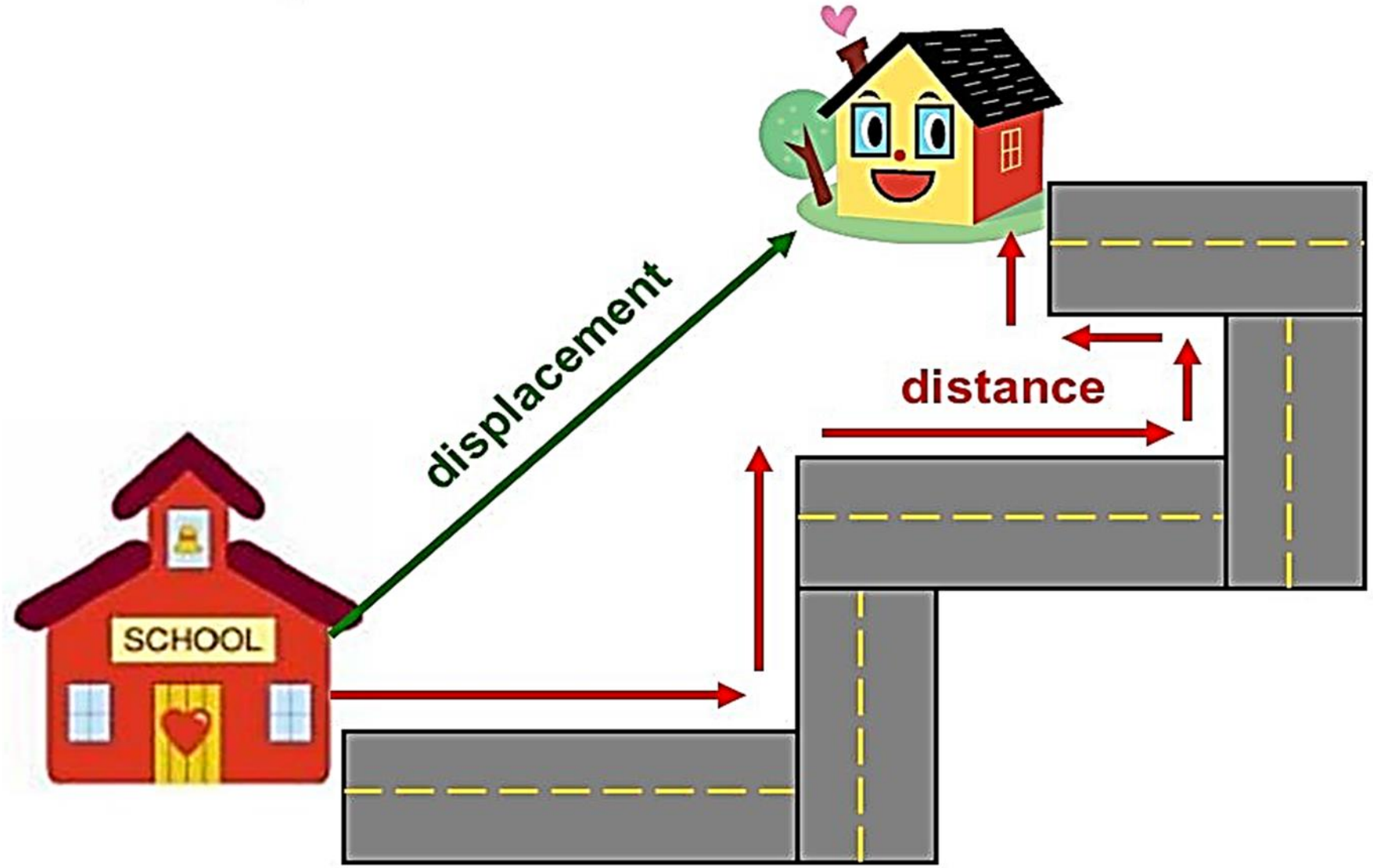
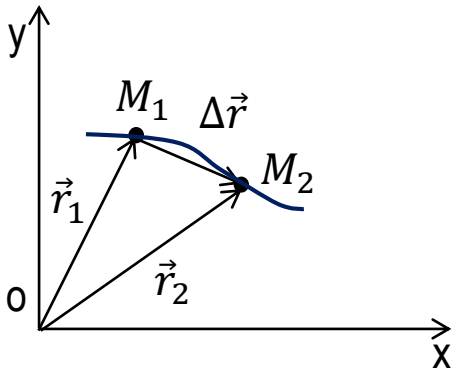
DISPLACEMENT AND DISTANCE



