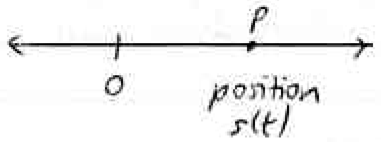
4.7: MORE APPLICS.

(A) Rectilinear Motion

along a line

Stalker



We use p for polynomial, demand

what's deriv. of s

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

can't be −

Speed $= |v(t)|$

what's deriv. of v

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

$s(t)$ — hrs. → miles

$v(t)$ — $\frac{\text{mi.}}{\text{hr.}}$ (mph)

$a(t)$ — $\frac{\text{mi.}}{\text{hr.}^2}$ (mph per hour)

(Acc. idea: go from 0 to 60 mph in 5 secs.)

Ex $s(t) = t^3 - 9t^2 - 48t + 1$
Describe the motion of P during $[-5, 5]$.

What might happen if $v=0$?

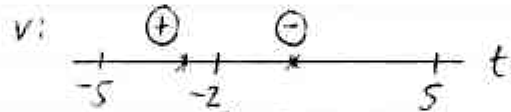
never DNE

$$v(t) = 3t^2 - 18t - 48 \overset{\text{set}}{=} 0$$
$$3(t^2 - 6t - 16) = 0$$
$$3(t-8)(t+2) = 0$$
$$\cancel{t=8}, \quad t = -2$$

outside $[-5,5]$

(← Direction of P may switch left ↔ right then.)

This is not the axis of motion!!



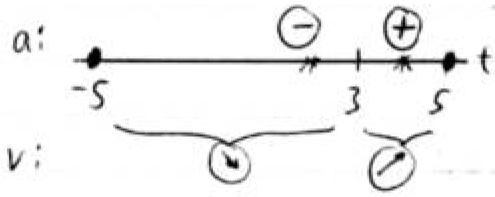
Direction: right   left

v could be DNE

washtert

$$a(t) = 6t - 18 \overset{\text{set}}{=} 0$$
$$6(t-3) = 0$$
$$\boxed{t = 3} \leftarrow P \text{ may switch speeding up} \leftrightarrow \text{slowing down then.}$$
(in $[-5,5]$)

what can happen then?
$v\nearrow$ or $v\searrow$



If $v \searrow$, does that mean the particle is nec. slowing down?

WARNING:

	$v>0$	$v<0$
$v\nearrow$	speed up	slow down
$v\searrow$	slow down	speed up

$|v|\nearrow$
speed $\nearrow$
moving away from 0

$v=-10$, $v=-20$: $v\searrow$, speed $\nearrow$

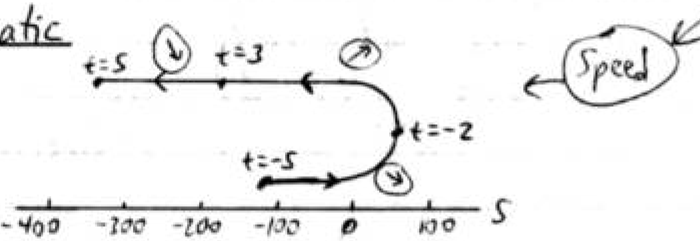
←speeding up

Endpts.
Crit. #s
PIN #s
– Key values

of t	$s(t)$
−5	−109
−2	53
3	−197
5	−339

Judge asks: what's $s(t)$ vs t?

Schematic



not the actual path of P. it's motion along the line

Note S t=3 F
S
$v \to 0$ as $t \to 8$

S=Slower
F=Faster

Schematic more "humble" than $s(t)$ vs t ← project onto s-axis.
"You're interpolating the graph." "Guessing at" $t=3$.
Even w/ 4.5 → concavity, etc.

If x units are produced and sold,

(B) Econ

$R(x)$ = total revenue (\$ in)
$C(x)$ = cost (\$ out)
$P(x)$ = profit
$= R(x) - C(x)$

What is the avg. cost func.?

Let $C(x)$ = cost of producing x units
(Then, $\frac{C(x)}{x}$ or $c(x)$ = average cost of 1 unit)

What do we want to max, really? P is what?

$R(x)$ = revenue from selling x units
$P(x) = R(x) - C(x)$
= profit if x units are produced and sold

Kid may not like 4 of a toll. Negative #s of units don't make sense. We're ignoring the common sense restric. that x should be an integer.

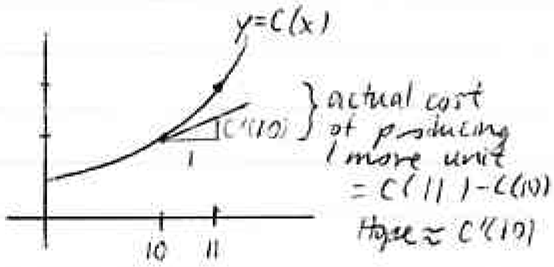
Domain: $[0, \infty)$

Read Ex 4 (pp. 225-6)

C', R', P'

$C'(x)$ = marginal cost function, etc.

Idea

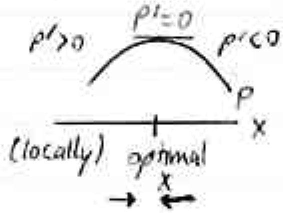


Does this remind you of something? (differentials)

(Read Ex 5 (p. 227))
$(C'(1000) \approx C(1001) - C(1000))$

$P'(x)$ = marginal profit func.

What's P' here?



(What if  ?)

$P'<0$ If you're over here, P', the marginal profit is +, so you want to produce more

underprod. overprod.

SKIP.

If I sell 5 doohickeys at $10 apiece, my revenue is $50.

<u>Break down R(x)</u>

$$R(x) = (\#\text{units sold})\left(\frac{\text{price}}{\text{unit}}\right)$$

If you have x units, you can sell them at $p(x)$ $\left(\frac{\$}{\text{unit}}\right)$.

$$= x\,p(x)$$

demand

demand function