MA141-005 (1)

Wednesday, February 27

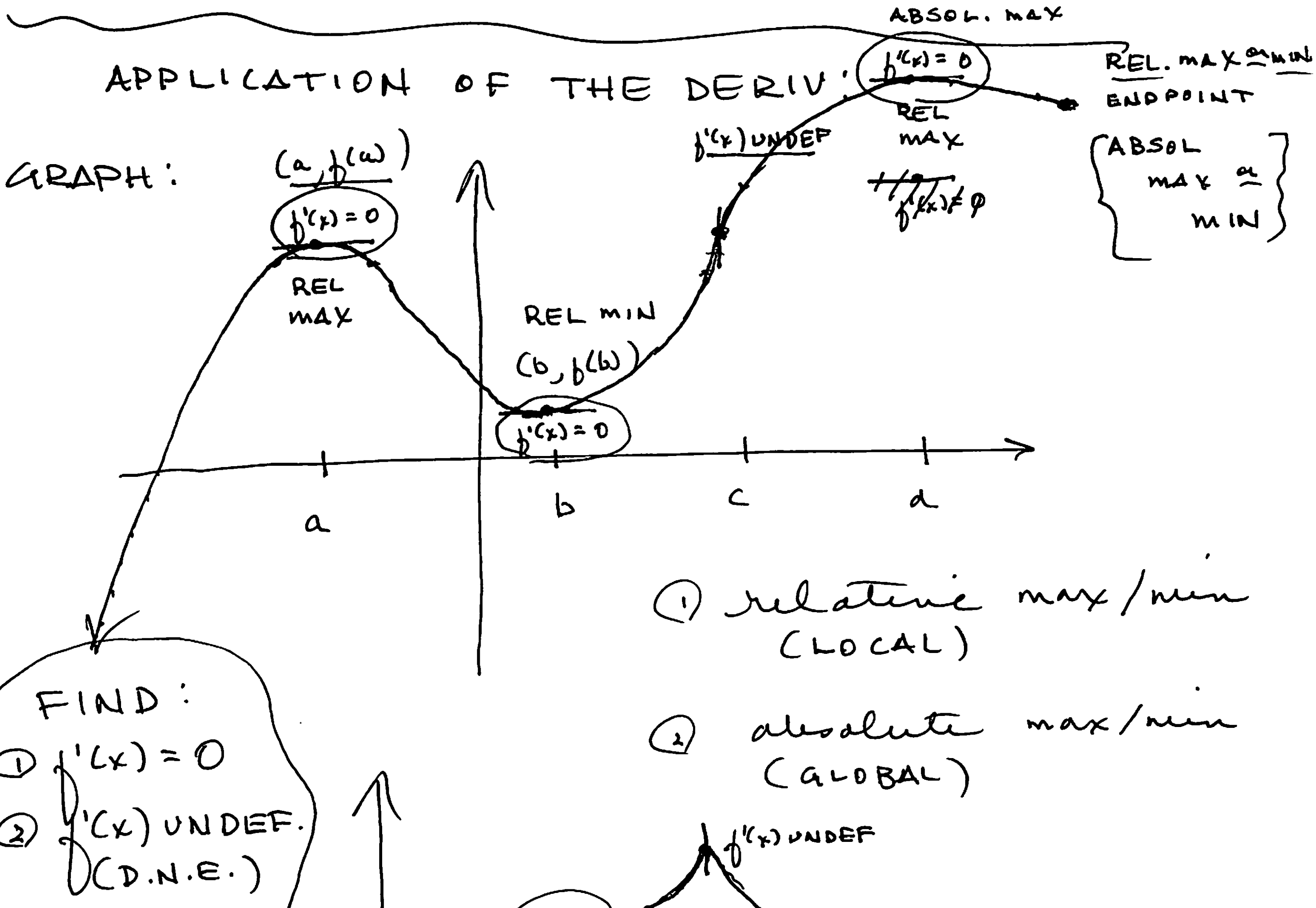
- today 3.2 (EXTREME VALUES)
  - absol. max/min
  - relative max/min