DISPLACEMENT VECTOR



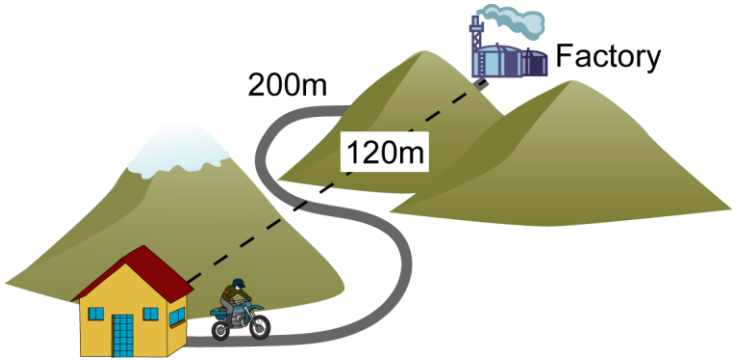
The **displacement** of a material point over a certain time interval is the *vector* $\Delta\vec{r}$ directed from its position at the initial moment (M_1) to the position at the final moment (M_2). The picture 1 shows that: $\Delta\vec{r} = \overrightarrow{r_2} - \overrightarrow{r_1}$

The material point displacement vector is equal to the difference between final ($\vec{r}_2$) and initial ($\vec{r}_1$) position vector.

DISPLACEMENT AND DISTANCE. VECTOR AND SCALAR

Distance is a scalar quantity (scalar quantity have magnitude only). Distance is a measure of the interval between two locations measured along the *actual path* connecting them. Distance can only be positive. **Unit is meters or kilometers.**

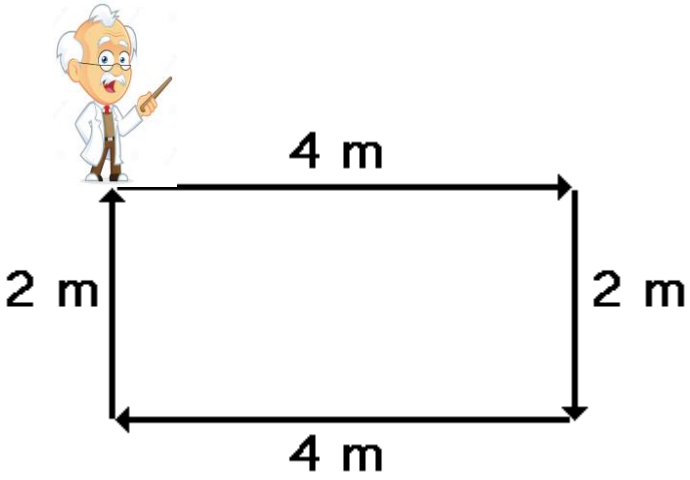
Displacement is an example of vector quantity (vector quantity has both magnitude and direction). Displacement is a *vector* measure of the interval between two locations measured along the *shortest path* connecting them. It is a straight line from the starting point (origin) to the end point. It is possible to have an displacement equal to zero if the object starts and ends in the same position. **Units is meters or kilometers.** → **(with direction)**



Adli go to work by motorcycle everyday as shown in the diagram above. The distance that Adli travels from his house to the factory is 200m. The displacement of Adli from his house after arriving at the factory is 120m.

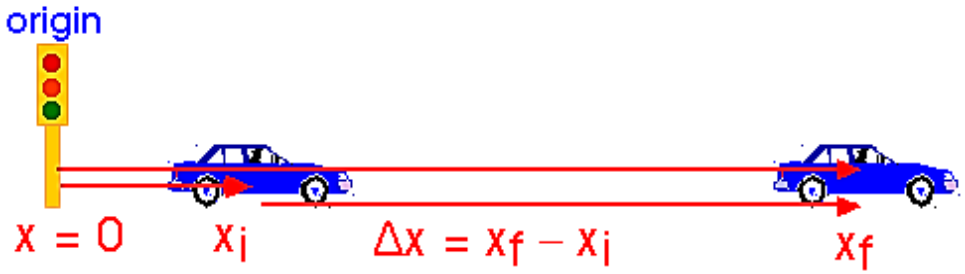
Example

A physics teacher walks 4 meters East, 2 meters South, 4 meters West, and finally 2 meters North.



- Even though the physics teacher has walked a total distance of 12 meters, her displacement is 0 meters.
- During the course of her motion, he has "covered 12 meters of ground" distance= 12 m.= (4m+2m+4m+2m)
- Yet, when he is finished walking, he is not "out of place" , there is no displacement for her motion (displacement = 0 m). Displacement, being a vector quantity, must give attention to direction.
- The 4 meters east is canceled by the 4 meters west; and the 2 meters south is canceled by the 2 meters north.

