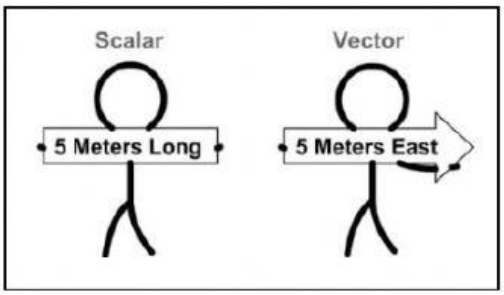
Name: _____ Date: _____

Physics Lesson 2: Scalars, Vectors, and Velocity and Speed

Name	Variable	Unit	Unit Abbreviation
Displacement or Distance	X	Meters	m
Time	t	Second	s
Velocity or Speed	v	Meters Per Second	m/s
Acceleration	a	Meters Per Second Per Second	m/s^2

How are scalars different from vectors?

- A **scalar** in physics includes only a magnitude. A **magnitude** is a number and a unit.
- Common Scalars and Examples
  - **Distance**: the pool is 5 meters long
  - **Speed**: the golf cart can drive 10 meters per second
  - **Time**: it takes 2 seconds
    - All scalars have a number and a unit but no direction



- A **vector** in physics includes a magnitude (number, unit) and a direction.
- Common Vectors and Examples
  - **Displacement:** I walked **5 meters east**
  - **Velocity**: example: I drove the golf cart **10 meters** per second **east**
  - **Acceleration**: I sped up by **4 meters per second east every second**

Distance vs. Displacement

- **Distance** (a scalar) is a measure of how far disregarding direction traveled.
  - My street is 100 meters long
- **Displacement** (a vector) is a measure of where you are from the **origin**, or starting point, and in what direction.
  - I walked along my street 100 meters east

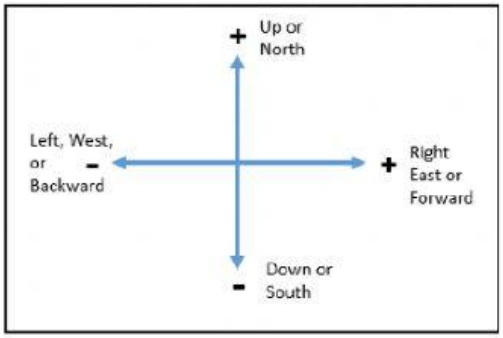
How do you calculate scalar distance?

You walk 6 meters east followed by 4 meters west. What **distance** did you walk?

Direction does not matter for distance
Disregard direction and add everything up
6 meters + 4 meters = 10 Meters

How do you calculate the vector displacement?

You walk 6 meters east followed by 4 meters west. What is your **displacement**?



For the **displacement vector,** you **turn direction into a mathematical sign** and add vectors.

The sign in front of the number is a placeholder for direction

6 meters east = +6 Meters
4 meters west = -4 Meters
Adding Vectors (+6) + (-4) = +2
+2 meters becomes 2 meters east

Answer: Your Displacement is **2 meters east**

Q1: A dog walks 50 m east and then 23 m west. What is its distance traveled?

Q2: A dog walks 50 m east and then 23 m west. What is its displacement?

Q3: A bird has flown 850 km south for the winter when he realizes he as to go back because it is still summer. After traveling 320 km north, what is the bird's distance traveled?

Q4: A bird has flown 850 km south for the winter when he realizes he as to go back because it is still summer. After traveling 320 km north, what is the bird's displacement?

Calculating Scalar Speed and Vector Velocity

x stands for displacement or change in position

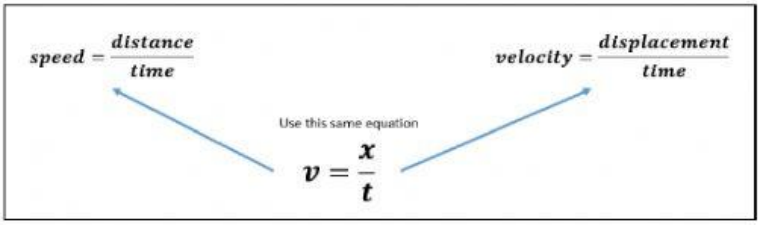
Δ (Greek letter delta) means change in

$\Delta x = x_f - x_i$ Change in position = your final position minus your initial positon

You walk from the 2-mile marker to the 7-mile marker you walked

(7 – 2) or 5 miles forward

Q5: What is Tom's displacement if he went from a position of 10 meters to a position of 4 meters?



Q6: What is the velocity of a plane that travels 5000 miles north followed by 10000 miles north in 20 hours?

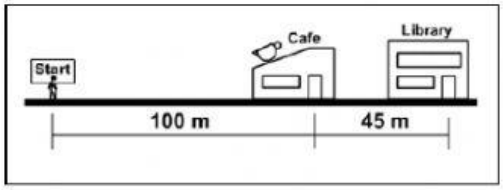
Q7: What is the speed of a plane that travels 5000 miles north followed by 10000 miles north in 20 hours?

Instantaneous vs. Average Velocity

- **Instantaneous velocity** is the velocity at an **exact moment**
- **Average velocity** is the velocity **averaged for a whole trip**

Practice Problems

Thomas, on his lunch break, took 30 minutes to go to the library and then the cafe. (Look at the picture for measurements)



1) What distance did Thomas travel during lunch?

2) What was his displacement?

4) What was the velocity of Thomas during the 30 minutes?

Choose One For #11 and #12

- scalar distance
- scalar velocity
- scalar speed
- scalar displacement
- vector distance
- vector displacement
- vector speed
- vector velocity

11) 15 m/s is a _____. (Pick from the list→)

12) 15 m east is a _____. (Pick from the list→)

13) What is your displacement after going 10 meters east followed by 3 meter west?

14) What is your distance after going 10 meters east followed by 3 meter west?

15) Sam takes 500 seconds to travel 300 meters from home to work. During this trip, he stops at a red light and his speedometer reads 0 m/s.
What is Sam's instantaneous speed at the red light?