Good afternoon: no warm up, we'll randomize then go over the AP limits packet

Next assessment:
Monday 9/24

What questions do you have from the packet?

HW

1. $f'(x) = -4x$
2. $f'(x) = 4x$
3. 

Avg: 4.5

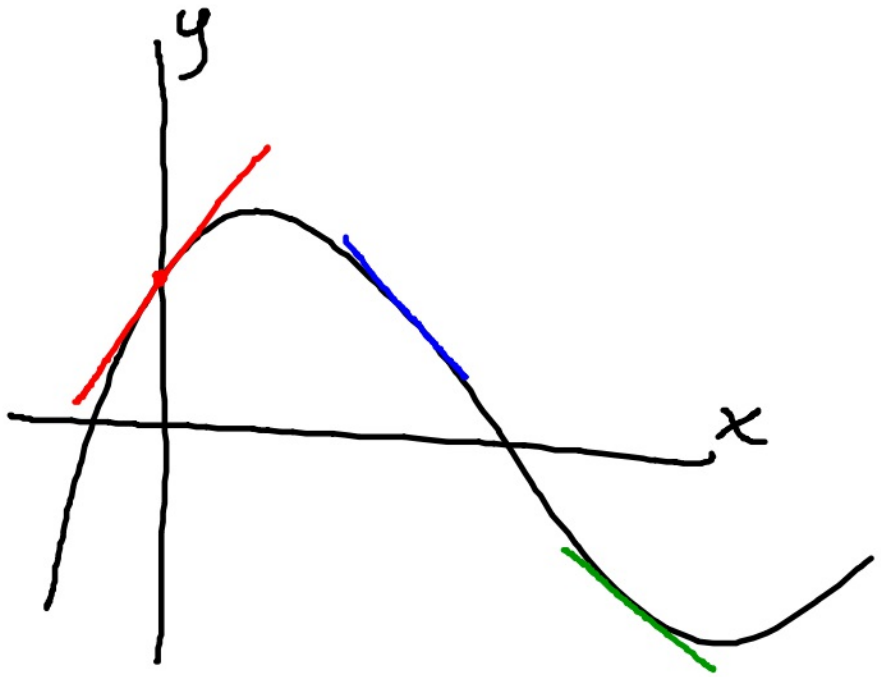
Inst @ 2: 4

4. 

Avg: 3

Inst @ -1: 4

# The central problem of differential calculus



A faster way to find derivatives

http://bit.ly/powerrule18

| x | Y1 [f(x)] | Y2 [(F(x+h)-F(x))/h, for small h value] | Relationship between x and Y2 |
|---|---|---|---|
| -10 | 100 | -20 | |
| -5 | 25 | -10 | |
| -1 | 1 | -2 | |
| 0 | 0 | 0 | |
| 1 | 1 | 2 | |
| 5 | 25 | 10 | |
| 10 | 100 | 20 | |

$2x$

$-x^2$

| x | Y1 [f(x)] | Y2 [(F(x+h)-F(x))/h, for small h value] | Relationship between x and Y2 |
|---|---|---|---|
| -10 | | 20 | |
| -5 | | 10 | |
| -1 | | 2 | |
| 0 | | 0 | |
| 1 | | -2 | |
| 5 | | -10 | |
| 10 | | -20 | |

$-2x$

$x^3$

| x | Y1 [f(x)] | Y2 [(F(x+h)-F(x))/h, for small h value] | Relationship between x and Y2 |
|---|---|---|---|
| -10 | | 300 | |
| -5 | | 75 | |
| -1 | | 3 | |
| 0 | | 0 | |
| 1 | | 3 | |
| 5 | | 75 | |
| 10 | | 300 | |

$3x^2$

$x^4 \rightarrow 4x^3$

$x^n \rightarrow n x^{n-1}$

$x^4$

| x | Y1 [f(x)] | Y2 [(F(x+h)-F(x))/h, for small h value] | Relationship between x and Y2 |
|---|---|---|---|
| -10 | | -4000 | |
| -5 | | -500 | |
| -1 | | -4 | |
| 0 | | 0 | |
| 1 | | 4 | |
| 5 | | 500 | |
| 10 | | 4000 | |