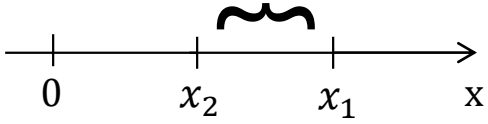
We use the symbol Δx for magnitude of object displacement in a straight line (we reserve symbol Δr for magnitude of object displacement in more than one dimension).
The object displacement can be mathematically defined as the difference between the final and initial position $\Delta x = x_f - x_i$

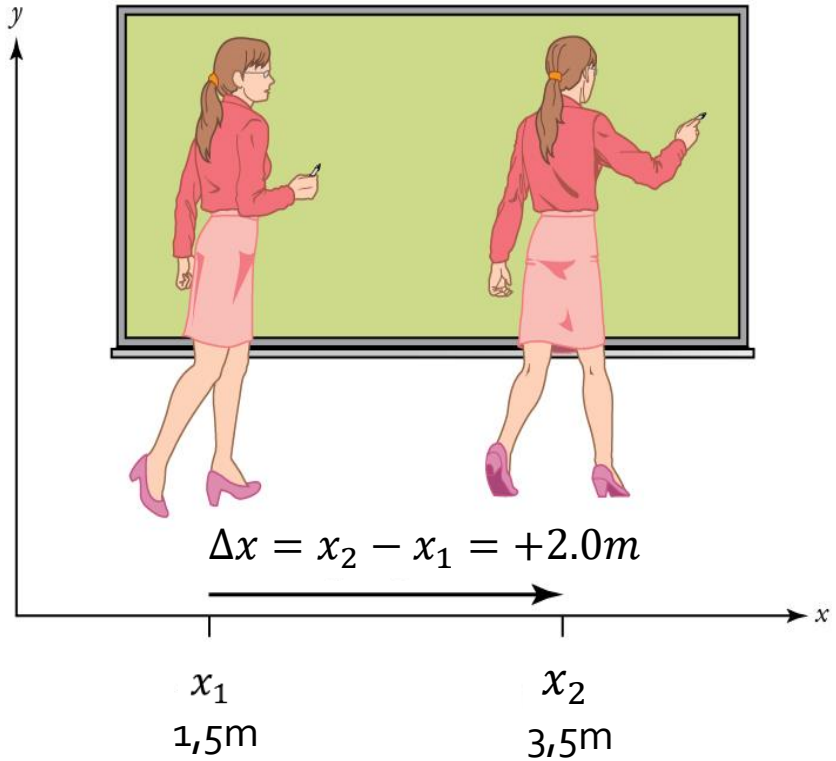


The object displacement (Δx) can have positive and negative values:

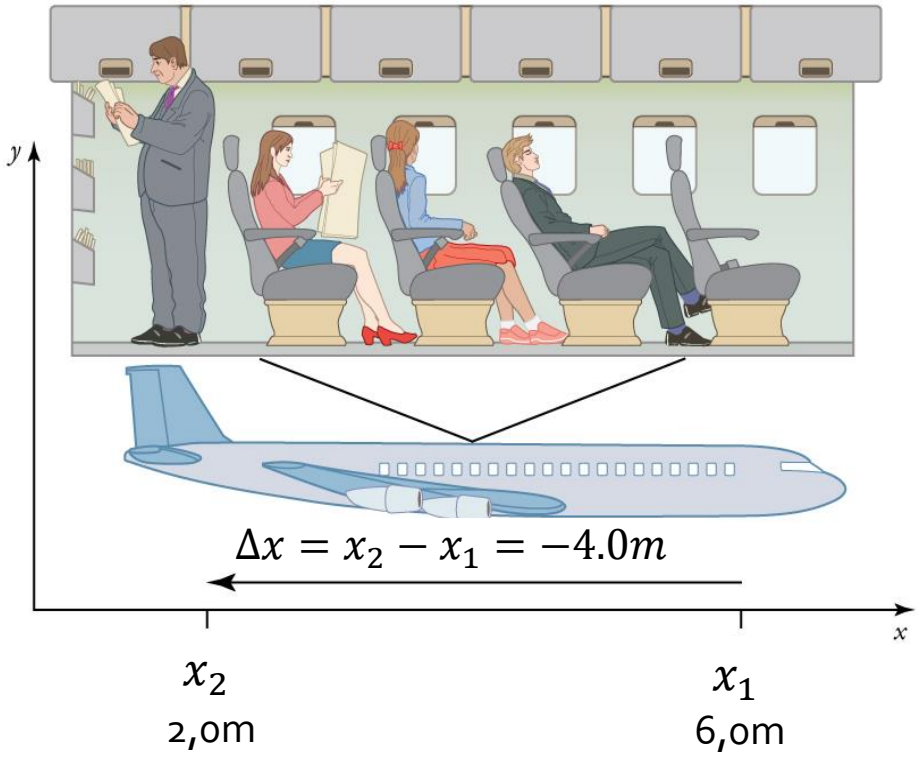
If $x_2 > x_1$,than displacement have positive value

If $x_2 < x_1$,then displacement have negative value





Picture 1: A professor paces left and right while lecturing.



Picture 2: A passenger moves from his seat to the back of the plane.

For the motion of an object in a straight line in one direction, the distance and the magnitude of the displacement vector are equal: s=Δx.