Position, Velocity, Acceleration

Scott N. Walck

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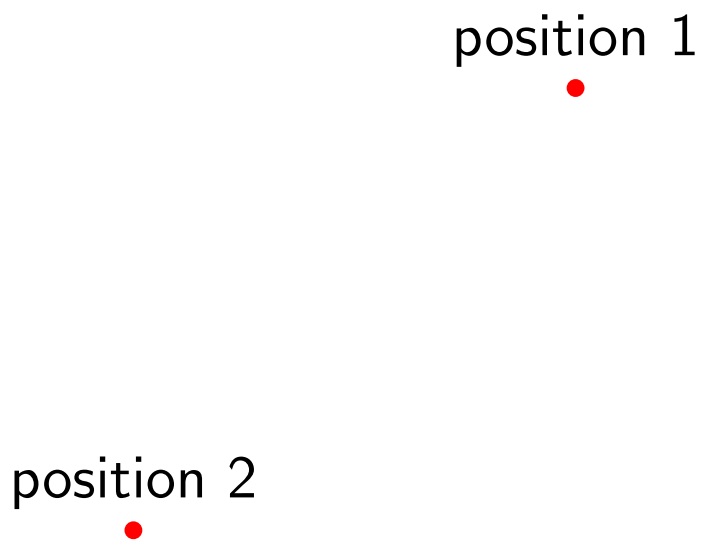
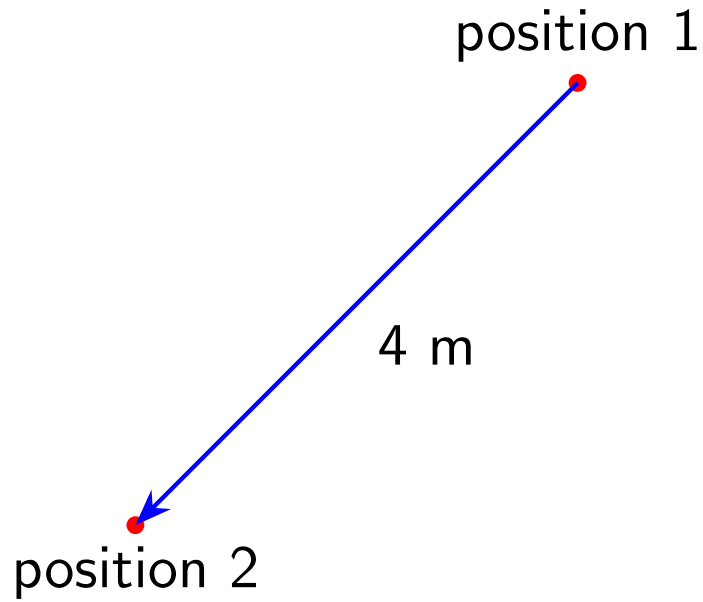
A position is a point

