MA141-004

Thursday, February 28

- today (3.2) APPLICATIONS OF THE DERIVATIVE
  - relative max/min
  - absolute max/min

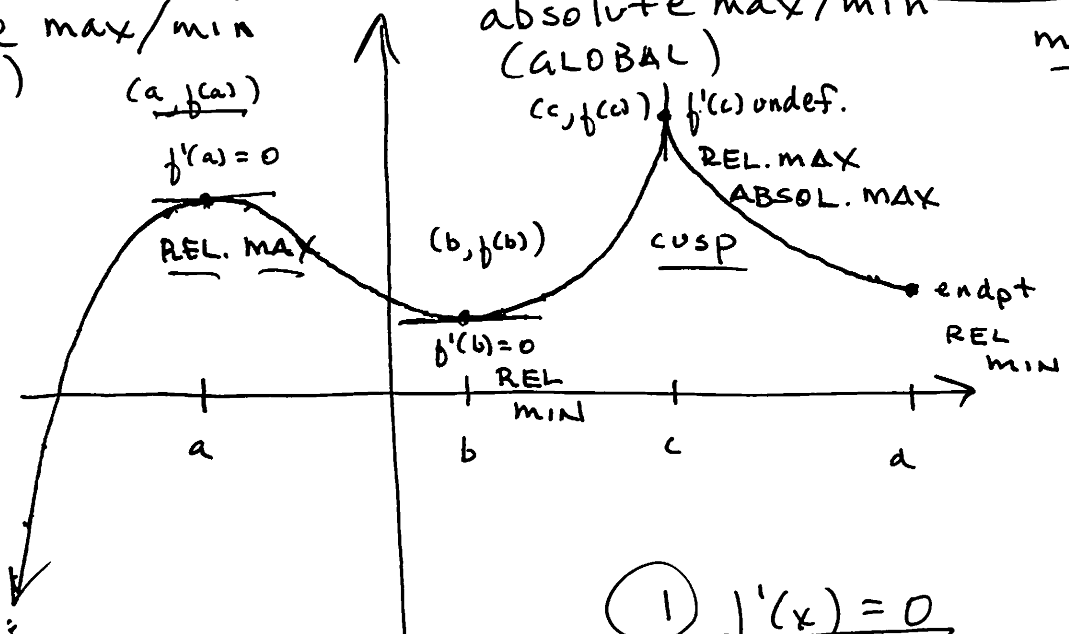
  } critical points, endpoints

  - ROLLE'S THEOREM
  - MEAN VALUE THEOREM

relative max/min (LOCAL)

absolute max/min (GLOBAL)

