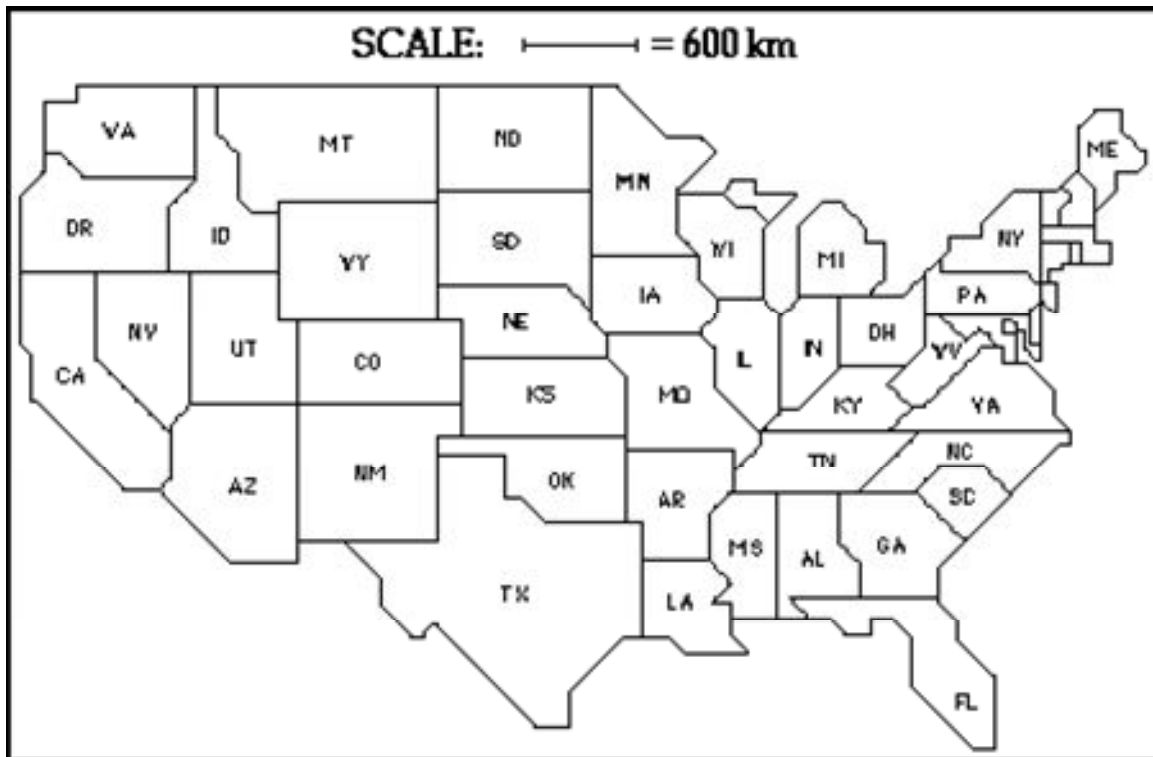


Physics Tours Lab

Materials: Protractor, cm-Ruler, US Map (provided), Calculator

Overview:

In this activity, you will use both the head-to-tail method and the analytical method of vector addition in order to determine the resultant displacement of two trips which have three individual "legs." For each trip, you will use the provided map of the United States (please excuse the quality) to make scale measurements in order to determine the ultimate location and you will use a calculator and trigonometric functions to determine the resultant displacement and thus identify the ultimate location.



Trip #1:

Head-to-Tail Method of Determining the Resultant:

On the map above, use the indicated scale to add the following three vectors (A, B, C) in a head-to-tail fashion. Include an arrowhead on each vector and label them clearly as A, B and C. Draw the resultant of $A + B + C$ on the diagram and label it as R_1 . Begin at Chicago, Illinois

A	B	C
4070 km at 165 degrees	1600 km at 270 degrees	2600 km at 340 degrees

The resultant of $A + B + C$ is _____ (include magnitude and direction). The final destination appears to be in or at least close to (use a map of the USA if necessary) the city of _____ in the state of _____.

Analytical Method of Determining the Resultant:

Now use a calculator, trigonometric functions, and principles of vector resolution to determine the components of each vector; include both magnitude and direction for each component. Show your work in each of the cells of the first three rows of the data table. Finally, add all the components to determine the horizontal and the vertical components of the resultant of $A + B + C$.

Vector	Horizontal or E-W Component	Vertical or N-S Component
4070 km at 165 degrees	_____	_____
1600 km at 270 degrees	_____	_____
2600 km at 340 degrees	_____	_____
Resultant	_____	_____

Now use the components of the resultant to determine the magnitude and the direction of the resultant. **PSYW** Once you have determined the resultant, make a measurement on the map to determine where this displacement would place a traveler.

As found by the analytical method, the resultant of $A + B + C$ is _____ (include magnitude and direction). When this resultant displacement is measured on the provided map, the final destination appears to be in or at least close to (use a map of the USA if necessary) the city of _____ in the state of _____.

Compare the results of the two methods of vector addition and use a few complete sentences to evaluate the effectiveness of the methods and the accuracy of your measurements.

Trip #2:

Head-to-Tail Method of Determining the Resultant:

On the map above, use the indicated scale to add the following three vectors (D, E, F) in a head-to-tail fashion. Include an arrowhead on each vector and label them clearly as D, E and F. Draw the resultant of $D + E + F$ on the diagram and label it as R_2 . Begin at Chicago, Illinois

D	E	F
1600 km at 250 degrees	1270 km at 350 degrees	1900 km at 80 degrees

The resultant of $D + E + F$ is _____ (include magnitude and direction). The final destination appears to be in or at least close to (use a map of the USA if necessary) the city of _____ in the state of _____.

Analytical Method of Determining the Resultant:

Now use a calculator, trigonometric functions, and principles of vector resolution to determine the components of each vector; include both magnitude and direction for each component. Show your work in each of the cells of the first three rows of the data table. Finally, add all the components to determine the horizontal and the vertical components of the resultant of $D + E + F$.

Vector	Horizontal or E-W Component	Vertical or N-S Component
1600 km at 250 degrees	_____	_____
1270 km at 350 degrees	_____	_____
1900 km at 80 degrees	_____	_____
Resultant	_____	_____

Now use the components of the resultant to determine the magnitude and the direction of the resultant. **PSYW** Once you have determined the resultant, make a measurement on the map to determine where this displacement would place a traveler.

As found by the analytical method, the resultant of $D + E + F$ is _____ (include magnitude and direction). When this resultant displacement is measured on the provided map, the final destination appears to be in or at least close to (use a map of the USA if necessary) the city of _____ in the state of _____.

Compare the results of the two methods of vector addition and use a few complete sentences to evaluate the effectiveness of the methods and the accuracy of your measurements.

