

MINILAB

3-1 Distance and Displacement

The words distance and displacement refer to two very different quantities. If you leave home and walk a distance 10 km, you might end your walk 10 km east of home, 5km east of home or back at your home. Your final position or displacement depends not only on the distance you travel but also the direction in which you walk. Displacement includes both the distance and direction of change in position, measured from the starting point. Therefore, displacement is a vector quantity and can be represented by an arrow-tipped line segment. The length of the arrow drawn to scale represents the magnitude quantity. The direction of the arrow represents the direction of the quantity. The vectors are added by placing the tail of one vector at the head of the other vector. The sum or resultant is drawn by connection of the tail of the first vector to the head of the second vector.

Equipment

Sharp pencil
Paper
Ruler
Protractor

Objectives

During this minilab you will

- Make and use scale drawing to determine distance.
- Use vector addition to determine displacement

Procedures and Interpretation

A. Practice in Using the Map Scale

1. Use the scale on the map and determine the distance in meters
 - a. from Granville Road along N 11th Street to Church Street and down Church Street to the YMCA.

- b. along Moull Street from N 21st Street to Mt. Vernon Road.

B. Adding Two Vectors

2. Take a walk from the corner of N 21st Street and Granville Road down N 21st Street to Church Street and s down Church Street to the YMCA.

3. Using the map scale, find the magnitude in meters of each of the distances.

4. Using a scale of $1\text{ cm} = 92\text{ m}$, draw on your paper a vector diagram representing your trip.
5. Measure the resultant displacement on your diagram and express it in meters.

6. Since your vector diagram forms a right triangle, calculate the resultant algebraically.

7. Return to the map and measure the total displacement using the map scale. How do the two resultants compare?

8. What distance did you walk?

C. Adding Three Vectors

9. Using the scale of $1\text{ cm} = 92\text{ m}$, draw a vector diagram for the following trip. Start at Newark High School and go down Brennan to Granville Road, then along Granville Road to N 11th Street and down N 11th Street to White's Field.

10. From your diagram, determine in meters the distance traveled.

11. Determine the total displacement using your diagram.

12. Determine the total displacement from the original map.

13. Explain why there might be a difference between your answers to questions 11 and 12.

