

Definitions: Position, Displacement, and Distance

Start in 1D

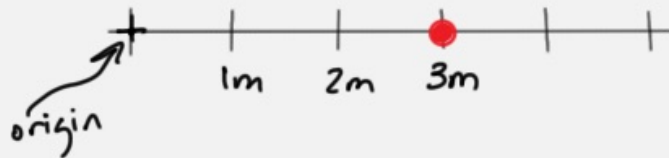
by Jessica Kintner

position, $\vec{x} \equiv$ location, usually wrt an origin

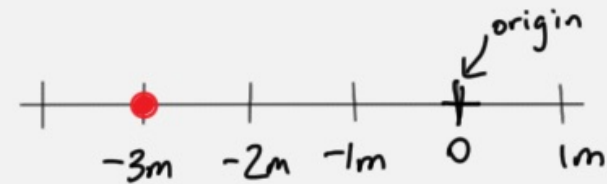
- it is a vector \equiv magnitude and direction are important. Much more on vectors later. In 1D: only need + or - to indicate direction

- units meters, m

- it can be a function of time. more on this later



The position of the red dot is at $x=3m$
 $x=+3m$



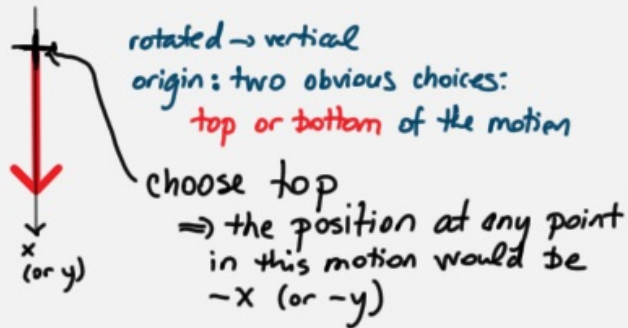
So in 1D, +/- tells you direction along the axis.

You can choose the location of the origin, but you must leave it fixed for the problem (part.)

You can also rotate the axis. (again, keep it consistent for entire part.)

Examples:

1. Drop object:



2. Cart rolls on incline:



Distance and Displacement

Example Question: If I run 4mi

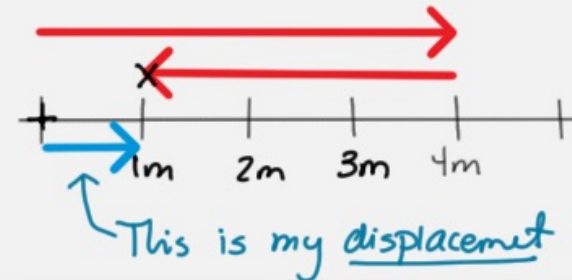
due East, then turn and run
 3mi due West:

- How far did I run?
 (how much exercise did I get?)
- How far am I from where I started?

Answers

a.) $4\text{mi} + 3\text{mi} = 7\text{mi}$
 In terms of exercise, I ran 7mi.
 This is the distance I ran

b.) $4\text{mi} - 3\text{mi} = 1\text{mi}$
 (east) (west) east



Displacement, $\Delta \vec{x} \equiv$

\equiv change in position

$$\Delta \vec{x} \equiv \vec{x}_f - \vec{x}_i$$

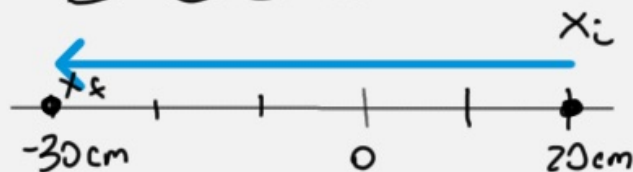
where

$\vec{x}_f \equiv$ final position

$x_i \equiv$ initial position

- it is a vector (so dir is important)
disp of 1mi E
diff 1mi W
- units m

Example: An object starts at a position of $x = +20\text{cm}$, and it ends up at position -30cm . What is its displacement?



$$\begin{aligned} \Delta x &= x_f - x_i \\ &= -30\text{cm} - 20\text{cm} \\ &= -50\text{cm} \end{aligned}$$

the negative sign indicates that it ended up to the left (-x dir) from where it started

Distance \equiv the space between two points.

- scalar \Rightarrow dir does not matter
- it is always + (like length)
- units m

Example: When I ran 4mi E then 3mi W, the total distance was $d_1 + d_2$
 $= |4\text{mi}| + |-3\text{mi}| = 7\text{mi}$