

Quantifying the motion of an object

Average speed

The average speed of an object, measured in m.s^{-1} , corresponds to the distance between the 2 points A and B through which the object passes divided by the duration of the travel.

$$v_m = \frac{AB}{t_A - t_B}$$

Average velocity

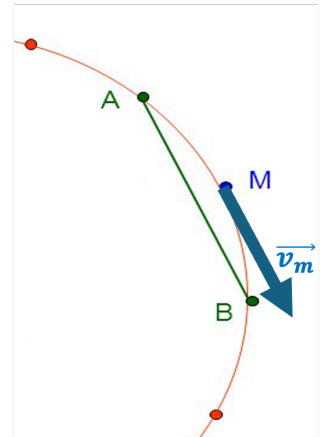
This definition can be applied to vectors, which adds a complementary information: the direction in which the object travels. The vector obtained this way is the average velocity of the object.

$$\vec{v}_m = \frac{\overrightarrow{AB}}{t_A - t_B}$$

Vector $\vec{v}_m$, tangent to the trajectory, will be drawn at point M, midpoint of path AB.

To determine the speed at point M, coordinates of the vector are needed:

$$\left. \begin{aligned} v_{m,x} &= \frac{AB_x}{t_A - t_B} = \frac{x_B - x_A}{t_A - t_B} \\ v_{m,y} &= \frac{AB_y}{t_A - t_B} = \frac{y_B - y_A}{t_A - t_B} \end{aligned} \right\} \Rightarrow v_m = \sqrt{v_{m,x}^2 + v_{m,y}^2}$$



Instantaneous velocity

The average trajectory between points A and B only gives an approximation of the instantaneous speed at point M.

To improve the accuracy of this estimate, we reduce the distance between the two points surrounding point M.