

## SPEED AND VELOCITY

SEPTEMBER 28, 2021

### THEORY RECAP

We started discussing speed and velocity. Speed is a distance passed per unit time. To find speed we have to divide the distance by the time, which required to pass the distance.

$$speed = \frac{distance}{time}$$

From now on we will start using letter to denote different physical quantities. In particular, let us denote distance by  $d$ , speed by  $v$  and time by  $t$ . Then we could write a formula which connects them more compactly:

$$v = \frac{d}{t}$$

Speed is a scalar. It means that it is just a number and has no direction. As we mention speed the direction of the motion is not important for us. For example, a speed limit sign specifies the maximum speed independently on the direction of your motion. In contrast to speed, the velocity is a vector. The velocity is a displacement per unit time.

$$\overrightarrow{velocity} = \frac{\overrightarrow{displacement}}{time}$$

Or again more compactly

$$\vec{v} = \frac{\vec{d}}{t}$$

The arrows over the characters show that the corresponding parameters are vectors.

If the velocity of the object does not change, the motion is called *uniform*. Since the velocity is a vector, it has, as we already know, both magnitude and direction. If the velocity does not change, both speed and direction of the motion remain constant (which means that they do not change as well).

### HOMEWORK

1. A rubber ball falls 5 feet down, hits the floor and bounces 3 feet up. Find the distance passed by the ball and the displacement. Make a drawing and show the displacement of the ball.
2. Let us finally settle the question, who is faster - a snail or a sloth. I did some serious research! Let me first give you a quote from a news article about World Snail Racing Championship (yes, that's a thing!). "The 2019 championships were held on 20th July 2019 and this year's winner was a snail called Sammy owned by Maria Welby from Grantham, Lincolnshire. Sammy covered the 13 inch course in 2 mins 38 secs." As for the sloths, they hold the Guinness Record as the slowest mammal and an article on [guinnessworldrecords.com](http://guinnessworldrecords.com) claims "While on the ground, three-toed sloths travel at just 1.8–2.4 m (6–8 ft) per min". Would a sloth become the winner in World Snail

Racing Championship (if admitted as a guest competitor)? Recalculate the speed of both species into the same units to justify your answer.

3. Is it possible that the distance passed by someone is less than the displacement? Explain your answer.
4. The velocity of an object is changing. Does it necessarily mean that the speed of the object is changing too? Explain your answer.