$4x^3$

$$\lim_{\Delta x \to 0} \frac{3(x+\Delta x)^2 - 4(x+\Delta x) - 12 - (3x^2 - 4x - 12)}{\Delta x}$$

$-4x^1$

$-4 \cdot 1x^0$

$-4$

$3x^1$

$6x \quad 3 \cdot 2x$

# The Power Rule For Differentiation

If $f(x) = x^n$

then $f'(x) = n \cdot x^{n-1}$

Practice: find dy/dx for each.

$y = 3x^3$ $\quad 3 \cdot 3x^2 \rightarrow \boxed{9x^2}$

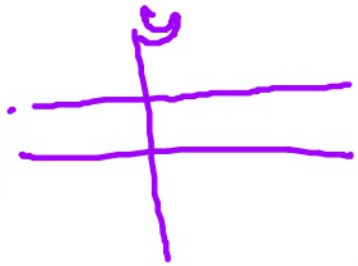
$f(x) = -2x^5$ $\quad -2 \cdot 5x^4 \rightarrow \boxed{-10x^4}$

$y = 5x^3 - 2x + 3$

$5 \cdot 3x^2$

$15x^2 - 2 + 0$

$15x^2 - 2$




$-2 \cdot x^1$

$-2 \cdot 1x^0$

$-2 \cdot 1 \cdot 1$

NOTE: In order to use the Power Rule, a term must be in $Ax^n$ form

Basic rules to know

$\frac{a}{x^n} \rightleftharpoons ax^{-n}$

$\sqrt[a]{x^b} \rightleftharpoons x^{b/a}$

Find the derivative function for $y = \frac{2}{\sqrt[3]{x^4}}$

$y = \frac{2}{\sqrt[3]{x^4}} = \frac{2}{x^{4/3}} = 2x^{-4/3}$

$y = 2x^{-4/3}$

$\frac{2}{1} \cdot \frac{1}{x^{4/3}} \; x^{-4/3}$

$f' = \frac{dy}{dx} = 2 \cdot -4 \cdot \frac{1}{3} x^{-7/3}$

$\frac{dy}{dx} = -\frac{8}{3} x^{-7/3}$

okay answer

$-\frac{8}{3} \cdot \frac{1}{x^{7/3}} \rightarrow -\frac{8}{3x^{7/3}} \rightarrow \frac{-8}{3\sqrt[3]{x^7}}$

best answer

[redacted]