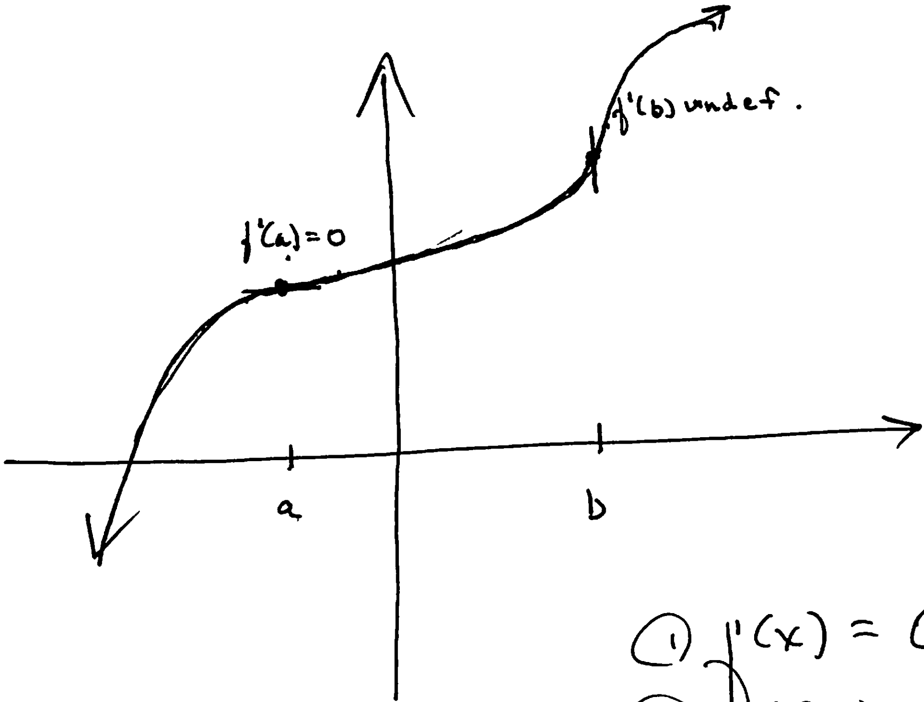
<u>max</u>/<u>min</u>



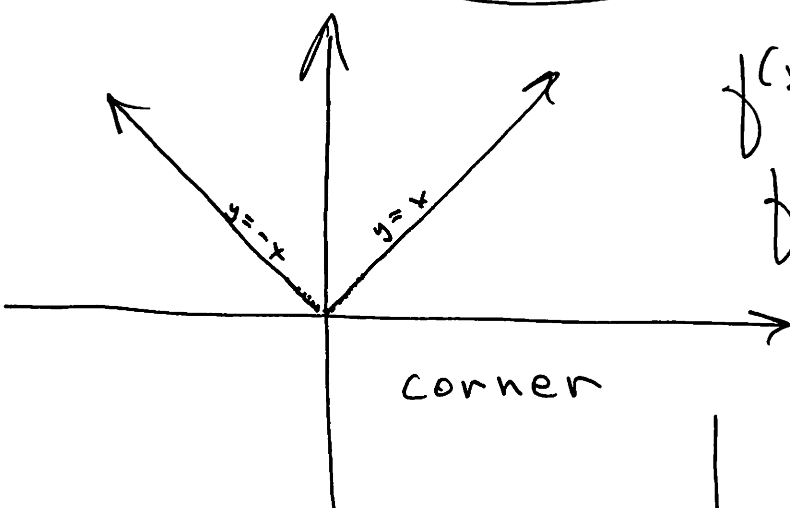
(1) $f'(x) = 0$ "FLAT" (HORIZONTAL TANGENT LINE THERE)

(2) $f'(x)$ UNDEFINED "STEEP" (VERTICAL TANGENT LINE THERE)

(3) ENDPTS.



1. $f'(x) = 0$ ✓
2. $f'(x)$ undef. ✓

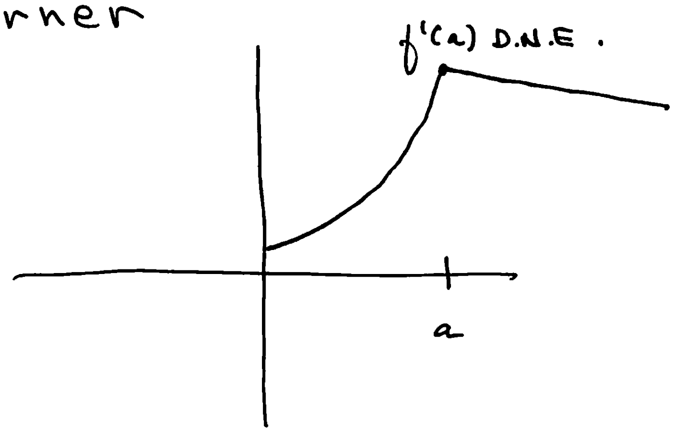


corner

$f(x) = |x|$

$f'(0) = ??$

D.N.E.



ex: $f'(x)=3x^2-3$ $[-2, 5]$

$f(x) = x^3-3x+4$

find rel max/min, absol. max/min

① $f'(x)=0$

$3x^2-3=0$

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

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

$x=1$ & $x=-1$

(HORIZ. TANGENT LINES THERE)

$(1, 2)$ $(-1, 6)$

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

$f(1)=(1)^3-3(1)+4 = \underline{2}$

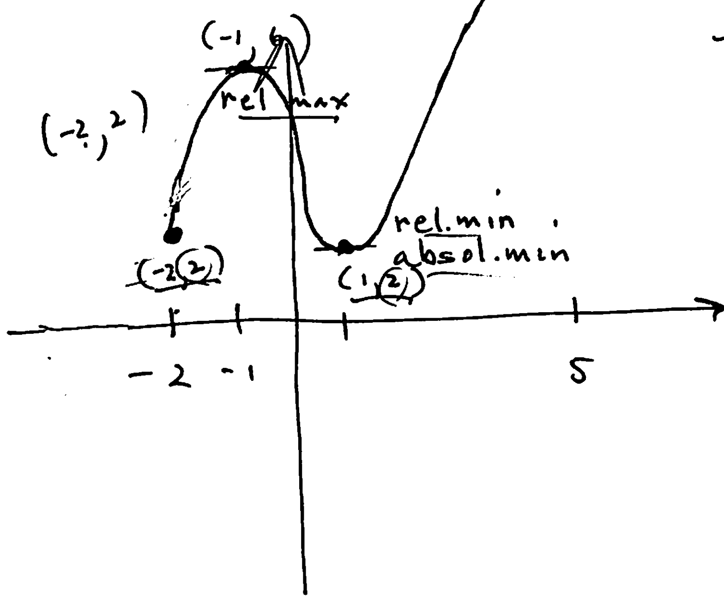
$f(-1)=(-1)^3-3(-1)+4 = \underline{6}$

② ~~$f'(x)$ undef.~~

$\boxed{3x^2-3}$ undef??