  } critical numbers, endpts

  - Rolle's theorem
  - Mean Value Theorem

APPLICATION OF THE DERIV:

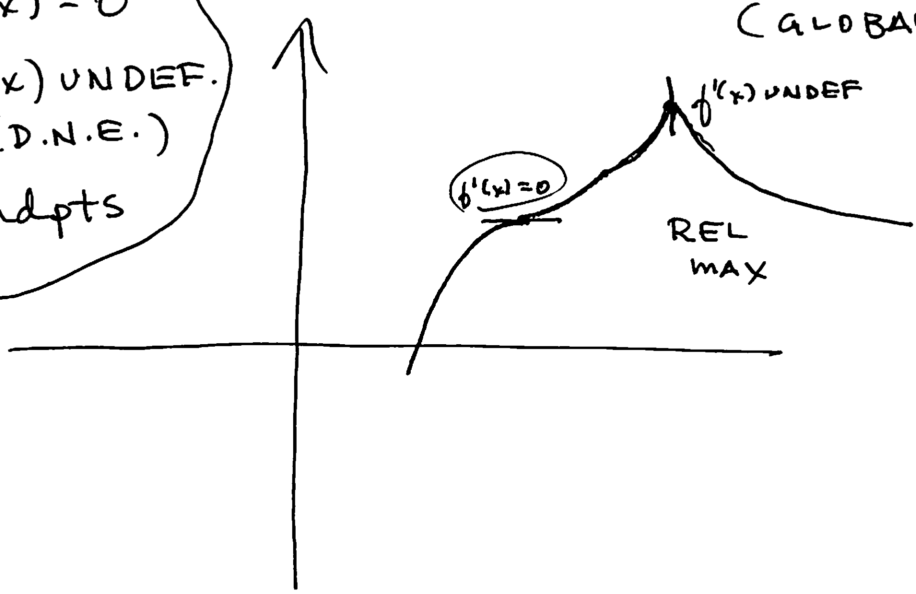
GRAPH:



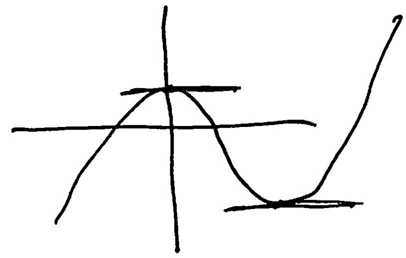
FIND:
1. $f'(x)=0$
2. $f'(x)$ UNDEF. (D.N.E.)
3. endpts

(1) relative max/min (LOCAL)

(2) absolute max/min (GLOBAL)



ex:



$f(x) = x^3 - 3x + 5$ $\mathbb{R}$

$f'(x) = 3x^2 - 3 = 0$

(1) $f'(x) = 0$ "FLAT PLACES"

