Physics Honors: Distance, Displacement, and Position

What does the term “distance” mean?

When you think you know, answer these questions -

A person walks a kilometer away from their house, then turns around and walks a kilometer back. What is the distance that the person walked?

A person walks a kilometer away from their house, then walks another kilometer away from their house. What is the distance that the person walked?

Does the distance that the person walked tell you where the person is?

Distance vs Displacement

Physics has two terms for motion.

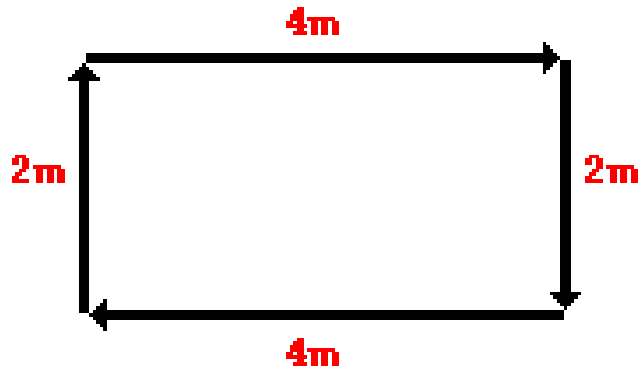
Distance refers to "how much ground an object has covered" during its motion

Displacement refers to "how far out of place an object is"; it is the object's overall change in position

In this picture a physics teacher walks 4 meters East, 2 meters South, 4 meters West, and finally 2 meters North.

What distance did the teacher walk?

What is the teacher's displacement after all that walking?



Vector vs Scalar?

The main difference between distance and displacement is the way direction of motion affects it

With distance, we add the amount the person moved no matter which way the person is moving.

Does this sound like a scalar or a vector?

With displacement, when the person moves right, we add and then when the person moves left, we subtract. We use +/- signs for direction.

A scalar value is always positive. A vector value uses +/- signs for direction.

Distance is a scalar value. Displacement is a vector value.