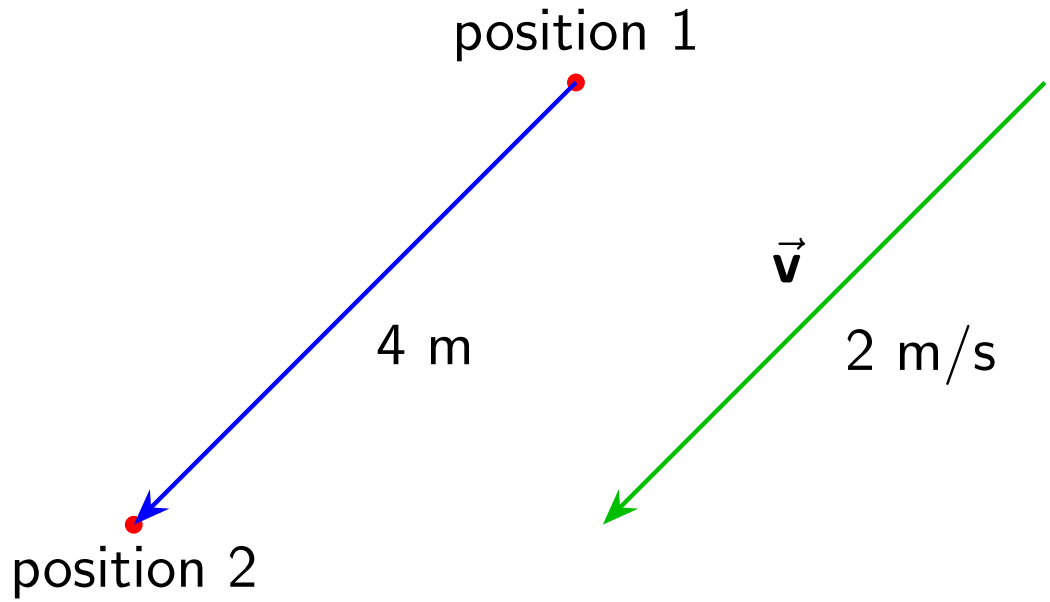


A displacement is a vector from one position to another



- displacement vector 4 m southwest
- Displacement is relative. One position is displaced relative to another. It takes two positions to define a displacement.

Velocity is displacement per unit time



- it takes 2 s to get from position 1 to position 2
- average velocity 2 m/s southwest

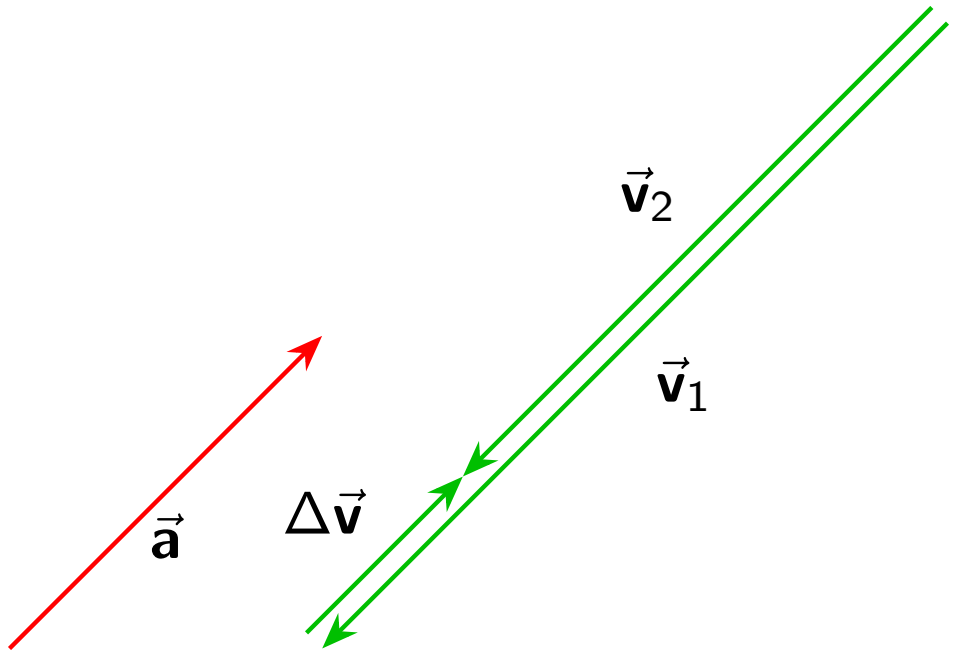
Velocity is relative.

How fast is Einstein's statue moving?

Relative to Earth's surface	0 m/s
Relative to Earth's center	361 m/s
Relative to the Sun	29,400–30,100 m/s
Relative to galaxy center	210,000–270,000 m/s

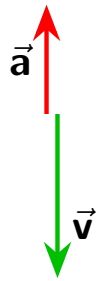
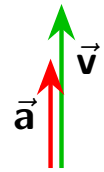
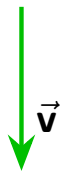
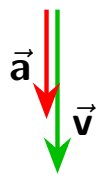
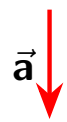
- We measure the velocity of an object relative to another object.

Acceleration is change in velocity per unit time



- Acceleration tells velocity how to change.

If velocity and acceleration point in the same direction, an object speeds up.