(2) ~~$f'(x)$ UNDEF.~~

(3) ~~endpts~~

$3x^2 - 3 = 0$

$3(x^2 - 1) = 0$

$3(x+1)(x-1) = 0$

$x = -1$, $x = +1$

$(-1, f(-1))$ & $(1, f(1))$

$(-1, 7)$ & $(1, 3)$

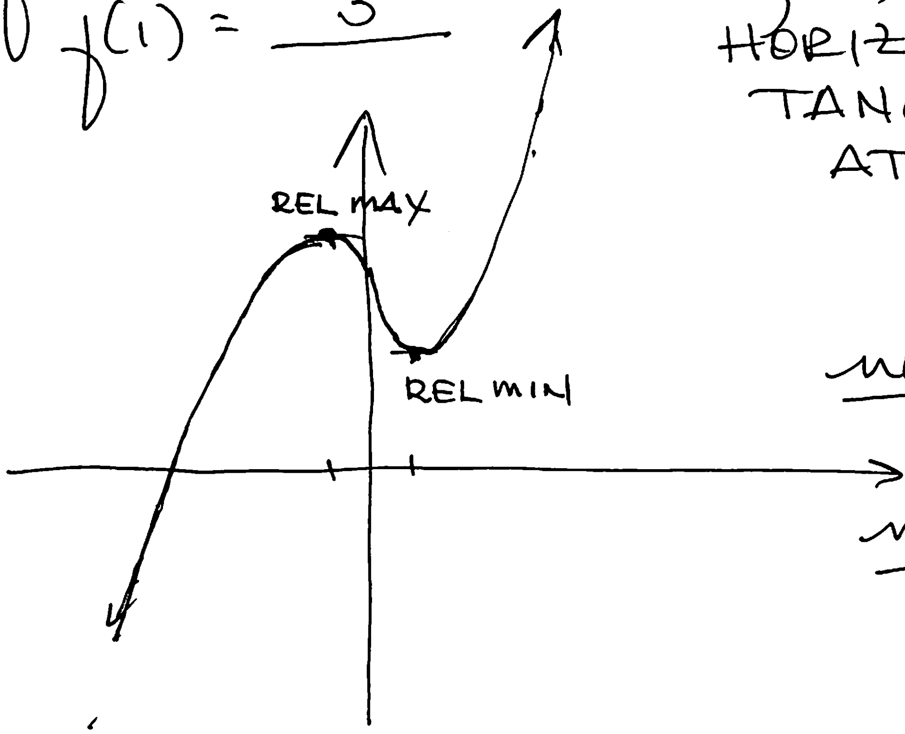
HORIZONTAL TANGENT LINES AT THESE PTS

$f(-1) = (-1)^3 - 3(-1) + 5$

$f(-1) = 7$

$f(1) = (1)^3 - 3(1) + 5$

$f(1) = 3$



no ABSOL MAX

no ABSOL MIN

ex: $y = \underbrace{x^{2/3}}\,\underbrace{(4-x)}$

not a polynom.

$y' = x^{2/3}\,[-1] + (4-x)\cdot\frac{2}{3}x^{-1/3}$

$$\boxed{y' = \underbrace{-1\cdot x^{2/3}} + \underbrace{\frac{(4-x)\cdot 2}{3x^{1/3}}}}$$

$$y' = \frac{-1\cdot x^{2/3}\cdot 3\cdot x^{1/3}}{3\cdot x^{1/3}} + \frac{(4-x)\cdot 2}{3\cdot x^{1/3}}$$

$$y' = \frac{-3x + 8 - 2x}{3\cdot x^{1/3}} = \frac{8-5x}{3\cdot x^{1/3}}$$

$$y' = \frac{8-5x}{3\cdot x^{1/3}}$$

① $\underline{y' = 0}$ $\quad \frac{8-5x}{3\cdot x^{1/3}} = 0 \quad 8-5x=0$

$8 = 5x$

$\frac{8}{5} = x$

$\boxed{\left(\frac{8}{5}\right)^{2/3}\left(4-\frac{8}{5}\right)}$

$(8/5,\ \underline{3.28}) = \boxed{(8/5,\ f(8/5))}$

HORIZ. TANGENT LINE THERE

② y' UNDEF

$\frac{8-5x}{3\cdot x^{1/3}}$ UNDEF??

