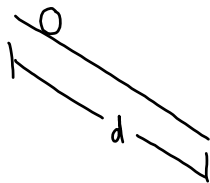


Average Speed

Consider a ball rolling down an incline:



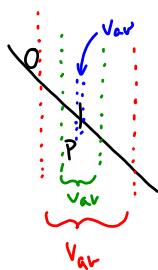
When you divide $\frac{d}{\Delta t}$
you get average speed:

$$v_{av} = \frac{d}{\Delta t}$$

We use the term average speed since speed is not constant.

Average speed is the ratio of the distance travelled to the time interval over which the body moves that distance.

Instantaneous Speed



Think of the instantaneous speed as the average speed when the distance travelled is almost zero and the time interval to travel that distance is almost zero.

$$v_{av} = \frac{d}{\Delta t}$$

$$v_{av} = \frac{0}{0}$$

problem \rightarrow undefined

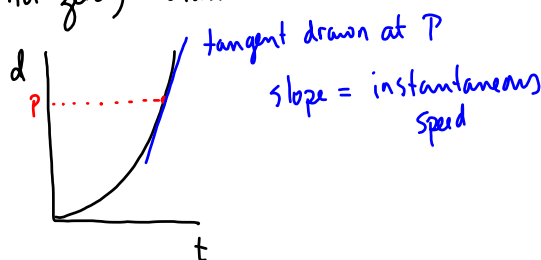
As the distance (and time interval) get closer to zero, the average speed will be closer to the instantaneous speed.

Mathematically we can express as a limit:

$$\lim_{\Delta t \rightarrow 0} v_{inst} = \lim_{\Delta t \rightarrow 0} \frac{d}{\Delta t}$$

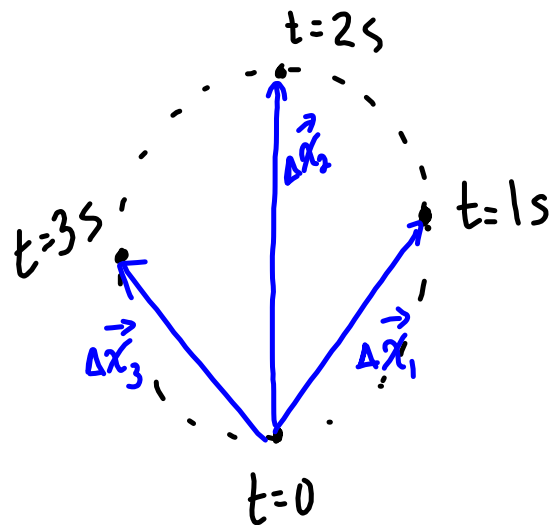
\uparrow the limit as Δt approaches zero

The instantaneous speed of an object at point P is its speed at the instant that it passes P and it is the average speed calculated over an infinitely small (but not zero) distance around P.



Average Velocity

Consider an object moving with a constant speed around a circle. It starts moving at time $t=0$



Average velocity:
$$\vec{v}_{av} = \frac{\vec{\Delta x}}{\Delta t}$$

Average velocity is the ratio of the displacement to the time interval over which the displacement occurs

NOTE: The magnitude and direction of the average velocity will depend on the time interval selected

NOTE: The direction of the average velocity is the same as the direction of the displacement

