Math 1210-3
Monday Feb 11

§2.3-2.4 Derivative rules, derivatives of trig functions. Maybe start §2.5 chain rule.

- We need to discuss pages 3-4 of Friday notes, starting with Exercise 3

Then,

<u>Exercise 1</u>

a) $(f+g)' =$

b) $(cf)' =$

c) $(f/g)' =$

d) $(x^n)' =$ $\qquad$ n any integer

e) $(\cos x)' =$

f) $(\sin x)' =$

g) $(\tan x)' =$

h) $(\cot x)' =$

i) $(\sec x)' =$

j) $(\csc x)' =$

k) $(fg)' =$ $\qquad$ (I accidentally left this out!)

<u>Exercise 2</u> $\quad (fgh)' =$

$(fghk)' =$

The chain rule

how to differentiate composite functions

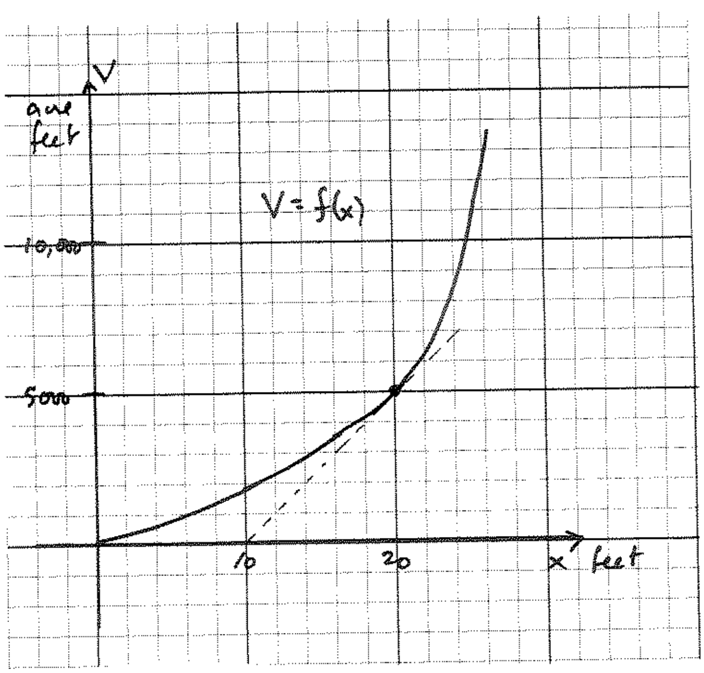
warmup...

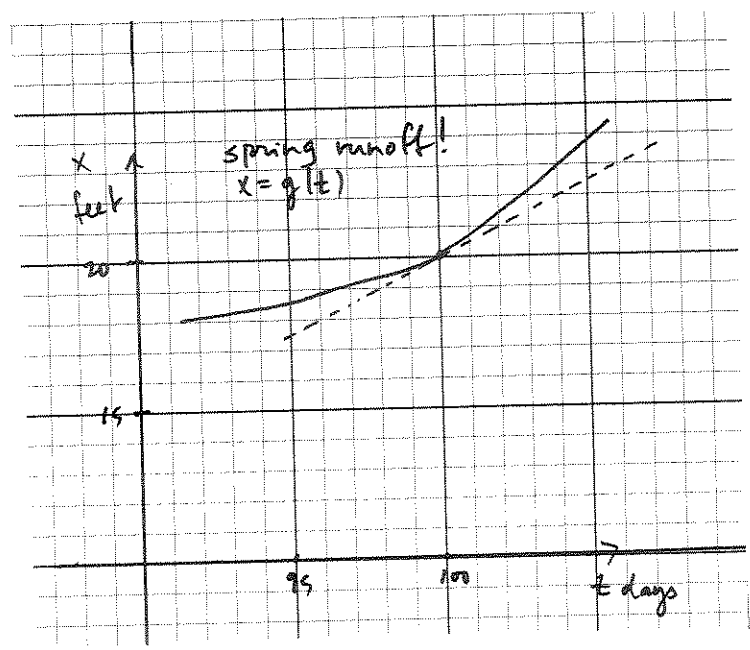
Exercise 3: If your dog is twice as fast as you,
and you're three times faster than your little brother,

how many times faster is your dog than your little brother?

Exercise 4: The volume of a reservoir (say, in acre-feet), is a function of the depth measurement (at the deepest point).
The depth is a function of time. Suppose that at calendar day 100 (some time in March), the depth is 20 feet, and the volume is 5000 acre feet.
Suppose that the volume $V = f(x)$, V = volume
x = depth

and depth $x = x(t)$ t = time in calendar day,
with graphs





4a) About how fast is the water depth increasing at $t=100$?

4b) About how fast is the reservoir volume increasing at $t=100$?

Hopefully page 2 motivates...

Chain Rule For $u = g(x)$
$y = f(u) = f(g(x))$

(notice we changed letters from page 2
"t" → "x"
"x" → "u")

Then
$$D_x\left(f(g(x))\right) = f'(g(x)) \cdot g'(x)$$

"The derivative with respect to x of $f(g(x))$ equals
the derivative of f, ~~at~~ evaluated at $g(x)$,
times $g'(x)$.

Exercise 5 Write $F(x)$ as $f(g(x))$, and use the chain rule to differentiate $F(x)$.

5a) $F(x) = (x^3 + x)^2$

5b) $F(x) = \sin\left(\frac{x}{1+x^2}\right)$

5c) $F(x) = \left[\tan\left(x^3 + x\right)\right]^2$! (this is why it's called the chain rule)

chain rule
Needs lots of practice