when $3\cdot x^{1/3} = 0$

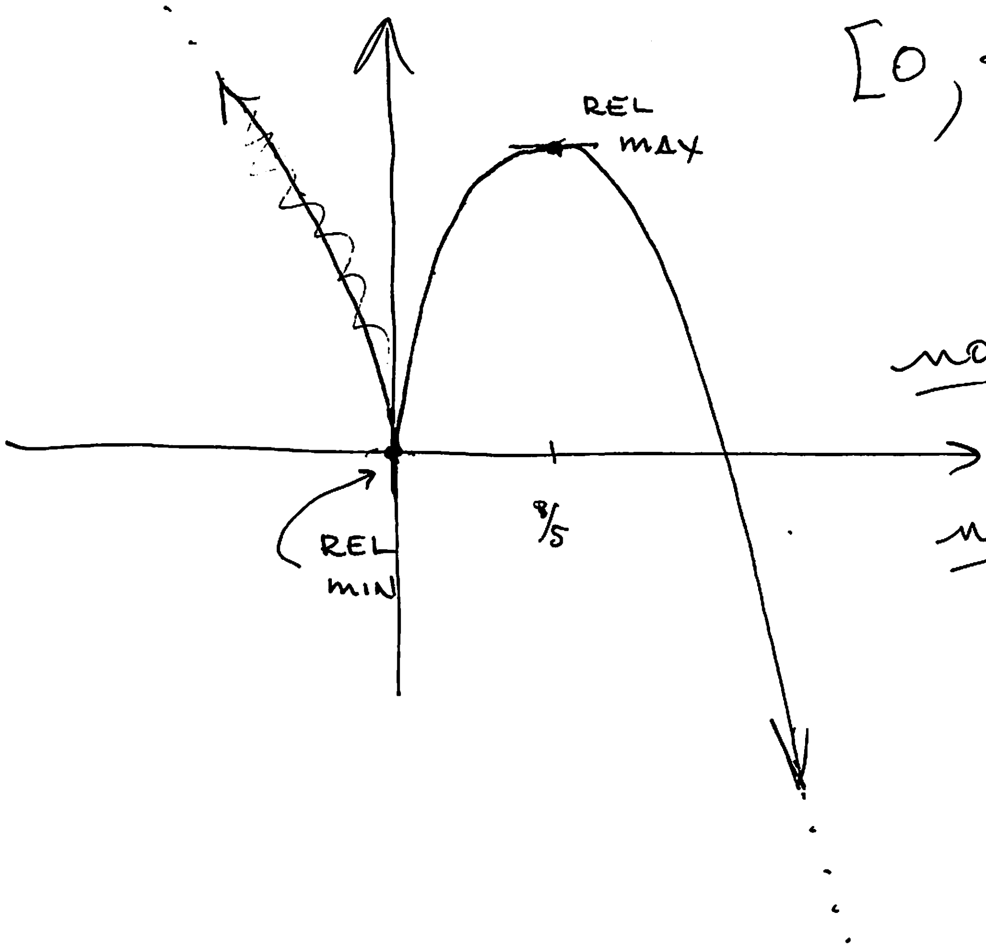
when $x=0$

$(0,0) = \boxed{(0,\ f(0))}$

VERTICAL TANGENT LINE

(4)

$[0, \infty)$

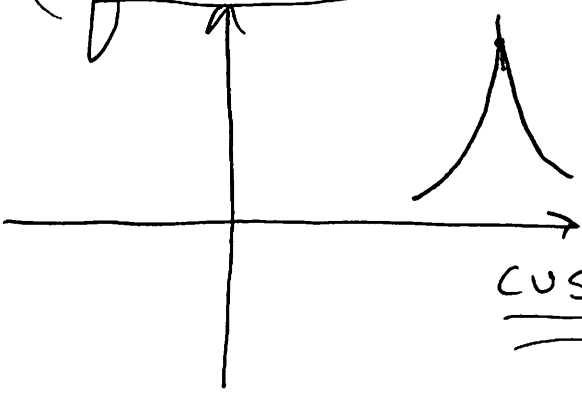


no ABSOL MAX

no ABSOL MIN

$f'(x)$ D.N.E.

