}$ = ____________________@__________________________

E. You have now found the resultant of a series of vectors in two ways.

1. Find the percent difference between the magnitudes of graphical addition and the measured result.

2. Find the percent difference between the magnitudes of component method and the measured result.

3. What is a benefit of using the graphical addition?

4. What is a benefit of using the component method?