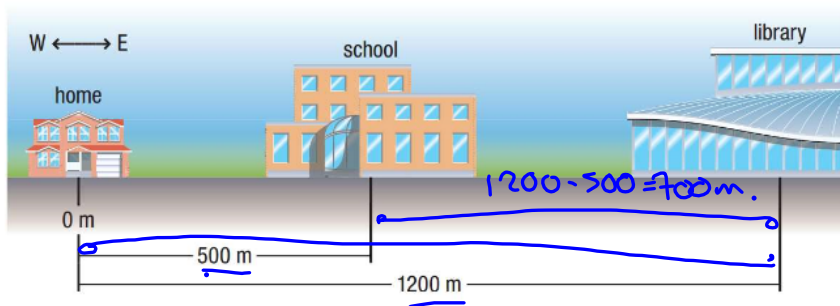


SPH3U: 1.1 Distance, Position, and Displacement**1. What is kinematics?**

Kinematics:	the study of motion.
distance	d total length of the path taken by an object. Units: m (metres).

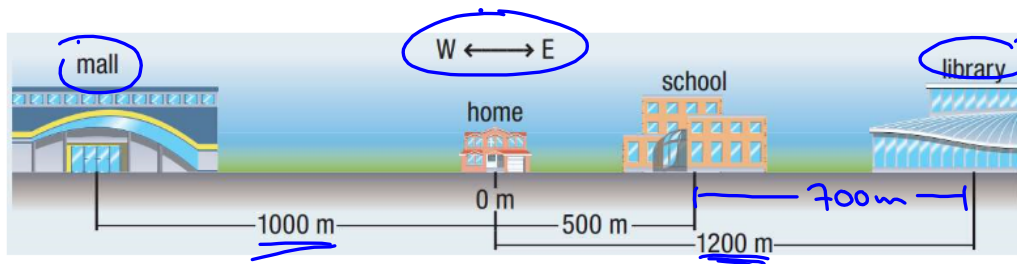


In the figure above, how far will you have traveled if you:

- walk directly from home to your school? $d = 500 \text{ m}$.
- walk from your school to the library, then return home? $d = 700 + 1200 = 1900 \text{ m}$.

2. Position and displacement

Scalar:	a measurement with only magnitude (size).
Vector:	has magnitude <u>and</u> direction. represented by an <u>arrow</u> .
position \vec{d}	the distance <u>and</u> direction of an object from a reference point. Vector.
reference point	some location that we choose to be 0.
displacement $\Delta \vec{d}$	change in position. $\Delta \vec{d} = \vec{d}_f - \vec{d}_i$ or $\vec{d}_2 - \vec{d}_1$. Vector.
delta (Δ)	the change in a value ($\Delta x = x_f - x_i$).



In the figure above, what is:

- the position of the school, with home as a reference point? $\vec{d} = 500 \text{ m [E]}$.
- the position of the school, with the library as a reference point? $\vec{d} = 700 \text{ m [W]}$.

Imagine that you walk from home to school in a straight-line route. What is your displacement? Use your home as a reference point.

$$\begin{aligned}\vec{\Delta d} &= \vec{d}_f - \vec{d}_i = 500 \text{ m [E]} - 0 \text{ m} \\ &= 500 \text{ m [E]}.\end{aligned}$$

What is your displacement if you walk from your school to the library?

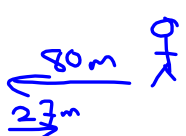
$$\begin{aligned}\vec{\Delta d} &= \vec{d}_f - \vec{d}_i = 1200 \text{ m [E]} - 500 \text{ m [E]} \\ &= 700 \text{ m [E]}.\end{aligned}$$

One night after working at the library, you decide to go to the mall. What is your total displacement when walking from the library to the mall?

$$\begin{aligned}\vec{\Delta d} &= \vec{d}_f - \vec{d}_i = 1000 \text{ m [W]} - 1200 \text{ m [E]} \\ &= 1000 \text{ m [W]} + 1200 \text{ m [W]} \\ &= 2200 \text{ m [W]}.\end{aligned}$$

$1200 \text{ m [E]} = -1200 \text{ m [W]}$

A dog is practising for her agility competition. She leaves her trainer and runs 80 m due west to pick up a ball. She then carries the ball 27 m due east and drops it into a bucket. What is the dog's total displacement?



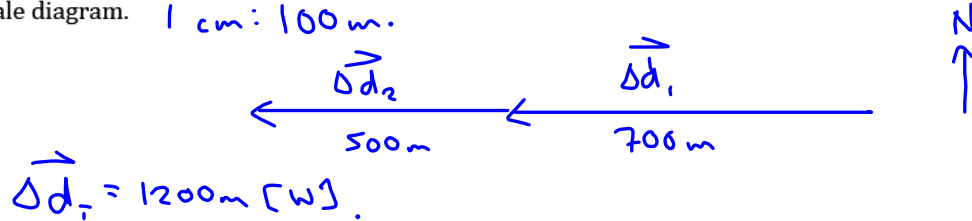
$$\begin{aligned}\vec{\Delta d}_T &= \vec{\Delta d}_1 + \vec{\Delta d}_2 \\ &= 80 \text{ m [W]} + 27 \text{ m [E]} \\ &= 80 \text{ m [W]} - 27 \text{ m [W]} \\ &= \underline{53 \text{ m [W]}}.\end{aligned}$$

3. Vector scale diagrams



Vector scale diagrams:	draw vectors (arrows) with a certain scale, for instance 1 cm : 1 km.
directed line segment	line with an arrow on it (vector).
tip and tail	tip: end of arrow. tail: start of arrow.
adding vectors	use tip-to-tail: 2nd vector's tail on 1st vector's tip.

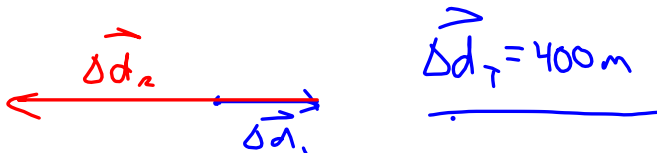
Add the two displacements $\Delta \vec{d}_1 = 700 \text{ m [W]}$ and $\Delta \vec{d}_2 = 500 \text{ m [W]}$ by drawing a vector scale diagram. 1 cm : 100 m.



Imagine that you are going to visit your friend. Before you get there, you decide to stop at the variety store. If you walk 200 m [N] from your home to the store, and then travel 600 m [S] to your friend's house, what is your total displacement?

1 cm : 100 m

→ N.



Homework:

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