1)



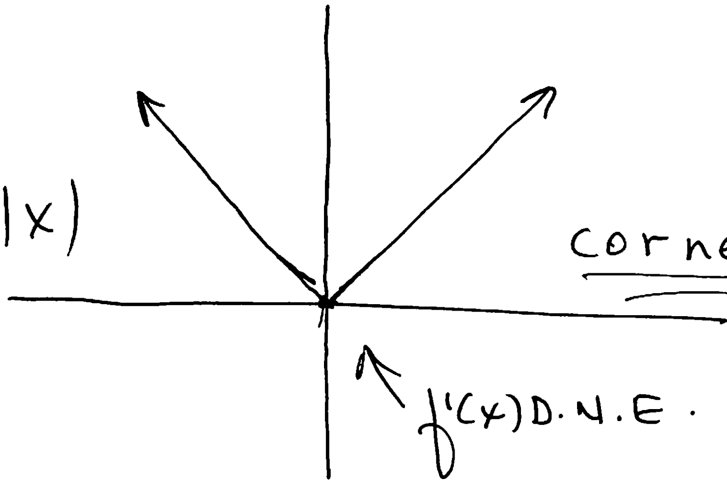
cusp

($f'(x)$ undef.)

VERTICAL TANGENT LINE

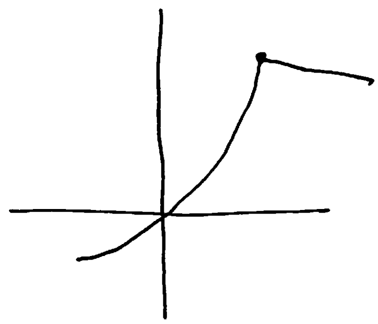
2)

$f(x) = |x|$



corner

$f'(x)$ D.N.E.



Definition 5. Critical Number $x = c$

A number $x = c$ in the domain of a continuous function f is called a **critical number** *of f if either*

$$(1) \qquad f'(c) = 0$$

or

$$(2) \qquad f'(c) \text{ does not exist}$$

critical points: $(c, f(c))$

Theorem 3. Rolle's Theorem

Let f be a function that is continuous on the closed, bounded interval $[a, b]$, differentiable on the open interval (a, b), and suppose that $f(a) = f(b)$. Then there is at least one point $c \in (a, b)$ where $f'(c) = 0$.

Theorem 4. The Mean Value Theorem

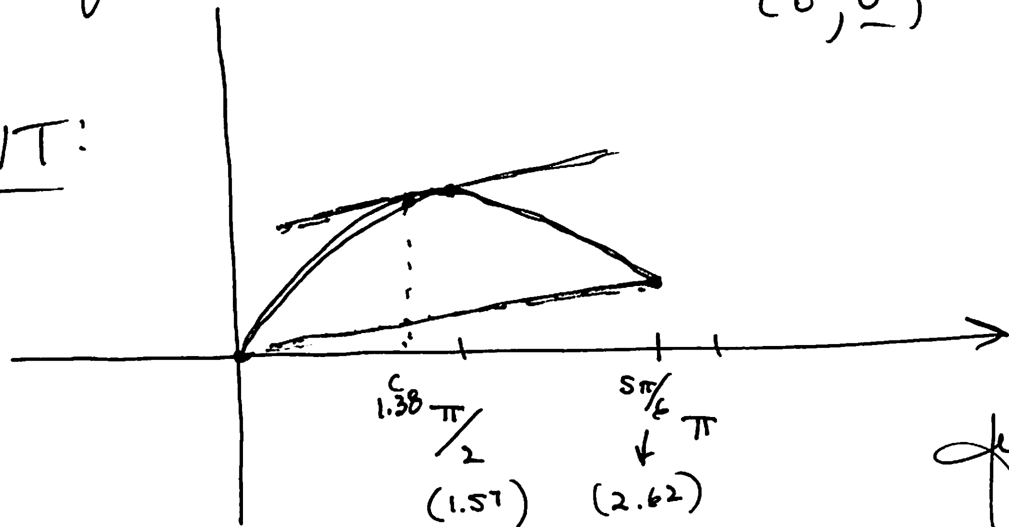
Let the function f be continuous on the closed and bounded interval $[a, b]$ and differentiable on the open interval (a, b). Then there exists at least one point $c \in (a, b)$ such that