Find the derivative of

$$y = -\frac{2}{x^2} + \frac{3}{\sqrt{x}} - 5$$

$$\frac{a}{x^n} = ax^{-n}$$

$$\sqrt[2]{x^1} = x^{1/2}$$

$$y = -2x^{-2} + 3x^{-1/2} - 5$$

$$\frac{dy}{dx} = -2 \cdot -2x^{-3} + 3 \cdot -\frac{1}{2} x^{-3/2} + 0$$

$$\frac{dy}{dx} = 4x^{-3} - \frac{3}{2} x^{-3/2}$$

$$\frac{4}{x^3} - \frac{3}{2\sqrt{x^3}}$$

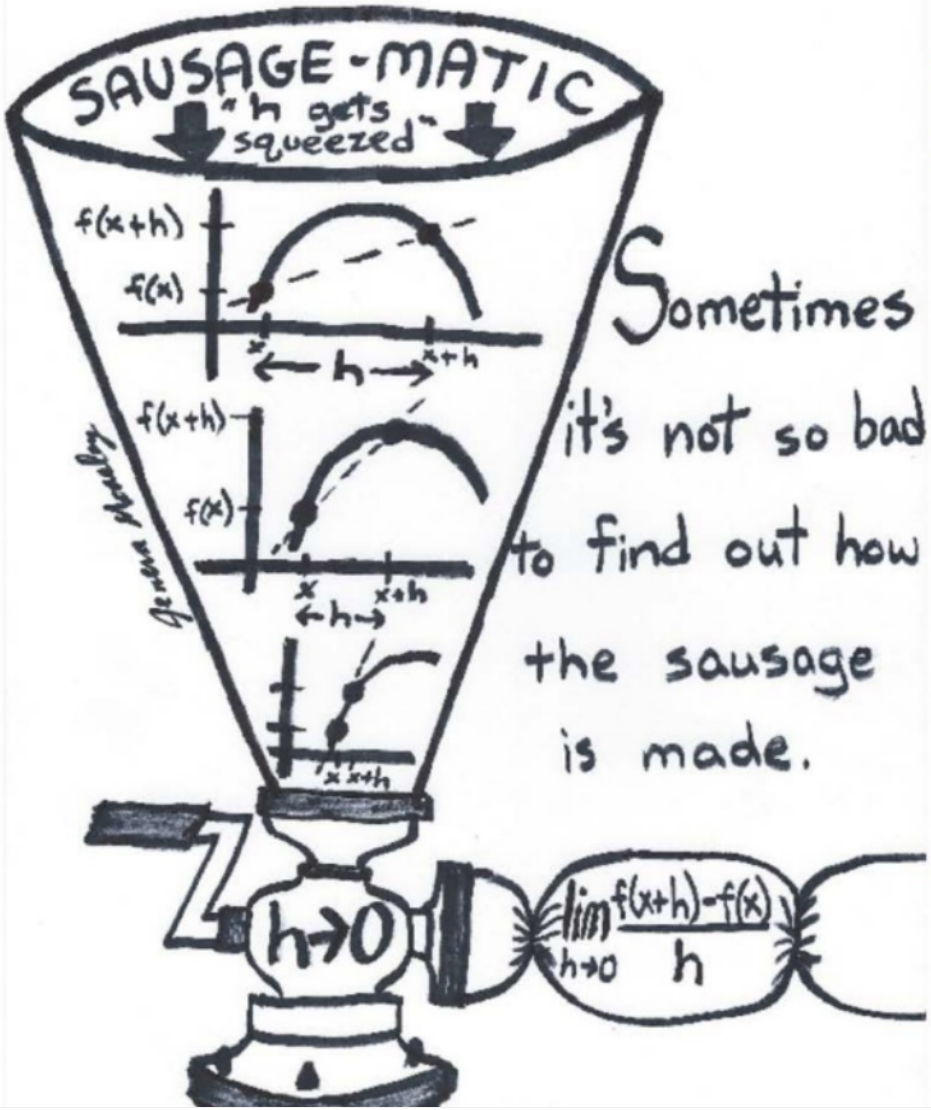
# Some 'common sense' derivatives

$$\frac{d}{dx}c = 0 \quad (where\ c\ is\ a\ constant)$$

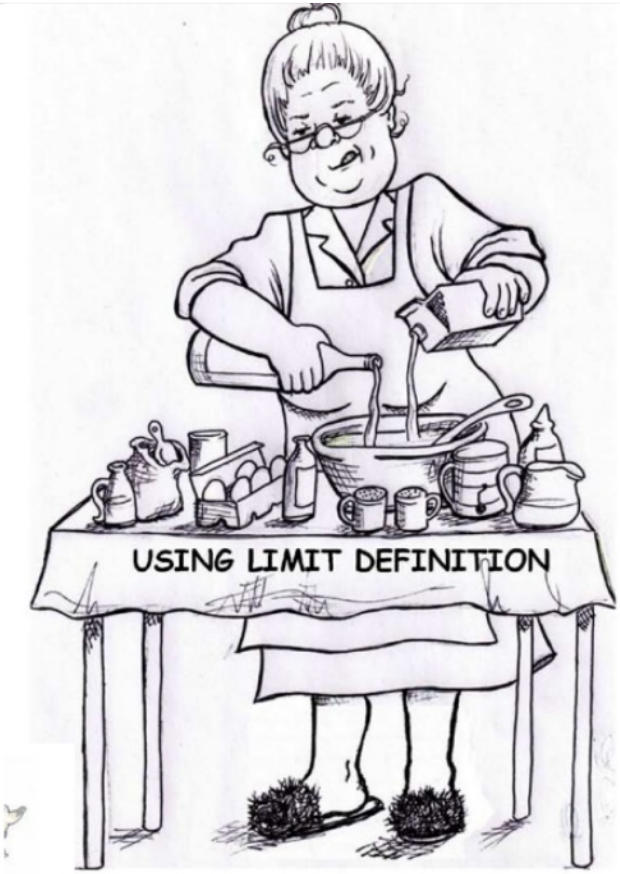
$$\frac{d}{dx}cx = c \quad (where\ c\ is\ a\ constant)$$

