M1

§2.3#19

$$x\cdot x^{-2}$$

$$(x+x^{-1})^3 = x^3 + 3x^2x^{-1} + 3x(x^{-1})^2 + (x^{-1})^3$$

1 3 3 1

1
1 1
1 2 1
1 3 3 1
1 4 6 4 1

$$= x^3 + 3x + 3x^{-1} + x^{-3} \Rightarrow$$

$$\frac{d}{dx}(x+x^{-1})^3 = 3x^2 + 3 - 3x - 3x^{-4}$$

Chain Rule Way: $\frac{dy}{dx} = 3(x+x^{-1})^2(1-x^{-2})$

2.3 way, using product Rule

$$(fg)' = f'g + fg'$$

$$(fgh)' = f'gh + fg'h + fgh'$$

Pf $(f(gh))' = f'(gh) + f(gh)'$

$$= f'gh + f(g'h + gh')$$

$$= f'gh + fg'h + fgh'$$

$$y = (x+x^{-1})^3 = (x+x^{-1})(x+x^{-1})(x+x^{-1})$$

$$\Rightarrow y' = (1-x^{-2})(x+x^{-1})^2 + (x+x^{-1})(1-x^{-2})(x+x^-$$

$$+ (x+x^{-1})^2(1-x^{-2})$$

$$= 3(1-x^{-2})(x+x^{-1})^2$$

Sep 17-12:07 PM

2.4 #33

Similar Question:

For what values of $x$ does $f(x) = x + 2\cos x$ have a horizontal tangent.

Not quite

Slope's negative whenever $2\sin x > 1$

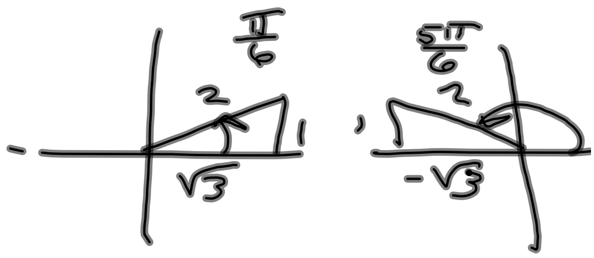
$$\boxed{y' = 1 - 2\sin x} \overset{SET}{=} 0 \longrightarrow$$

$$-2\sin x = -1 \longrightarrow$$

$$\sin x = \frac{1}{2}$$

$\frac{\pi}{6} + 2n\pi$

$\frac{5\pi}{6} + 2n\pi$




$$\left\{ x \;\middle|\; x = \frac{\pi}{6} + 2n\pi,\ \frac{5\pi}{6} + 2n\pi,\ n \in \mathbb{Z} \right\}$$

$n \in \mathbb{Z}$ means $n = 0, \pm 1, \pm 2, \pm 3, \ldots$

§2.7 Boyle's Law Adiabatic

If Temp held constant, then
$PV = \text{Constant}$.

(a) Find rate of change of volume wrt P.

$$\frac{dV}{dP}$$

My 1st thought : Hey! §2.6

$$\boxed{PV = C}$$

Differentiating wrt time. (Assume $P = P(t)$)

$$P'V + PV' = 0$$

$$PV' = -P'V$$

$$V' = -\frac{P'V}{P} = -\frac{P'}{P}\cdot\frac{C}{P} = -\frac{P'C}{P^2}$$

If we follow instructions (I didn't), we differentiating wrt P, then

$P' = 1$, which reduces to

$$V' = -\frac{C}{P^2}$$

Book wants:

$$PV = C$$

$$\Rightarrow V = \frac{C}{P} = CP^{-1}$$

$$\Rightarrow \frac{dV}{dP} = -1CP^{-2} = \boxed{-\frac{C}{P^2} = \frac{dV}{dP}}$$

My approach was slightly more general.

#23b "steadily compressed" means change in volume. $\frac{dP}{dt}$ = Constant was my thought.

"Steadily compress" for 10 min.

Is $\boxed{\text{volume decreasing}}$ more rapidly at start or at the end? $\frac{dV}{dt}$

$\frac{dV}{dP} = -\frac{c}{P^2}$ $P \xrightarrow{t \text{ increases}}$ increases

Decreasing in absolute value

$\left|-\frac{c}{P^2}\right|$ getting smaller

It was shrinking faster at the start.