$$f'(c) = \frac{f(b) - f(a)}{b - a}$$

$f(x) = \sin x \qquad \left[0, \frac{5\pi}{6}\right]$

$\quad (0, \underline{0}) \qquad (5\pi/6, \underline{1/2})$

<u>MVT:</u>



find c <u>in</u> $(0, 5\pi/6)$ such that

$$\frac{f(b) - f(a)}{b - a} = f'(c)$$

$$\frac{1/2 - 0}{5\pi/6 - 0} = \underline{\cos c} = \frac{1/2}{\frac{5\pi}{6}} = \frac{1}{2} \cdot \frac{6}{5\pi} = \frac{6}{10\pi}$$

$$\cos c = \frac{6}{10\pi}$$

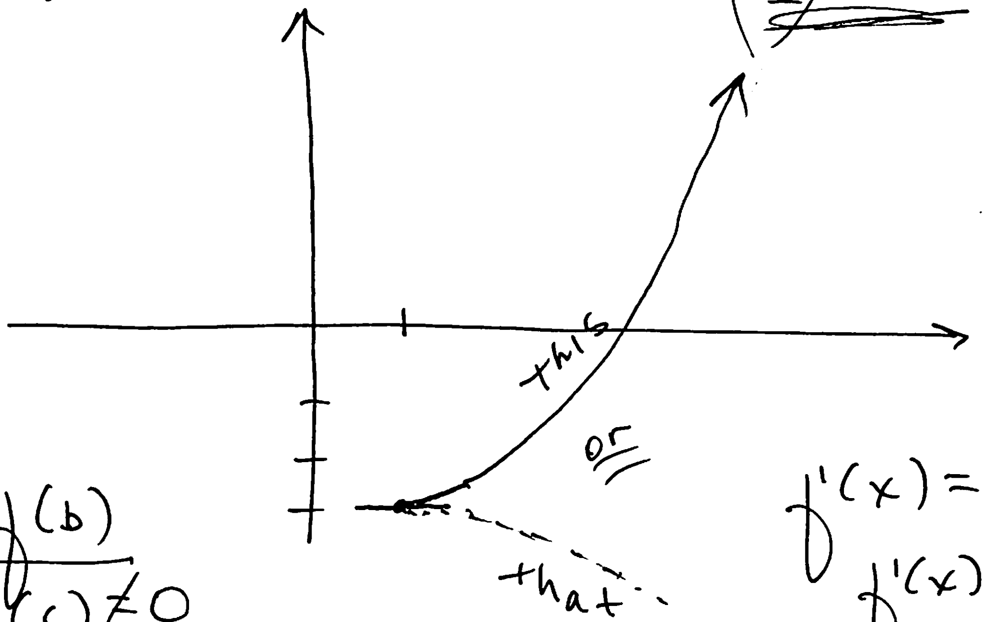
$$\cos^{-1}\left(\frac{6}{10\pi}\right) = \underline{c}$$

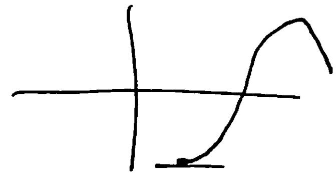
$$c \approx 1.38 \text{ (radians)}$$

check: $\underline{\cos 1.38} \approx \frac{6}{10\pi}$

$f(x) = 3x^4 - 6x^2$

$[1, \infty)$





$f(a) \overset{??}{\neq} f(b)$

$\therefore f'(c) \neq 0$
beyond $x=1$

$f'(x) = 12x^3 - 12x$

$f'(x) = 12x(x^2 - 1)$

$\therefore f'(x) = 12x(x-1)(x+1)$

$x=0$, $x=1$, $x=-1$

final crit. #

no more critical points to the right of $x=1$

if p, then q. TRUE

(if ~q, then ~p) TRUE

$f'(c) \neq 0$, then $f(a) \neq f(b)$

Missed the February Newsletter?
Read it here to get tips for keeping your class running smoothly, plus see what's new in WebAssign for Fall.