$\frac{d}{dx}[c * f(x)] = \quad c * f'(x)$ [can "factor out" a constant]

$\frac{d}{dx}[f(x) \pm g(x)] = f'(x) \pm g(x)$ [derivative of a sum/diff is the sum/diff of derivatives]

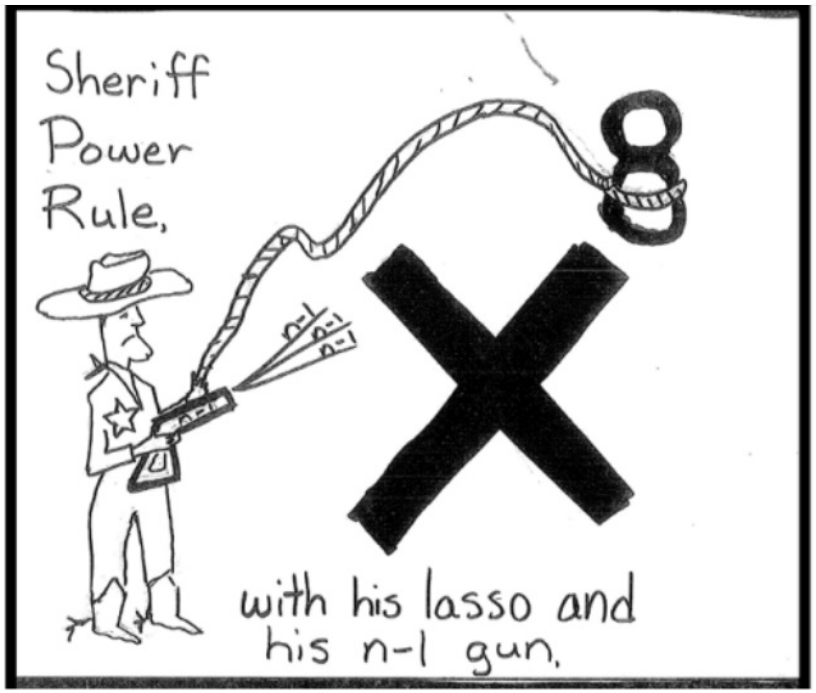



Calculus cartoons from
Dr Jeneva Moseley (UTK/Lee U)