(5, 114) rel max absol. max

contin (polynom.)



endpts:

$(-2, \underline{2})$ &

$(5, \underline{114})$

$f(-2)=(-2)^3-3(-2)+4$

$f(5)=(5)^3-3(5)+4$

$f(x) = \underbrace{x^{2/3}}\,\underbrace{(4-x)}$ not a polynom

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

① $f'(x) = 0$

② $f'(x)$ undef

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

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

$f'(x) = \frac{-3\cdot x + \overset{8-2x}{2(4-x)}}{3x^{1/3}} = \frac{8-5x}{3x^{1/3}}$

CRIT. PTS

① $f'(x) = \boxed{0 = \frac{8-5x}{3x^{1/3}}}$ $\left(8/5,\ \underline{3.28}\right)$

$m_{TAN} = 0$

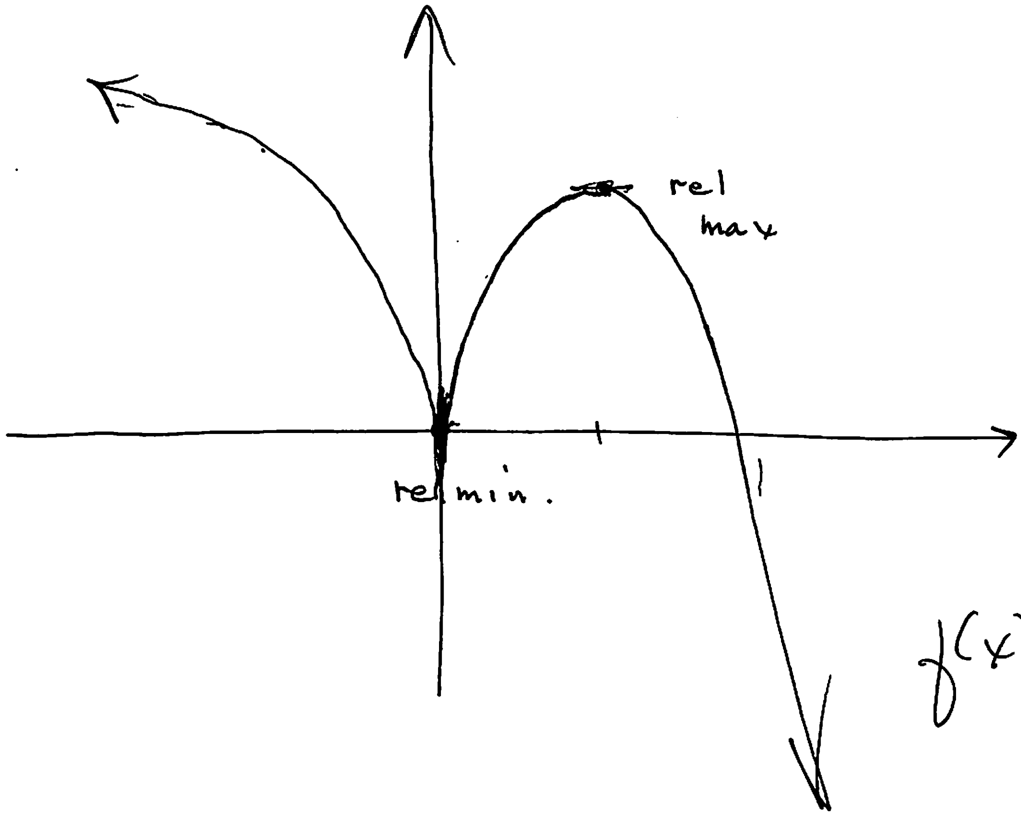
$8-5x=0 \quad x = 8/5$ "FLAT"

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

② $f'(x)$ undef.

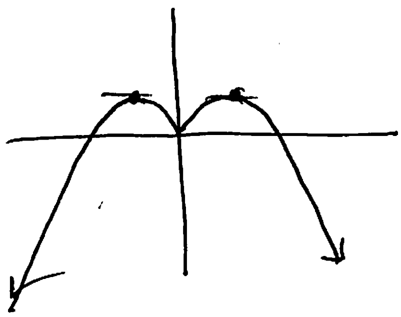
$\frac{8-5x}{3x^{1/3}}$ undef?? when $3\underline{x^{1/3}} = 0 \quad x = 0$

vertical tangent line there $(0,\ \underline{0})$ "STEEP"



$f(x) = x^{2/3} \cdot (4-x)$

contin??