ClassView

MA 141, section 005 (Show All Sections)

Class Tools
Instructor: John Griggs
Term: Spring 2019
Access:
Julian Sass
Seyma Bennett Shabbir
Roster (39 Students)
ScoreView | Class Insights
Edit Class Settings
Communication
Class Schedule
Copy To New Sections
Copy To Existing Course

Assignments | Resources

Reschedule Assignments...

[Past (17) | Current/Recent (19) | Future | **All Assignments**] [**Low Detail** | Medium | High]

Name		Category	Due
Intro to WebAssign	view | edit | schedule | scores	Homework	1-22-19 11:00 PM EST
Entering Symbolic Answers	view | edit | schedule | scores	Homework	1-22-19 11:01 PM EST
Homework 0.1	view | edit | schedule | scores	Homework	1-31-19 11:00 PM EST
Homework 0.2	view | edit | schedule | scores	Homework	1-31-19 11:01 PM EST
Homework 0.3	view | edit | schedule | scores	Homework	1-31-19 11:02 PM EST
Homework 0.4	view | edit | schedule | scores	Homework	1-31-19 11:03 PM EST
Homework 1.1	view | edit | schedule | scores	Homework	1-31-19 11:04 PM EST
Homework 1.2	view | edit | schedule | scores	Homework	1-31-19 11:05 PM EST
Homework 1.3	view | edit | schedule | scores	Homework	1-31-19 11:06 PM EST
Homework 1.4	view | edit | schedule | scores	Homework	1-31-19 11:07 PM EST
Homework 2.1	view | edit | schedule | scores	Homework	1-31-19 11:08 PM EST
Homework 2.2	view | edit | schedule | scores	Homework	2-22-19 11:01 PM EST
Homework 2.3	view | edit | schedule | scores	Homework	2-22-19 11:02 PM EST
Homework 2.4	view | edit | schedule | scores	Homework	2-22-19 11:03 PM EST
Homework 2.5	view | edit | schedule | scores	Homework	2-25-19 11:04 PM EST
Homework 2.6	view | edit | schedule | scores	Homework	2-25-19 11:05 PM EST
Homework 2.7	view | edit | schedule | scores	Homework	2-25-19 11:06 PM EST
Homework 3.1	view | edit | schedule | scores	Homework	3-8-19 11:00 PM EST
Homework 3.2	view | edit | schedule | scores	Homework	3-8-19 11:01 PM EST
Homework 3.3	view | edit | schedule | scores	Homework	3-8-19 11:02 PM EST
Homework 3.4	view | edit | schedule | scores	Homework	3-8-19 11:03 PM EST
Homework 3.5	view | edit | schedule | scores	Homework	3-20-19 11:04 PM EDT
Homework 3.6	view | edit | schedule | scores	Homework	3-20-19 11:05 PM EDT
Homework 4.1	view | edit | schedule | scores	Homework	4-16-19 11:00 PM EDT
Homework 4.2	view | edit | schedule | scores	Homework	4-16-19 11:01 PM EDT
Homework 4.3	view | edit | schedule | scores	Homework	4-16-19 11:02 PM EDT
Homework 4.4	view | edit | schedule | scores	Homework	4-16-19 11:03 PM EDT
Homework 4.5	view | edit | schedule | scores	Homework	4-16-19 11:04 PM EDT
Homework 5.1	view | edit | schedule | scores	Homework	4-26-19 11:00 PM EDT
Homework 5.2	view | edit | schedule | scores	Homework	4-26-19 11:01 PM EDT
Propagate			

* dates changed