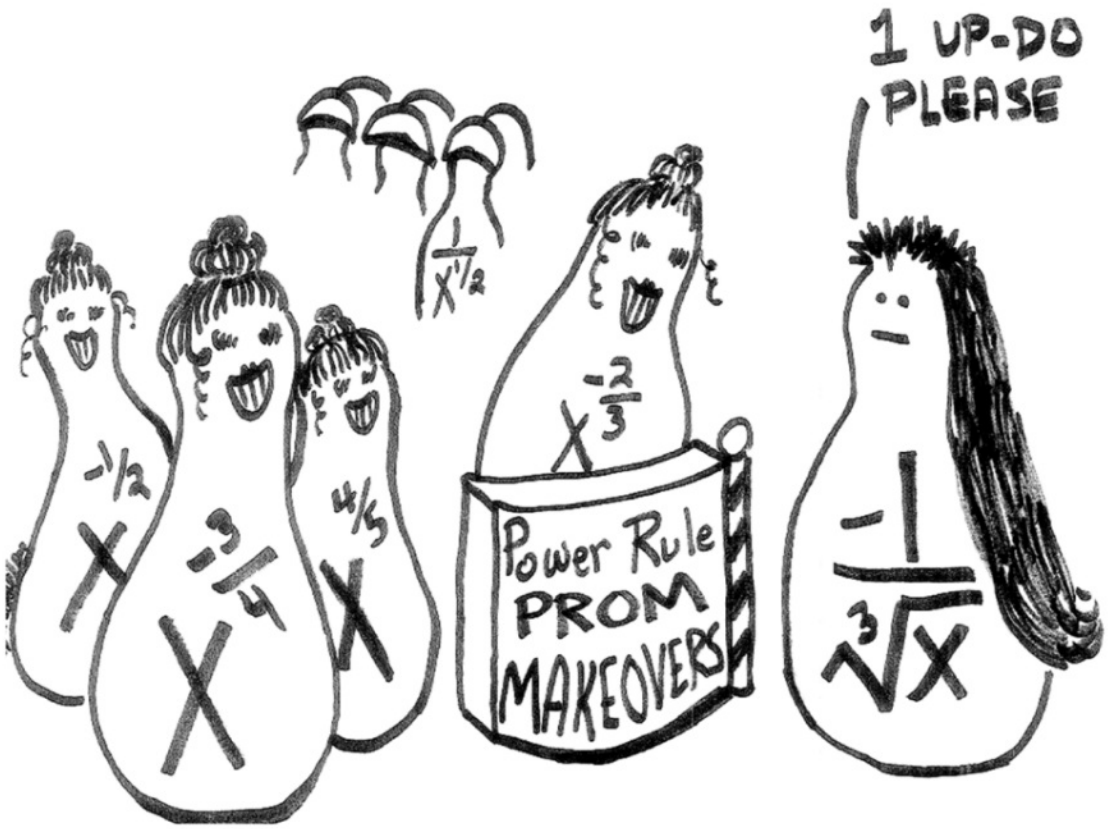


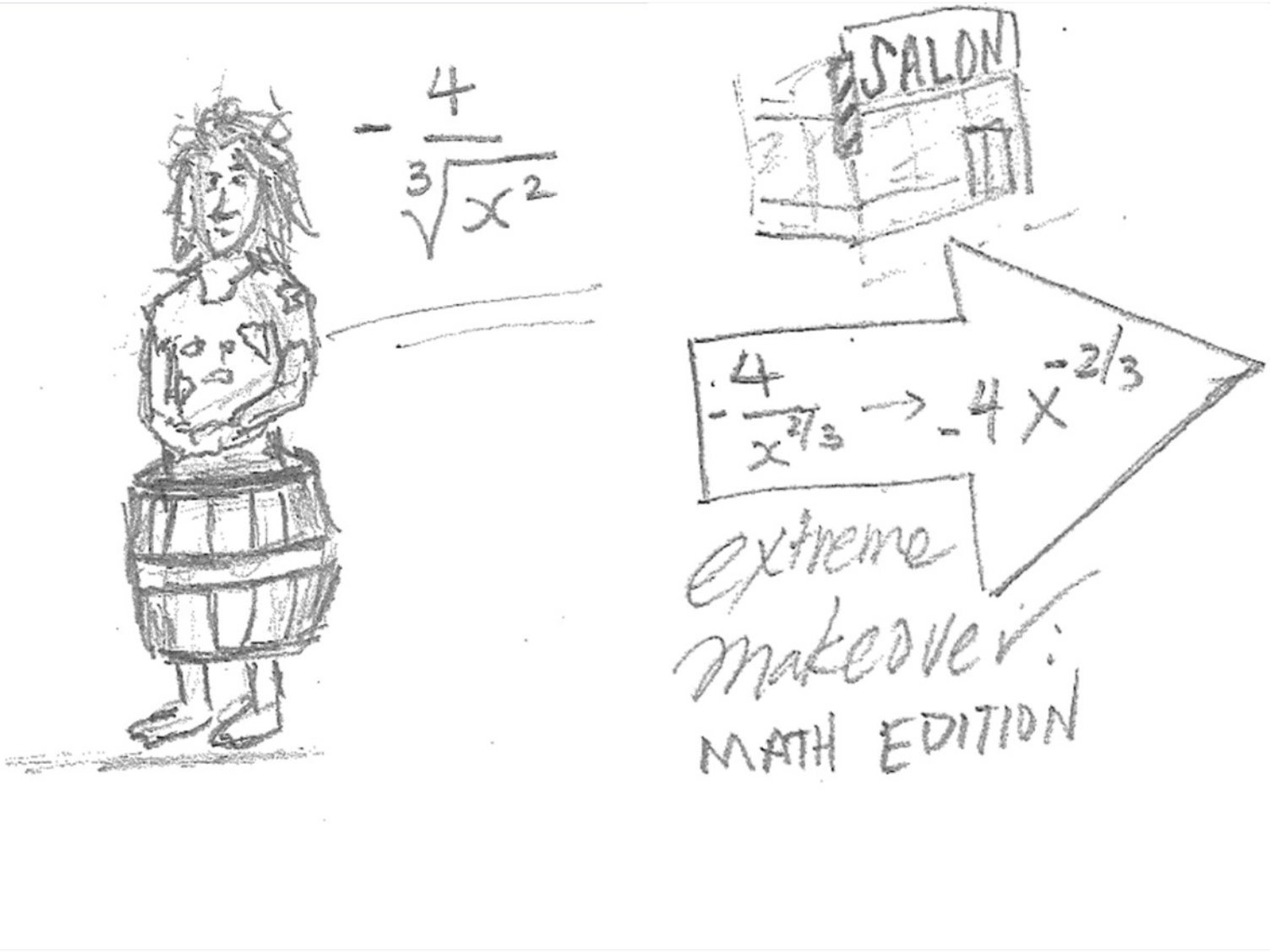

$$\lim_{\Delta x \to 0} \frac{(x + \Delta x)^n - x^n}{\Delta x}$$

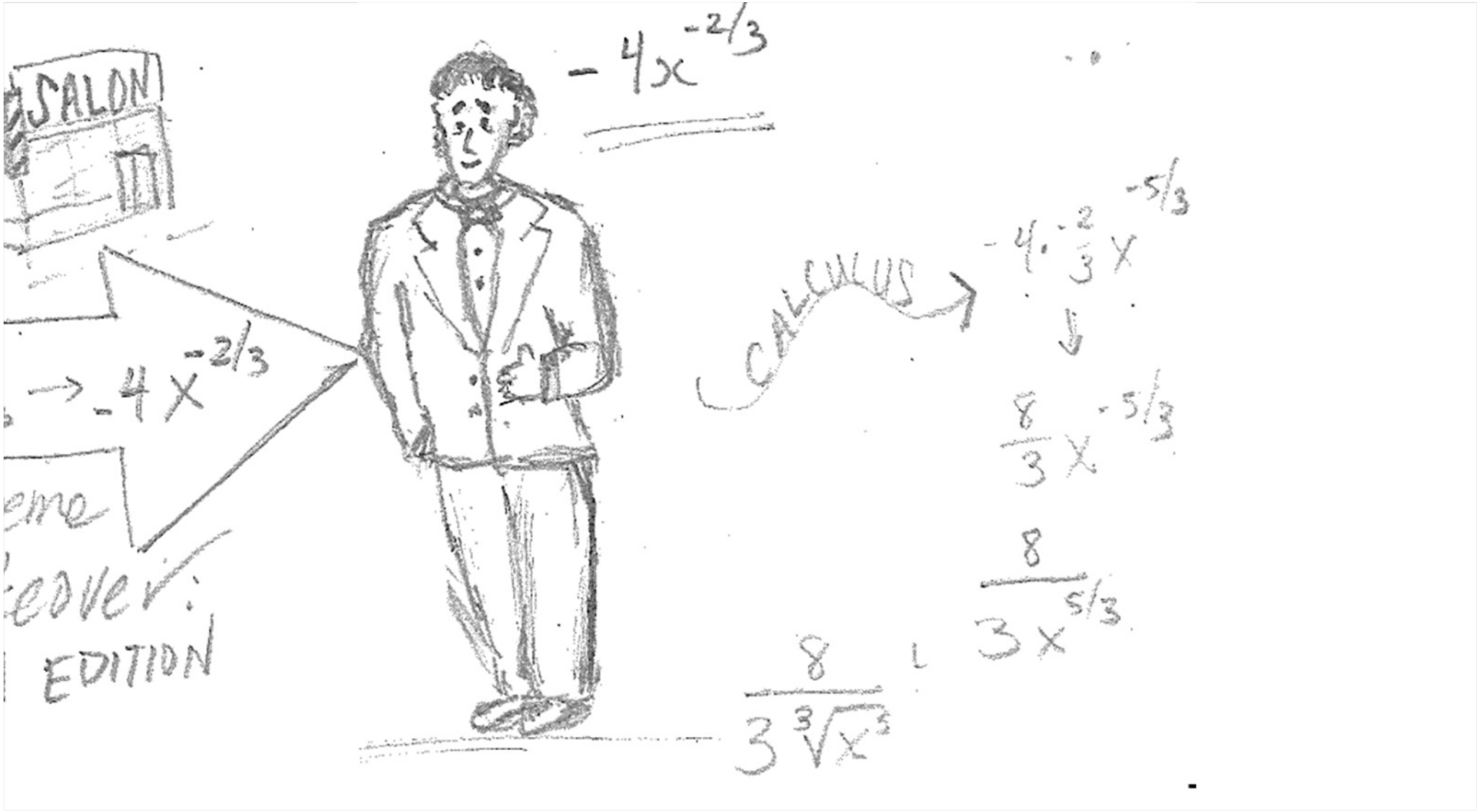

$$\frac{d}{dx} x^n = nx^{n-1}$$


Sheriff
Power
Rule,
8
n-1
n-1
n-1
with his lasso and
his n-1 gun.


cleaning up
this town,
7
8
n-1
one derivative at a time


1 UP-DO PLEASE
Power Rule PROM MAKEOVERS


$-\frac{4}{\sqrt[3]{x^2}}$
SALON
$-\frac{4}{x^{2/3}} \rightarrow -4x^{-2/3}$
extreme
makeover:
MATH EDITION


SALON
$-4x^{-2/3}$
$\rightarrow -4x^{-2/3}$
CALCULUS
$-4 \cdot \frac{-2}{3} x^{-5/3}$
$\frac{8}{3} x^{-5/3}$
$\frac{8}{3x^{5/3}}$
$\frac{8}{3\sqrt[3]{x^5}}$

justcalculusthings

First things to add to booklet:

- Definition of Continuity at a Point → $\lim_{x \to c^-} f(x) = f(c) = \lim_{x \to c^+} f(x)$
- Intermediate Value Theorem
- Extreme Value Theorem

} see video

- Limit Definition of Derivative → $f'(x) = \lim_{\Delta x \to 0} \frac{f(x+\Delta x) - f(x)}{\Delta x}$
- Power Rule for Differentiation

→ $\frac{d}{dx}\left[x^n\right] = n x^{n-1}$

HW

p. 114 #3-18, 25-30, 39-46, 54-56

(goes by much faster than you think :))

(don't forget calcchat.com!)