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(c) Isothermal Compressibility

$\beta = \frac{1}{P}$ we want to show.

$\beta = -\frac{1}{V} \cdot \frac{dV}{dP}$ from example 5.

$V = \frac{c}{P}$

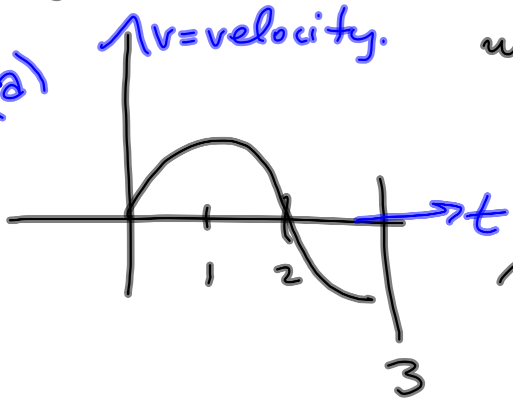
$\frac{dV}{dP} = -\frac{c}{P^2}$

$= -\frac{1}{\frac{c}{P}} \cdot -\frac{c}{P^2} = -\frac{P}{c} \cdot -\frac{c}{P^2} = \frac{1}{P}.$

§2.7 #s 5, 6

5 Graphs of VELOCITY funcs.

(a)




when is it slowing-down?

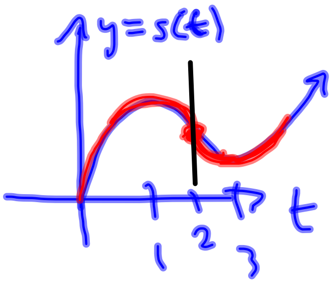
when $\frac{dv}{dt} < 0$

(1, 3) is where v has negative slope.

speeding-up?

(0, 1)

6 Graphs of POSITION func, s(t)



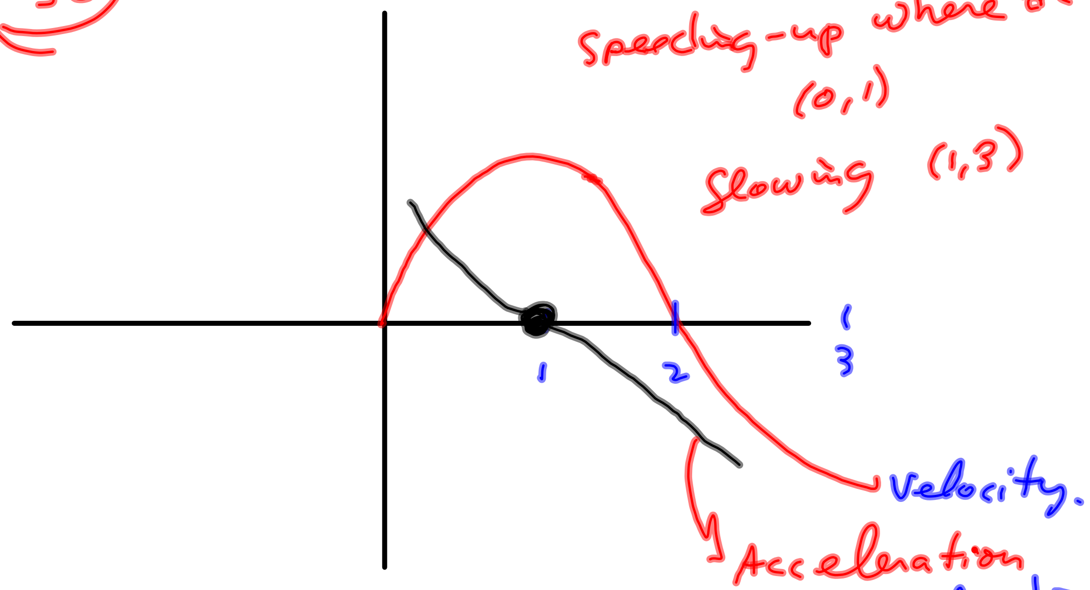

when's it speeding up?

(2, 4)

Slowing: (0, 2)

5a

Speeding-up where $a(t) > 0$
(0,1)
slowing (1,3)




6a