ROLLE'S THEOREM

if f

1. contin on $[a, b]$
2. diff. on (a, b)
3. $f(a) = f(b)$

then there is at least one point c in (a, b) such that $\boxed{f'(c) = 0}$

MEAN VALUE THEOREM

if f

1. contin on $[a, b]$
2. diff. on (a, b)

then at least one value c in (a, b) such that $f'(c) = \frac{f(b) - f(a)}{b - a}$

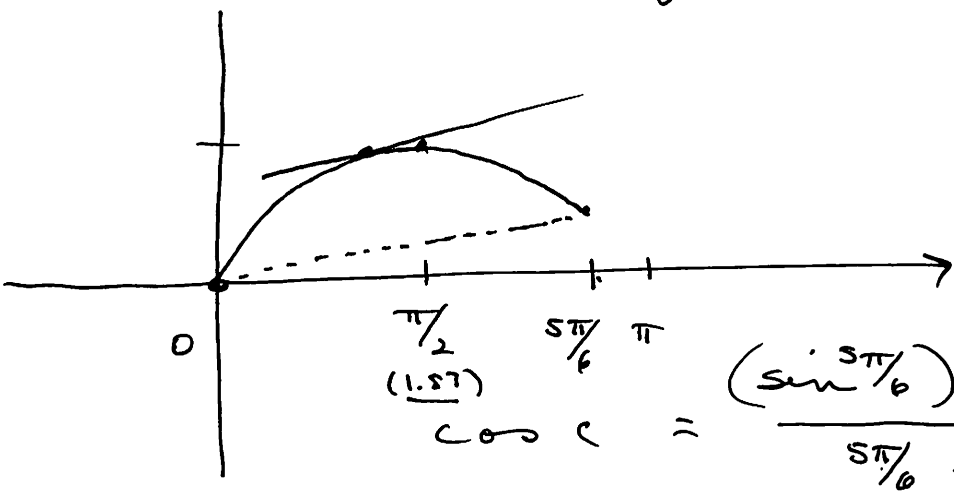
5°

MVT: $\left[0, \frac{5\pi}{6}\right]$ $c \approx 1.38$ radians

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

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

$\sin \frac{5\pi}{6} =$



$$\cos c = \frac{\left(\sin \frac{5\pi}{6}\right) - (\sin 0)}{\frac{5\pi}{6} - 0}$$

$$\cos c = \frac{\frac{1}{2} - 0}{\frac{5\pi}{6} - 0} = \frac{\frac{1}{2}}{\frac{5\pi}{6}}$$

$$\cos c = \frac{1}{2} \cdot \frac{6}{5\pi} = \frac{3}{5\pi}$$

$$\cos c = \frac{3}{5\pi}$$

$$* \quad \cos^{-1}\left(\frac{3}{5\pi}\right) = 1.38$$

check: $\cos 1.38 \approx \frac{3}{5\pi}$

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: $\boxed{(c, f(c))}$

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

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

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 004 (Show All Sections)

Class Tools

Instructor: John Griggs
Term: Spring 2019
Access:
Seyma Bennett Shabbir
Caprice Stanley

Roster (35 Students)
ScoreView | Class Insights
Edit Class Settings
Communication
Class Schedule
Copy To New Sections
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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	2-26-19 11:04 PM EST
Homework 2.6	view | edit | schedule | scores	Homework	2-26-19 11:05 PM EST
Homework 2.7	view | edit | schedule | scores	Homework	2-26-19 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	3-21-19 11:04 PM EDT
Homework 3.6	view | edit | schedule | scores	Homework	3-21-19 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			

due dates changed

MA 141-004 S19 Recitation 8, Feb 27

Recall that the *linearization of f at $x = c$* is the function which is defined by the equation of the tangent line to f at $x = c$:

$$L_c(x) = f(c) + f'(c)(x - c)$$

and the *linear approximation of f* at values of x near c is given by $f(x) \approx L_c(x)$.

1. Find the linear approximation of $f(x) = \cos(x)$ at $x = \pi/4$ and use it to approximate the value $\cos(5\pi/16)$.

2. Find the linear approximation of $f(x) = \ln(x^2)$ at $x = 1$ and use it to approximate the value $\ln(1.44)$. (Notice that $1.44 = (1.2)^2$)

Recall that *Newton's Method* is an iterative process designed to approximate the roots (or zeros) of a function f. Given an approximation x_n, the next approximation is

$$x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)}.$$

3. Use Newton's method to approximate $\sqrt{7}$ to three consistent decimal places.

4. Use Newton's Method (3 iterations with initial guess $x_0 = 3$) to approximate the intersection of the curves given by $y = \frac{1}{2}x^3$ and $y = 2x + 3$.