Physics Applications

If $s = f(t)$ is a position function of a particle that is moving in a straight line, then

$\frac{\Delta s}{\Delta t}$ represents the **average velocity** over time period Δt

$v = \frac{ds}{dt} = s'(t)$ represents the **instantaneous velocity**

$a(t) = v'(t) = s''(t)$ represents the **acceleration** (instantaneous rate of change of the velocity with respect to time)

(note: this is why the units have time^2 - $\frac{\text{distance}}{time} \Big/ time = \frac{\text{distance}}{time^2}$. Example: $ft/\sec^2$)

1. A particle moves according to the law of motion: $s(t) = 0.01t^4 - 0.04t^3$, $t \geq 0$ where t is measured in seconds and s in feet.

a) Find the average velocity overt the time interval $[0\ ,2]$.

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b) Find the velocity at time t .

c) What is the velocity after 4 seconds?

d) When is the particle at rest?

e) When is the particle moving in a positive direction?

f) Draw a diagram to illustrate the motion of the particle.

g) Find the total distance travelled during the first 8 seconds.

h) Find the acceleration at time t and after 3 seconds.

i) When is the particle speeding up? When is it slowing down?

j) Use a calculator to view the graphs of the position, velocity and acceleration functions for $0 \le t \le 4$.