

ES: If given the position function, how do we find the velocity and acceleration function?

Position Function

location of an object at time t

$$x(t)$$

Initial position ($t=0$)

$$s(t)$$

$$x_0 \text{ or } s_0$$

Velocity Function

Rate of change of position.

$$v(t) = s'(t)$$

Velocity is $+$ for \uparrow and \rightarrow motion

$-$ for \downarrow and \leftarrow motion

Initial velocity ($t=0$)

$$v_0$$

Acceleration Function

Rate of change of velocity

$$a(t) = v'(t) = s''(t)$$

Speed

$$|v(t)|$$

- Speed up when $v(t)$ and $a(t)$ have same signs $(+)(+)$
 $(-)(-)$

- Speed down when $v(t)$ and $a(t)$ have different signs $(+)(-)$
 $(-)(+)$

Displacement

the net change in position
 $d = (\text{final pos.} - \text{original pos.})$

Total
Distance

total distance traveled by the
object in the time interval.
(all direction)

$$TD = |\overset{\text{right/left}}{\Delta \text{pos.}}| + |\overset{\text{right/left}}{\Delta \text{pos.}}|$$

(ex)

If $s(t) = t^3 + t$ Find $v(t)$ and $a(t)$

$$v(t) = 3t^2 + 1$$

$$a(t) = 6t$$

Summary