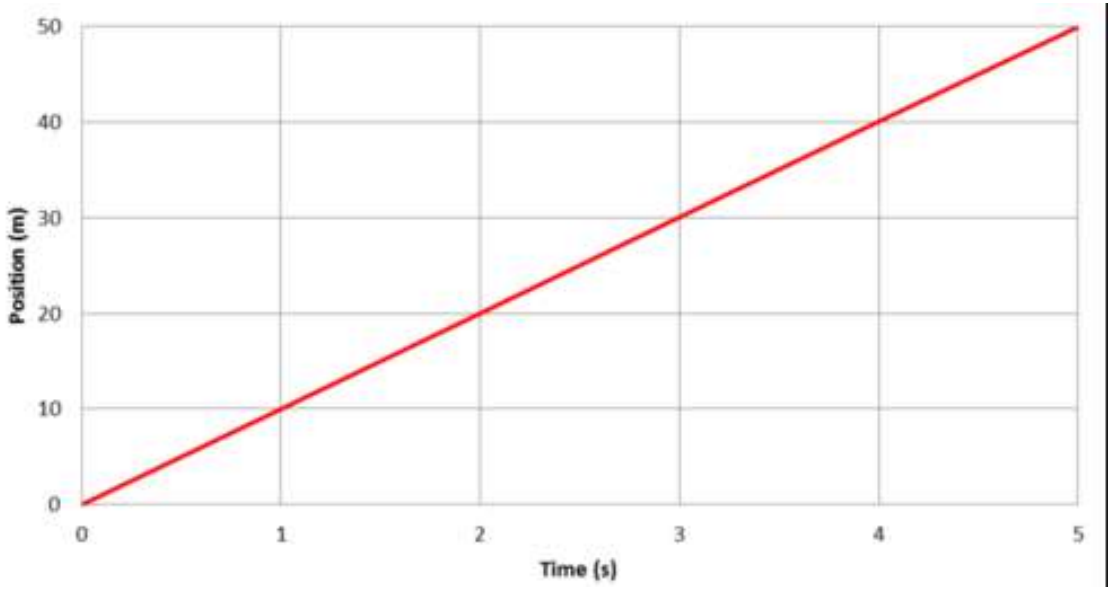
Distance vs Displacement POGIL

Motion Graphs

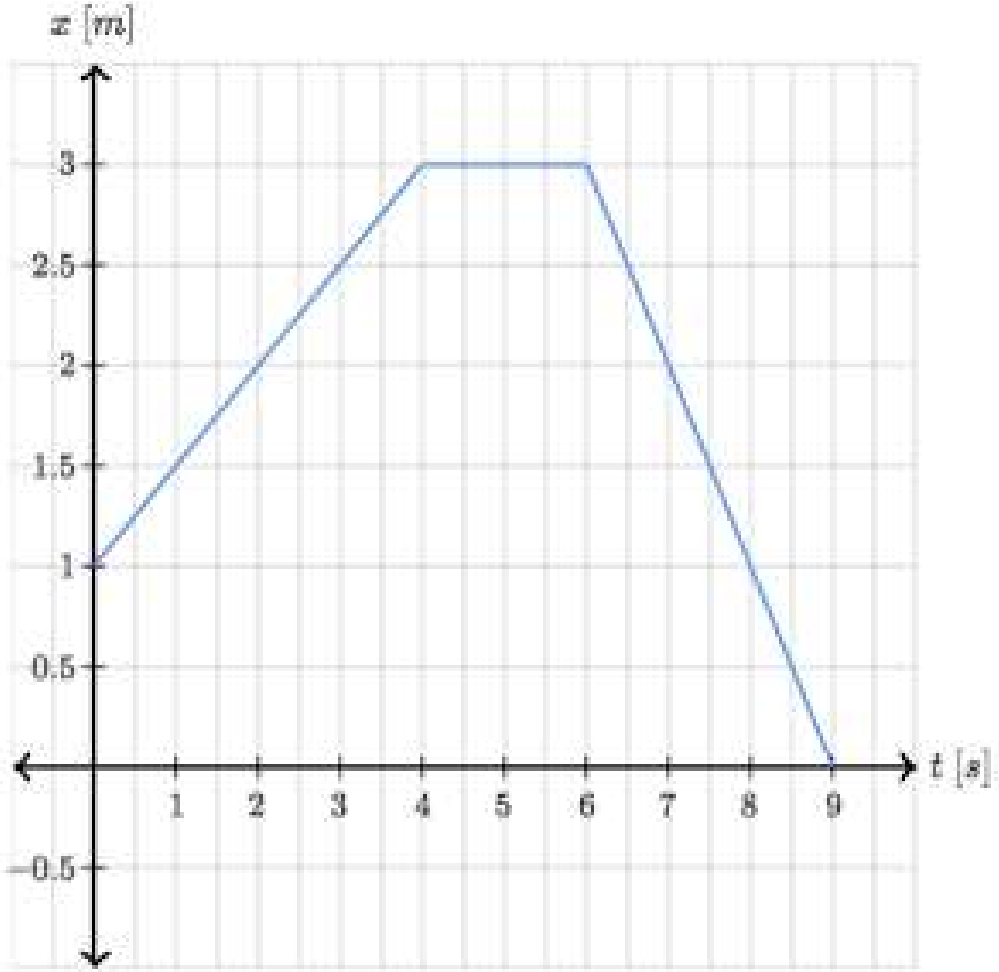
On the graph to the right, the object is at a position of 0 at a time of 0.

Then the object has moved 10 meters after 1 second, 20 meters after 2 seconds, 30 meters after 3 seconds, etc…

Position can be positive or negative (for direction). Time can only be positive.

