Section 2.2 #92. $f(x)=\sin x$ on $[0,\frac{\pi}{6}]$

average rate of change $= \dfrac{\sin\frac{\pi}{6}-\sin 0}{\frac{\pi}{6}-0} = \dfrac{\frac{1}{2}-0}{\frac{\pi}{6}} = \dfrac{3}{\pi} = .95$

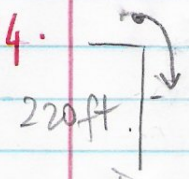
instantaneous rate of change $= (\sin x)' = \cos x$

at $x=0$, $\cos(0)=1$

at $x=\frac{\pi}{6}$, $\cos(\frac{\pi}{6})=\frac{\sqrt{3}}{2}=.866$

close to the average of the two instantaneous rates of change.

#94.



initial velocity $= -22$ ft/sec

initial height $= 220$ ft

position $= s(t) = -16t^2 - 22t + 220$.

velocity $= v(t) = s'(t) = -32t - 22$

after 3 seconds velocity $= v(3) = -32\cdot 3 - 22 = -118$ ft/sec.

When falls 108 ft, height from ground is $220-108 = 112$ ft.

To find the time it takes to fall 108 ft solve

$108 = -16t^2 - 22t + 220$ for t

$\Rightarrow 16t^2 + 22t - 112 = 0 \Rightarrow t = 2$ or $t = -\frac{27}{8}$ (using quadratic formula)

velocity at 2 seconds $= v(2) = -32\cdot(2) - 22$

$= -86$ ft/sec.

#96.

drop the stone $\Rightarrow$ initial velocity $= 0$.

$s(t) = -4.9t^2 + h_0$ (h_0 unknown) (initial height)

It takes 6.8 seconds to hit the pool

$\Rightarrow s(6.8) = 0$ (height is zero when it hits the pool)

$-4.9(6.8)^2 + h_0 = 0 \Rightarrow h_0 = 226.576$ meters.

#106. Inventory cost $= C = \dfrac{1{,}008{,}000}{Q} + 6.3Q$ (Q: order size)

$C' = -\dfrac{1{,}008{,}000}{Q^2} + 6.3 \Rightarrow$ instantaneous rate of change when $Q=350$ $= \dfrac{-1{,}008{,}000}{350^2} + 6.3 \approx -1.93$

change in C: $C(351) - C(350) = -1.91$ — the two numbers are very close.