The Language of Motion

*In your own words, describe **MOTION:***

This unit is all about motion, which involves things moving in different **directions** and how **quickly** they move. In order to do this, we must first distinguish between **Vectors** and **Scalars.**

VECTORS and SCALARS

Prior knowledge: What is the difference between a scalar quantity and a vector quantity?

Scalar quantities show **magnitude** only. Magnitude refers to the **size** of a measurement or the **amount**.

Example:

Sarah says, "Meet me a honey's doughnuts, its only 800 metres away". – This is scalar because you are only saying how far it is

Vectors are like scalars but they include **direction** as well as **magnitude**.

Example:

Sarah says, "Meet me a honey's doughnuts, its only 800 metres south east of here". – This is a vector because you are including the size (how far it is) and the direction you have to go

Direction is usually surrounded by **square** brackets. You also know a symbol represents a vector if it has an **arrow** above it.

Example:

88 m [W], $\vec{d}$

Circle the values below that are vectors:

a) 5.0 m	b) -4.3 m/s	c) v	d) 7.84 m [E]
e) 3.1 m/s North	f) - 6.7 m/s^2 [up]	g) d	h) 11 m/s
i) t	j) 3 feet per minute	k) +48	l)- 89 Km [S]
m) $\vec{a}$	n) 323.4 km	o) 25 m/s south east	

DISTANCE vs. POSITION

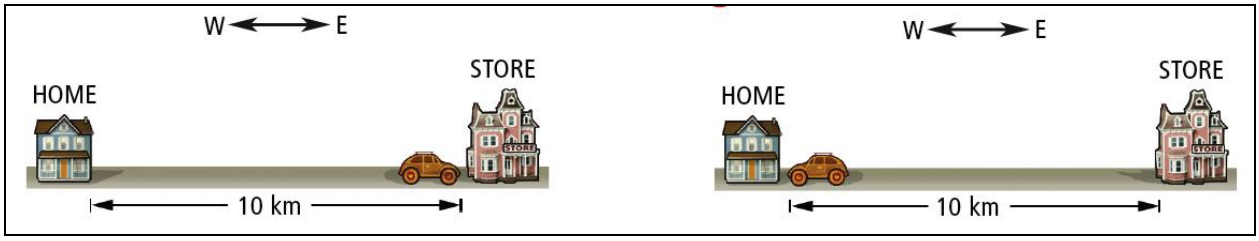
Distance is a **scalar** quantity that describes the length of a path between two **points** or **locations.**

Example: a person ran a distance of 400 m around the track

Position ($\vec{d}$) is a **vector** quantity that describes a **specific** point relative to a **reference** point.

Example: the school is 3 km east of my house

> **note:* in this unit we will be using **SI units** – the units used for all measurements in science (international system)
>
> ***For position the SI units are metres, m.*



A car leaves home and drives 10 km to the store and then returns home. The cars **position** from his home to the store and back is 0 km. The car has driven a total **distance** of 20 km but its final **displacement** is 0 km.

What's the difference? Explain the difference between **distance** and **displacement.**

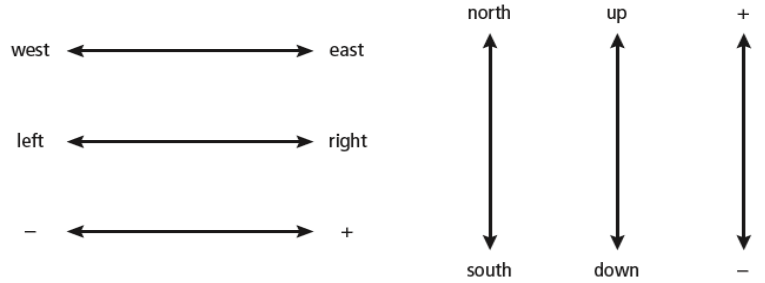
Displacement: how position changes
distance: length of a path between two points

Let's figure out the difference here:

