Math 1210-2
Wednesday August 22

- Our course assistant Jianyu Wang will hold the weekly problem session Thursday (tomorrow) in our classroom JWB 335, at the usual class time, 9:40-10:30. This is for your benefit, and optional.

- Our first quiz will be in the last 15-20 minutes of class this Friday. It will consist of a couple problems related to P.1, P.2, P.3 of polynomial calculus (except for ones like P.3 # 13, 14 which we won't have covered yet.) The suggested problems on the organizational sheet from Monday (and on-line at our home page) would be good to try, and if you're stuck, you can ask Jianyu for help tomorrow).
- Our Webworks director, Hsiang-Ping Huang, will tell you how to use this internet-based homework system in the first 20 minutes of today's class. A demonstration problem set should already be posted on our Webworks page. The first graded homework set should be open by Friday and will be due on Monday Sept. 3 at midnight.

After Ping's Webworks intro, we'll finish yesterday's notes, i.e. do page 4. That will lead naturally to our goal today:

P.3 Derivative of a polynomial.

From how we worked Exercise 6 Tuesday notes the following facts should be believable. We'll study them more carefully later, in §2.3 to our text, Varberg.

Theorem B: If f and g are functions and c is a constant, then

(1) $(cf)' = cf'$

(2) $(f+g)' = f' + g'$ (so $(f+g+h)' = (f+g)'+h' = f'+g'+h'$ etc)

Exercise 1: Using $1' = 0$, $x' = 1$, $(x^2)' = 2x$ and theorem B, rework Exercise 6 Tues notes without limits, i.e.
find $f'(x)$ for $f(x) = 2x^2 + 5x - 7$

Using Theorem B we will be able to find the derivative (we also say "differentiate") any polynomial as soon as we figure out how to differentiate x^k for each whole number k.

So far we know

$1' = 0$

$x' = 1$

$(x^2)' = 2x$

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need to fill in

$(x^3)' =$

$(x^4)' =$

$(x^k)' =$

Exercise 2: Find $(x^3)'$ using the limit definition $f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$

Exercise 2a Expand $(x+h)^3$. We should notice a pattern which leads to Pascal's triangle, and the binomial theorem (p 493 Vanberg)

Exercise 2b Use 2a to deduce $(x^3)' = 3x^2$

Exercise 3 Use the Pascal's triangle discussion from Exercise 2 to explain why $(x^k)' = \lim_{h \to 0} \frac{(x+h)^k - x^k}{h} = k x^{k-1}$ for every whole number k

Exercise 4: Let $f(x) = 8x^{10} + 34x^5 - 10x^4 + 13x^3 - 2x + 5$.

(a) Find $f'(x)$

(b) What is the slope of the graph $y = f(x)$ at $x = 0$?