

Distance and Displacement Lab



Note! Round all measurements to the nearest meter!

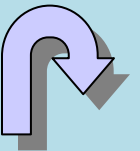
For this lab, you will need a large area to move around. You will most likely need to complete this lab outside in a large yard or field.

1. Place a piece of tape or some kind of marker where you will begin your walk outside. This tape marks the **ORIGIN**.

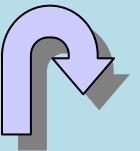
2. Walk 10 steps forward and stop. (Note: Forward is whichever direction you choose!) Using a meter stick (or some kind of measuring device), measure the **DISTANCE** you walked. *If you do not have a partner to measure for you, mark your final position with tape and measure from the origin to your final position.* Write or type that distance here:
_____ (Don't forget units!)



3. Now turn 180 degrees (turn around) and walk 5 steps and stop. Using the meter stick, measure the **DISTANCE** you walked this time. Write or type that distance here: _____ (Don't forget units!)



4. Now turn 180 degrees and walk 20 steps and stop. Using the meter stick, measure the **DISTANCE** you walked. Write or type that distance here:
_____ (Don't forget units!)



5. Finally, measure how far you are from the origin. **Note: Make sure you measure how far you are from the origin "as the crow flies," or IN A**



STRAIGHT LINE.

You should **NOT** be measuring along the path you took. Write or type that measurement here (**Don't forget to include the direction you moved and the unit!**): _____ This is your **MEASURED DISPLACEMENT**.

6. We've measured your distance and displacement. Now, let's **CALCULATE** the **DISTANCE** and **DISPLACEMENT** you walked.

- Add all measurements to find the **DISTANCE**: _____ (**Don't forget units!**)
- Add all forward measurements and subtract all backwards measurements to find the **CALCULATED DISPLACEMENT** (**Make sure you include a direction and the unit.**): _____

Did your **MEASURED DISPLACEMENT** match your **CALCULATED DISPLACEMENT**? _____ It should!

7. Find your origin (piece of tape) again, and walk 10 steps forward. Measure how far (the **DISTANCE**) you walked. Write or type it here: _____ (**Don't forget your units!**)

8. Turn 90° left, walk 15 steps and measure how far (the **DISTANCE**) you walked. Write or type it here: _____ (**Don't forget your units!**)

9. Turn 90° left, walk 10 steps and measure how far (the **DISTANCE**) you walked. Write or type it here: _____ (**Don't forget the units!**)

10. Turn 90° left, walk 20 steps and measure how far (the **DISTANCE**) you walked. Write or type it here: _____ (**Don't forget the units!**)



11. Measure how far you are from the origin. **Note:** Make sure you measure how far you are from the origin "as the crow flies," or IN A



STRAIGHT LINE.

You should NOT be measuring along the path you took. Write or type that measurement here (Don't forget to include the direction you moved and the unit!): _____ This is your **MEASURED DISPLACEMENT**.

12. We've measured your distance and displacement. Now, let's **CALCULATE** the **DISTANCE** and **DISPLACEMENT** you walked.

- Calculate your **DISTANCE** and write or type it below. Show your work. Add up the measurements you wrote in numbers 7 through 10.
Distance = _____ (Don't forget the units!)
- Now you are going to **CALCULATE** your **DISPLACEMENT** and write it below (**Include units and a direction**). Show your work. Add number 7 + number 8 then subtract number 9 and number 10. Calculated Displacement = _____ (Don't forget the direction and unit.)

Does your **MEASURED** displacement match your **CALCULATED** displacement? _____ It should!

13. Find your origin (piece of tape) again, and walk 20 steps forward. Measure how far (the **DISTANCE**) you walked and write or type it here: _____ (Don't forget the units!)



14. Turn 90° right and walk 20 steps. Measure how far (the **DISTANCE**) you walked and write or type it here: _____ (Don't forget the units!)



15. Measure how far you are from the origin, your **MEASURED DISPLACEMENT**. Note: Make sure you measure how far you are from



the origin "as the crow flies," or IN A STRAIGHT LINE.

You should NOT be measuring along the path you took. Write or type that measurement here (Don't forget to include the direction you moved and the unit!): _____

16. We've measured your distance and displacement. Now, let's **CALCULATE** the **DISTANCE** and **DISPLACEMENT** you walked.

- Calculate your **DISTANCE** and write or type it below. Show your work. Add number 14 and 15. Distance = _____ (Don't forget the units!)
- Here's a way to calculate your **DISPLACEMENT**. You can use the Pythagorean Theorem! Add the square of number 13 and the square of number 14. Write or type it here: _____ (Don't forget to include units!)
- Now **square** the displacement you measured in number 15 (your **measured displacement**). Write or type it here: _____ (Don't forget to include units!)
- The two numbers should be equal or nearly so. If you have a calculator, find the square root of the value you found for the **sum of the square of #13 and square of #14**. This value is the **MAGNITUDE** of your **CALCULATED DISPLACEMENT**. Does it match your measured displacement (or nearly so)?
- To completely express your displacement, just put *the direction you ended up relative to the origin* at the end of the calculated displacement you found previously. What is your displacement? Write or type it here: _____ (Don't forget to include units and a direction!)

17. Now diagram the last walk and indicate displacement with a vector arrow. Show all your measured distances and displacements on the diagram.

18. Show with the same diagram how you used the Pythagorean Theorem to find your calculated displacement. Label the square of each leg of your triangle on the diagram.

19. Can you explain why the Pythagorean Theorem can be used to find the calculated displacement in your last walk? Hint: you made a 90 degree turn on your walk.