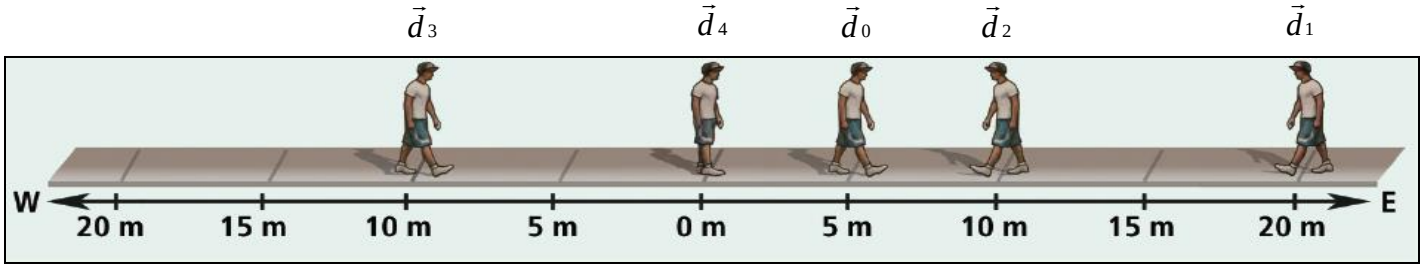
Scalar = Distance. Definitions of Distance The length of a path between two points or locations — Measured in units: meters
Vector = Displacement. Definition of Displacement Describes how much an object's position has changed — Measured in units: meters

When dealing with different directions, we must remember that certain directions are associated with positive values and some are associated with negative values.

Complete the diagram below showing common sign conventions:



The diagram below shows a man walking back and forth on a side walk. At each time point he is a different point away from the original position.



At $\vec{d}_3$, the man displacement is **15 m [W]**, and total distance is **45 m**.

How do we calculate this?

Distance: $d = d_1 + d_2 + d_3$ .... → d = 15 m + 10 m + 20 m = 45 m

Displacement: $\Delta\vec{d} = \vec{d_f} - \vec{d_i}$ → $\Delta\vec{d} = -10\text{ m} - 5\text{ m} = -15\text{ m} = 15\text{ m [W]}$

Fill in the table below with all the missing values. Include all steps you took

Point	Position	Total Distance Traveled
$\vec{d}_0$	5 m [E]	0 m
$\vec{d}_1$	20 m [E]	20 m – 5 m = 15 m
$\vec{d}_2$	10 m [E]	15 m + 10 m = 25 m
$\vec{d}_3$	10 m [W]	15 m + 10 m + 20 m = 45 m
$\vec{d}_4$	0 m	15 m + 10 m + 20 m + 10 m = 55 m

Distance	Displacement
Total distance is the **length of a path between two points**	Total displacement is the **straight line distance from one point to another**
Equation for Total Distance:	Equation for Displacement:
Add: $d = d_1 + d_2 + d_3 \ldots$	Add: $\Delta\vec{d} = \overrightarrow{d_f} - \overrightarrow{d_i}$
Circle the correct answer:	Circle the correct answer:
Distance is a: 1. scalar 2. vector.	Displacement is a: 1. scalar 2. vector.
Distance has/doesn't have a direction.	Displacement has/doesn't have a direction.

TIME INTERVAL and POSITION

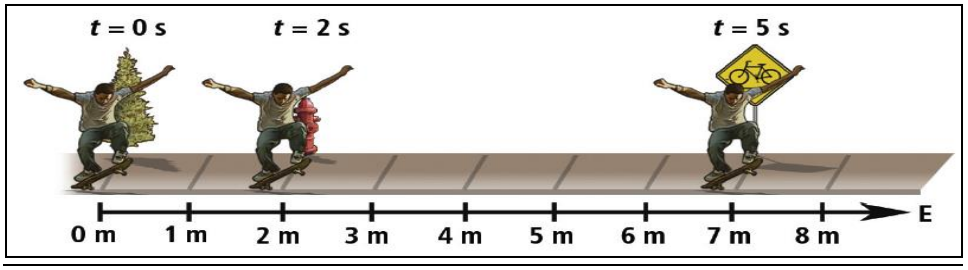
Time (t) is when an event occurs

- **Initial time** (t_i) is when the event began
- **Final time** (t_f) is when the event finished

Time **interval** is the difference between the final and the initial times

How do we calculate this?

$$\Delta t = t_f - t_i$$



What is the time interval from the fire hydrant to the sign?

$\Delta t = t_f - t_i \rightarrow \Delta t = 5\ s - 2\ s = 3\ s$