10/13/2017

P.V-A

POSITION
VELOCITY
ACCELERATION

DISPLACEMENT (POSITION)

$$\Delta s = f(t+\Delta t) - f(t)$$

THESE ARE y-values

where it is — where it has been

VELOCITY

AVERAGE VELOCITY

$$V_{av} = \frac{\text{DISPLACEMENT}}{\text{TIME TRAVELED}} = \frac{f(t+\Delta t)-f(t)}{\Delta t}$$

SECANT LINE

INSTANTANEOUS VELOCITY

$$v(t) = \frac{ds}{dt} = \lim_{\Delta t \to 0} \frac{f(t+\Delta t)-f(t)}{\Delta t}$$

DEFINITION OF DERIVATIVE

SPEED IS THE ABSOLUTE VALUE OF VELOCITY.
(HAS NO DIRECTION)

$$\text{Speed} = |v(t)| = \left|\frac{ds}{dt}\right|$$

ACCELERATION

$$a(t) = \frac{dv}{dt} = \frac{d^2s}{dt^2}$$

FREE FALL CONSTANTS

ENGLISH $g = 32 \frac{ft}{s^2}$ $s = \frac{1}{2}(32)t^2 = 16t^2$

METRIC $g = 9.81 \frac{m}{s^2}$ $s = \frac{1}{2}(9.81)t^2 = 4.9t^2$

EX. $s(t) = t^2 - 4t + 3$

a.) FIND Displacement at 2 sec.

b.) FIND Average Velocity $[0, 4]$

c.) FIND INST. VELOCITY $t = 4$

d.) FIND ACCELERATION $t = 4$

e.) DESCRIBE THE MOTION

f.) Smile life is good!

a.) $s(2) = 2^2 - 4(2) + 3 = 4 - 8 + 3 = -1$

$x = 2 \quad s(x) = -1$ units

b) $s(0) = 3$ $\quad$ $s(4) = 3$

$x = 0$ $\quad$ $x = 4$

$$\frac{3-3}{4-0} = \frac{0}{4} = 0$$

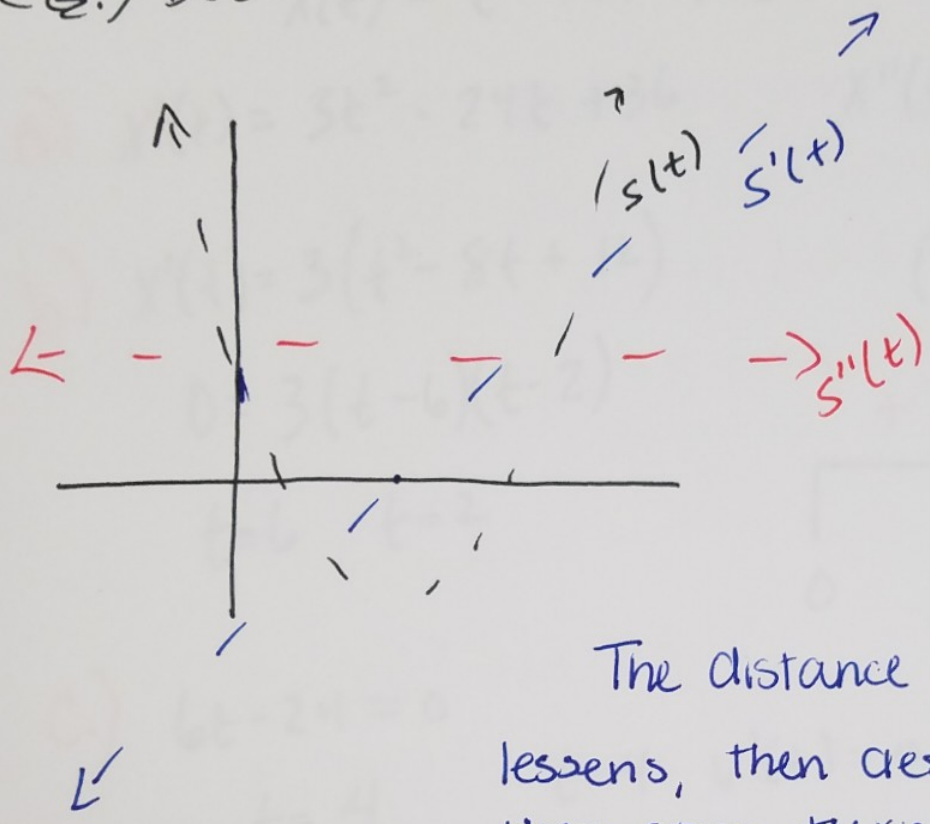
c.) $s'(t) = 2t - 4$

$s'(4) = 2(4) - 4 = 4$ $\frac{\text{units}}{\text{sec}}$

d.) $s''(t) = 2$

$s''(4) = 2$ $\frac{\text{units}}{\text{sec}^2}$

ex.) Describe



The distance from the destination lessens, then destination is passed then stops, turns, passes destination, and continues to go past it.

~~Incres~~ Increasing velocity, constant acceleration

EXAMPLE 1

$$x(t) = t^3 - 12t^2 + 36t - 20 \qquad 0 \le t \le 8$$

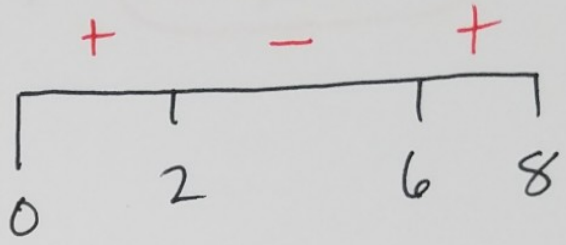
a.) $x'(t) = 3t^2 - 24t + 36$ $\qquad x''(t) = 6t - 24$

b.) $x'(t) = 3(t^2 - 8t + 12)$

$0 = 3(t-6)(t-2)$

$t = 6 \quad t = 2$

(2, 6)



C.) $6t - 24 = 0$

$t = 4$ $\qquad t = 4 \quad v'(t) = 0$

$x'(t) = 3t^2 - 24t + 36$

$x'(4) = 3(4) - 24(4) + 36$

$= 48 - 96 + 36$

$= 84 - 96 = -12$ UNITS/sec

D.) $x(t) = t^3 - 12t^2 + 36t - 20$

accelerates at $x = 4$ $(4, \infty)$

Decelerates at $0 \le x < 4$ $[0, 4)$

at max neg. Velocity $x = 4$

EXAMPLE 2. $S(t) = t^3 - 6t^2 + 9t$ METERS

$S'(t) = 3t^2 - 12t + 9$

$S'(2) = 3(2)^2 - 12(2) + 9$

$= 3 \cdot 4 - 12 \cdot 2 + 9$

$= 12 - 24 + 9$

$S'(2) = -3$

$S'(4) = 3(4)^2 - 12(4) + 9$

$= 48 - 48 + 9$

$S'(4) = 9$

$0 = 3t^2 - 12t + 9$

$0 = 3(t^2 - 4t + 3)$

$0 = 3(t-1)(t-3)$

$0 = 3 \quad 0 = t-1 \quad 0 = t-3$

NO! $t = 1$ $t = 3$

at Rest

RIGHT $[0,1) \cup (3,\infty)$