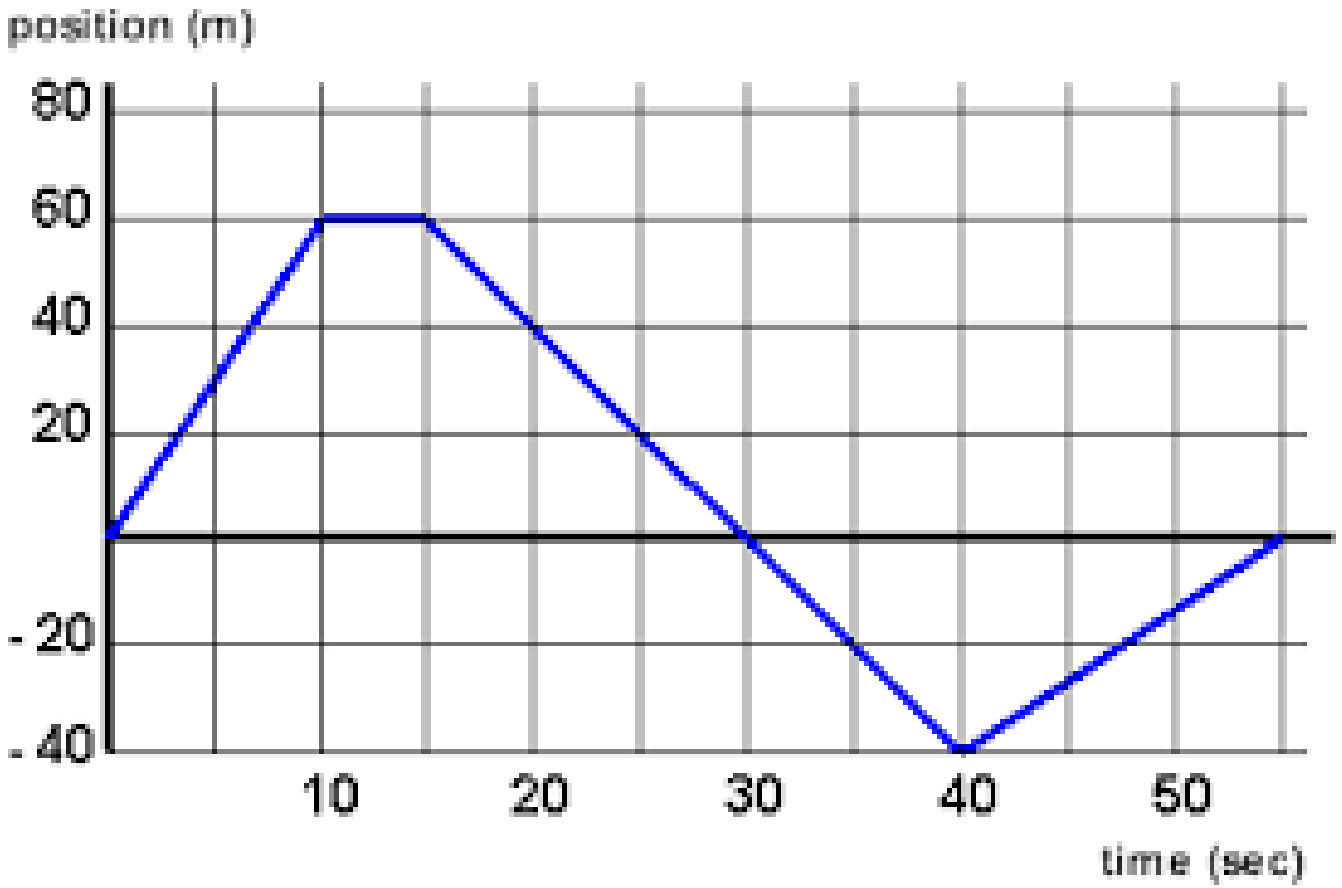


How would you describe the motion of the object in this graph? Is it speeding up, slowing down, or moving at the same speed?



Questions:

- How is this object moving from in the time from 0 seconds to 4 seconds?
- What is this object doing in the time frame from 4 seconds to 6 seconds?
- How is this object moving in the time period from 6 seconds to 9 seconds?
- What is the total distance this object moves?
- At what time is this object's displacement 0?



- How is this object moving from in the time from 0 seconds to 10 seconds?
- What is this object doing in the time frame from 10 seconds to 15 seconds?
- How is this object moving in the time period from 40 seconds to 50 seconds?
- What is the total distance this object moves?
- At what time(s) is this object's displacement 0?