

Where Am I? Lab

Teacher's Guide

Topic:

Vectors and Projectiles

The following information is provided to the student:

Question:

What is the ultimate destination which results from the combination of three displacement vectors?

Purpose:

To identify the ultimate destination which results from the combination of three displacement vectors.

A complete lab write-up includes a Title, a Purpose, a Data section, and a Conclusion. The Data section should include the provided table. For each vector, the vector should be sketched and labeled with magnitude and angle with respect to a nearby axis; the N-S and E-W components should be calculated; work should be organized and labeled. The final destination should be identified. The Conclusion responds to the question raised in the Purpose (as always).

Materials Required:

Meter stick.

Description of Procedure:

Students are provided with the magnitude and displacement of three vectors. Trigonometric functions are used to resolve the vectors into north-south and east-west components. Students then begin at the designated starting location and walk out the displacements in an effort to determine where the secret destination is. Finally, students add all components to determine the magnitude and direction of the total displacement resulting from the original three vectors.

Alternative Materials and Procedure:

If school administrator's frown on hallway labs, then construct a map of your room and try this activity as a classroom activity. Keep all the movements in two dimensions - parallel to the floor.

Safety Concern:

There is always a higher than usual level of risk associated with working in a science lab. Teachers should be aware of this and take the necessary precautions to insure that the working environment is as safe as possible. Student *horseplay* and off-task behaviors should not be tolerated.

Suggestions, Precautions, Notes:

1. This lab will take some teacher preparation time. Organizing the results of the preparation will reduce and even eliminate the need for preparation in the coming years. Obtain or create a map of the school (or at least the part of the school where you teach). Choose a starting point and measure the lengths of displacements from the starting location to the centers of all hallway intersection points. Then choose 12 to 15 destinations and plot out a 6-legged trip from the starting location to the destinations. Use the legs of the trip to determine the magnitude and direction of three sets of

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angled (i.e., not parallel to the hallways) displacements which will take a student from the starting location to one of the destinations. Each of the three *angled* displacements in the set should be resolvable into hallway displacements; when students walk out along these hallway displacements they should arrive at the intended destination.

- If you teach in more than one classroom, then consider making the starting location a location other than your classroom. For instance, make a stairwell or some other central location the starting location.
- If your creative juices are flowing, consider hiding a riddle at each destination. Students must find the location and then return and give the answer to the riddle.

Auxiliary Materials:

The following page is provided to the student for completion and inclusion in the Data section of their lab notebook.

Important!! Show your work in the table:

Vector	East-West Component	North-South Component
A: _____		
B: _____		
C: _____		
R		

The overall displacement (resultant) is _____ meters with a direction of _____. **Show your calculations below.**

Scoring Rubric:

VP3. Where Am I? Lab	Score
<ul style="list-style-type: none"> ___ Included, labeled and organized all parts of the lab report. ___ Data section includes completed table. Each vector is sketched and labeled with magnitude and direction; a trigonometric function is used to accurately determine the N-S and E-W components of the vectors; work is labeled and organized. The final destination is correctly identified - a sign of both good mathematics and good measurements. ___ Conclusion correctly states the final destination resulting from the combination of the three given vectors. 	___/___

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Connections to The Physics Classroom Tutorial:

The following readings are a suitable accompaniment to this lab:

<http://www.physicsclassroom.com/Class/vectors/u311d.cfm>

<http://www.physicsclassroom.com/Class/vectors/u311e.cfm>

Connections to Minds on Physics Internet Modules:

Sublevel 5 of the Vectors and Projectiles module is a suitable accompaniment to this lab:

<http://www.physicsclassroom.com/mop/module.cfm>