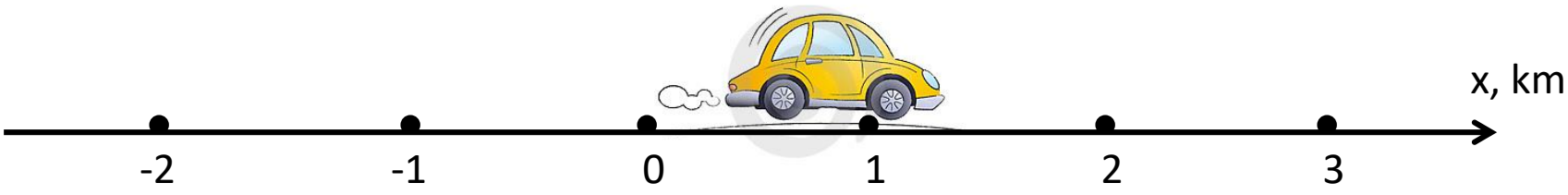
Instantaneous Velocity and Speed



Earlier, we defined ***Average velocity:*** between time moments t_i and t_f:

$$v = \frac{\Delta x}{\Delta t}$$

x_i, x_f - initial and finite positions.

displacement: $\Delta x = x_f - x_i$

travel time: $\Delta t = t_f - t_i$

Instantaneous velocity tells you how fast an object moves *right now* , at specific time moment t. The formula is the same as above but **Δt must be as small as possible.** Similarly we can define ***instantaneous speed***.

Acceleration

- **Acceleration:**

$$a = \frac{\text{change in velocity}}{\text{change in time}} = \frac{\Delta v}{\Delta t}$$

Standard units of acceleration : m/s^2

- **If there were no air resistance, all objects in Earth gravity would fall with the same acceleration,**

$g = 9.81\ m/s^2$

(directed downward)

Galileo Galilei's experiment in Pisa (possibly, a legend)

Homework

Problem 1.
A ball is thrown vertically upwards from the ground level with initial speed v_0=30m/s. Gravitational acceleration is g = 10 m/s^2, and is directed downward.
Find the time after which the ball will reach the highest point of its flight.

Problem 2.
James Bond's favorite car is called Austin Martin DB5. It can reach speed 100km/hr in 8 seconds. Some of his girlfriends drive Ferrari Spider that can reach speed 100 km/hr in 3.3 seconds. Find acceleration of each of these cars (in m/s^2).