Unit 2 Lesson 4
Measuring Distance and Displacement Portfolio

Introduction
Vectors have many uses. For example, you can use vectors to describe the distance an object travels and the displacement that results from an object’s movement. Before you can make use of vectors, you must first select a frame of reference.

To use vectors to describe an object’s position or movement on a flat surface, you must first define a frame of reference that includes the origin—a specific point that does not move. Two imaginary lines, or axes, that pass through the origin at right angles are then chosen. These two lines are the $x$-axis and the $y$-axis. Using the axes, you can describe the position of an object in terms of its $x$- and $y$-coordinates.

Pre-Lab
Displacement Vector

1. What is the length of the $x$- component? ______________

2. What is the length of the $y$-component? ______________

3. Use Pythagorean Theorem ($L = \sqrt{x^2 + y^2}$) to calculate the displacement vector. ______________

4. The distance traveled is the ($x$ component + $y$ component). How does the distance length compare to the displacement length?

________________________________________________________________________________
LAB

Materials

String, thread or tape.

Ruler (download and print a paper ruler from [http://www.myonlineruler.com/PrintableRuler.html](http://www.myonlineruler.com/PrintableRuler.html) if you do not have one).

Directions

a. Use the string, thread or tape to make the x axis and y axis on the floor. Each axis should be about 1 meter or 100 cm long.

b. Use the string, thread or tape to make a triangle anywhere on the graph.

c. Take a picture of your vector. (Submit picture with assignment)

d. Complete the data table. Use your ruler to measure the length to get the coordinates.

<table>
<thead>
<tr>
<th>START</th>
<th>FINISH</th>
<th>Length of component</th>
</tr>
</thead>
<tbody>
<tr>
<td>x-coordinate =</td>
<td>x coordinate =</td>
<td>x =</td>
</tr>
<tr>
<td>y-coordinate =</td>
<td>y coordinate =</td>
<td>y =</td>
</tr>
</tbody>
</table>

e. Use Pythagorean Theorem (L = \sqrt{x^2 + y^2}) to calculate the length of the displacement vector.

f. The distance is the length of the x component + y component. What is the distance?________

g. Distance is i. longer ii. shorter or iii. the same as the displacement. (Circle your answer)
Conclusion Questions

1. An AC repair technician is trying to find the house he needs to make a repair. He travels 9 km east, then turns around and travels 4 km west and then turns around again and travels 14 km to his destination.

   ![Diagram](image)

   a. What distance did he travel? ___________km

   b. What is the displacement? (Remember change in position from beginning to end) ___________km

2. Jennifer swims 4 complete lengths of a 50m pool
   (Define a length as from one side of the pool to the other)

   ![Diagram](image)

   a. What distance did she swim? _____________m

   b. What is her displacement? ___________m

3. Nolan kicks a soccer ball 19m directly across the field to Henry who then kicks it 13m down the field to Javier.

   a. Draw a diagram to show the movement of the ball from player to player.

   ![Diagram](image)

   b. What distance did the ball travel? _________________m

   c. What is the ball’s displacement? _________________m