We started class with a checkin on limits from graphs and continuity.

HW; Page 191 #1 - 30, 33, 75Don't need to Draw Graphs)

DO NOW:

Put question #'s from previous HW's on board

We will go over #28 from page 173

$x^3-a^3=(x-a)(x^2+ax+a^2)$

Use the definition of the derivative to find f'(x) for

$f'(a)=\lim_{x\to a}\frac{f(x)-f(a)}{x-a}$ $f'(a)=\lim_{h\to 0}\frac{f(a+h)-f(a)}{h}$

1) $f(x)=x^2$

~~2) f(x)=x³~~

$$f'(a)=\lim_{h\to 0}\frac{f(a+h)-f(a)}{h}$$
$$=\lim_{h\to 0}\frac{(a+h)^2-a^2}{h}$$
$$=\lim_{h\to 0}\frac{\cancel{a^2}+2ah+h^2-\cancel{a^2}}{h}$$
$$=\lim_{h\to 0}\frac{\cancel{h}(2a+h)}{\cancel{h}}$$
$$=\lim_{h\to 0}2a+h$$
$$=2a$$

$f(x)=x^3$

$$\lim_{x\to a}\frac{x^3-a^3}{x-a}=$$
$$\lim_{x\to a}\frac{\cancel{(x-a)}(x^2+xa+a^2)}{\cancel{x-a}}=\lim_{x\to a}x^2+xa+a^2=$$
$$a^2+a^2+a^2=3a^2$$


Dalai Lama
Recognizing our shared humanity and our biological nature as beings whose happiness is dependent on others, we learn to open our hearts, and in so doing we gain a sense of purpose and a sense of connection with those around us.
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In Chapter 3, we actually find symbolic rules for derivatives, not just talk about what derivatives mean and what they tell us about a function

We start with the POWER RULE:

For any real constant m, if $f(x)=x^m$,

then $f'(x)=mx^{m-1}$

(we will prove this later for natural number exponents)

$f(x)=x^{63.9}$ $f'(x)=63.9x^{62.9}$

We have the following rule for combining derivatives;

If $h(x)=(f+g)(x)$ then $h'(x)=f'(x)+g'(x)$

If $j(x)=(kf)(x)$ then $j'(x)=kf'(x)$ for any constant k

Examples: Find the first and second derivatives of:

$p(x)=5x^{10}-3x^4+\pi x^2-2.3x+\sqrt{73}$

$p'(x)=50x^9-12x^3+2\pi x-2.3$

$p''(x)=450x^8-36x^2+2\pi$

$\rightarrow$ $m(x)=2x^{10.5}-3x^{\frac{4}{3}}+x^{-2}$

$m'(x)=21x^{9.5}-4x^{\frac{1}{3}}-2x^{-3}$

$m''(x)=199.5x^{8.5}-\frac{4}{3}x^{-\frac{2}{3}}+6x^{-4}$

What are antiderivatives?

DERIVATIVE JEOPARDY

Given a function f, find another function F (the <u>antiderivative</u> of f), so that F'=f

Every power function has an antiderivative, given by the following rule:

The antiderivative of x^k is $x^{k+1}/(k+1)$ if $k \neq -1$

The antiderivative of x^{-1} is ln x (for x>0)
(we will figure out why this is true later on)

Example: Find the antiderivative of:

$$p(x) = 5x^{10} - 3x^4 + \pi x^2 - 2.3x + \sqrt{73}$$

$$P(x) = \frac{5}{11}x^{11} - \frac{3}{5}x^5 + \frac{\pi}{3}x^3 - \frac{2.3}{2}x^2 + \sqrt{73}\,x + 40$$

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