Physics 11
Lab: Adding Displacement Vectors

Objective:
To compare different methods of vector addition

Materials:

String (25 m)	Protractor	masking tape
Compass	Tape measurer	metre stick

Procedure

1. Plant an X at your starting point with masking tape

2. Find the orientation (direction) of displacement vector #1.

3. Measure a string of the appropriate length, and tie it to a second X.

4. Double-check your magnitude and direction.

5. Repeat the above steps for displacement vectors #2 and #3. Always double check you measurements.

6. Measure the magnitude and direction of the resultant vector.

Group #	Displacement #1	Displacement #2	Displacement #3
1	6.00 m [N]	8.00 m [S 30° W]	10.00 m [E 60° S]
2	6.00 [S]	10.00 m [E 60° N]	8.00 m [N 30° W]
3	8.00 m [E]	6.00 m [N 60° W]	10.00 m [E 300° N]
4	10.00 m [W]	8.00 m [E 30° S]	6.00 m [W 60° S]
5	6.00 [E]	10.00 m [N 60° E]	8.00 m [S 30° E]
6	10.00 m [W]	6.00 m [S 60° W]	8.00 m [W 30° N]
7	8.00 m [N]	6.00 m [N 60° W]	10.00 m [E 30° N]
8	10.00 m [S]	8.00 m [S 30° W]	6.00 m [W 60° N]
9	6.00 [E]	8.00 m [E 60° S]	10.00 m [W 30° S]
10	8.00 m [N]	10.00 m [S 30° W]	6.00 m [E 60° S]
11	10.00 m [N]	6.00 m [W 60° S]	8.00 m [S 30° E]

Analysis:

A) In the "field"

Give the measurement of the magnitude and the direction, as you have measured them in the field.

Resultant Vector, as measured in the field: _____

B) Graphically

On a white piece of paper, draw your displacement vectors to scale. (Use a ruler and a protractor!).

Using your scaled drawing, determine the magnitude and direction of your resultant displacement.

C) Mathematically (by components)

Sketch your three displacement vectors.

Using the "by components" method, determine the magnitude and the direction of your resultant displacement.

D) Calculating percent relative error

$$\% \text{ relative error} = \frac{\left|\text{Theoretical Value} - \text{Experimental Value}\right|}{\text{Theoretical Value}} \times 100$$

For this lab, we will use the values obtained by adding the vectors by components as the "theoretical" values.

1) Calculate the % relative error on the magnitude and on the direction for the values you have obtained in the "field".

2) Calculate the % relative error on the magnitude and on the direction for the values you have obtained by adding vectors graphically.

Conclusion

Discuss the results you have obtained using the different methods. Which ones where more or less precise? How can you explain the errors you have calculated?