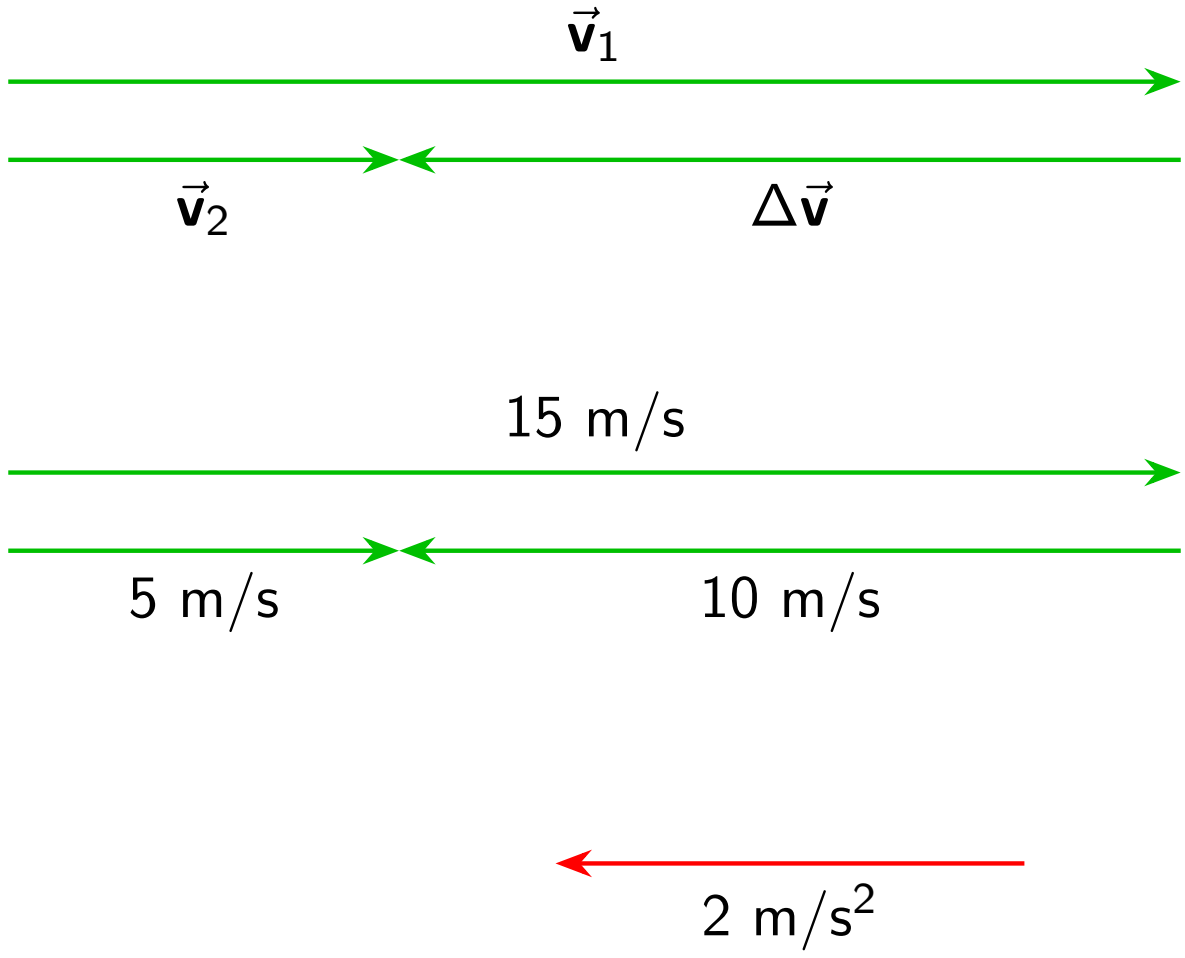
decrease speed 	 start moving	 increase speed
maintain speed 	$\vec{a} = 0$ sit still	 maintain speed
increase speed 	 start moving	 decrease speed

If velocity and acceleration point in opposite directions, an object slows down.

A *coordinate system* allows us to use numbers.

In one dimension (Giancoli Chapter 2), we define a coordinate system by choosing which way is positive.

Giancoli 7th, Example 2-6



Negative Acceleration

- Negative acceleration does *not* mean slowing down.
- It means acceleration points in the negative direction of our coordinate system.
- Starting in chapter 3, we want to avoid using the phrase "negative acceleration". Better to say "acceleration to the left", "westward acceleration", or "acceleration to the south".

Dropping an object from rest