☆You can pick up your test after school☆ outline

21 Nov 11

☆Scan your Assignment☆

• Day 41 •

- HW ✓ & Q & A with Warm-ups
- TEST comments
- Graphing derivatives on the TI calculator
- Theorems: IVT, MVT, Rolle's Theorem
- Limits @ Infinity & L'Hôpital's Rule
- Begin Optimization
- Homework Assignment

tomorrow

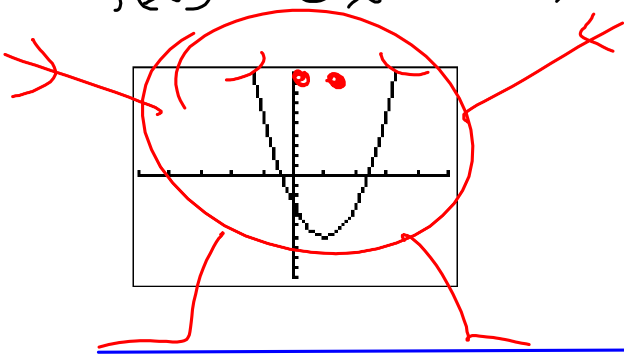
☆ end of page

WARM-UP

warm-up

1) Describe the intervals of increasing or decreasing.
Locate & JUSTIFY any relative extrema (if they exist).
Describe the concavity.
Locate and justify any point(s) of inflection.
If no point(s) of inflection $\Rightarrow$ EXPLAIN.

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



$$f'(x) = 6x - 6$$

$f'(x) = 0$ when $6x - 6 = 0 \Rightarrow 6(x-1) = 0$

c#: $x = 1$

	0	1	2
f'	$-$		$+$
f	$\downarrow$		$\uparrow$

increasing on $(1, \infty)$ and decreasing on $(-\infty, 1)$
By virtue of the first derivative test, $(1, -6)$ is a relative minimum because the f' changes sign from negative to positive about $x = 1$.

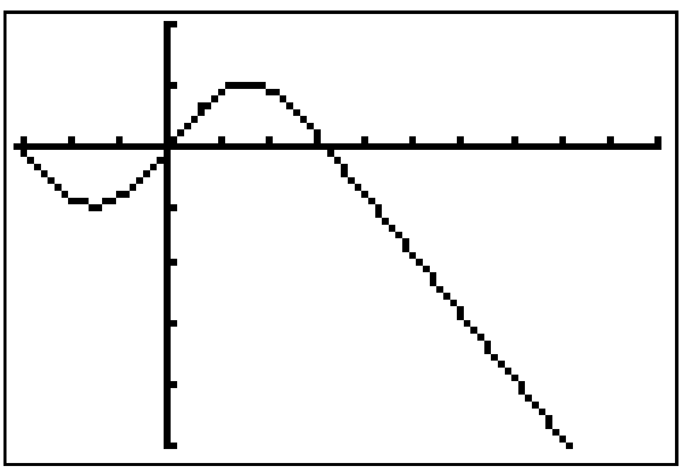
$f''(x) = 6 \Rightarrow f''(x) > 0$ on $(-\infty, \infty)$
$\therefore f$ is concave up on $(-\infty, \infty)$

f does not have any points of inflection because f'' never changes sign.

warm-up

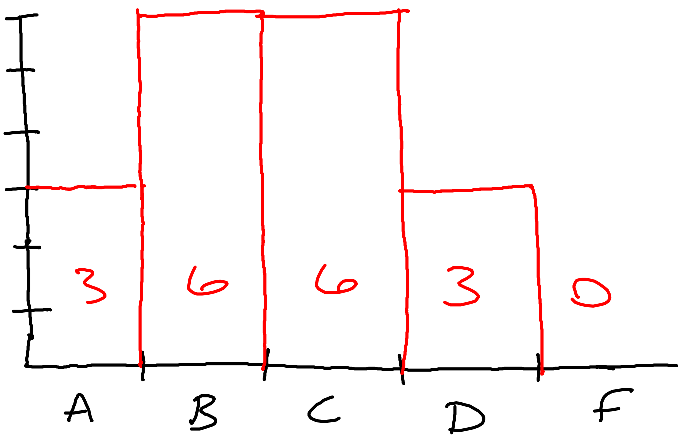
② Find a & b such that the function is continuous & differentiable on $(-\infty, \infty)$

$$f(x) = \begin{cases} \sin x, & x < \pi \\ ax + b, & x \geq \pi \end{cases}$$



⇒ Test 2 Comments

Class average 79% (n=18)



Overall course grade average: 85%

Test corrections: extra 15/15 quiz grade (optional)
Meet with me in the mornings. Due 9 DEC 11.

⇒ My advice for improving performance (Habits of success)

- homework: "no just getting it done 'cause it's due"
  study it → master it
  re-work old problems
- lecture: review afterwards, ask questions
- study: everynight at least 10 minutes
- Extra problems & Resources: Princeton Review book
  Re-read your textbooks
- See me in the morning
- form a peer study group

★ THIS WILL PREPARE YOU FOR COLLEGE!

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⇒ A comment about the Power Rule

$f(x) = (3)(x^2)$ $\qquad$ $f'(x) = 3(2x) + (x^2)(0)$

$= 6x$

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

$h(x) = 3\sin 3x$

$$V = k(R - r)r^2 \qquad 0 \le r \le R$$

$$V = k(Rr^2 - r^3)$$

$$V = \boxed{kR}r^2 - \boxed{k}r^3$$

$$\frac{dV}{dr} = 2kRr - 3kr^2 = 0 \, ?$$

$$kr\underbrace{(2R - 3r)}_{2R - 3r = 0} = 0$$

$$2R = 3r \Rightarrow r = \frac{2R}{3}$$

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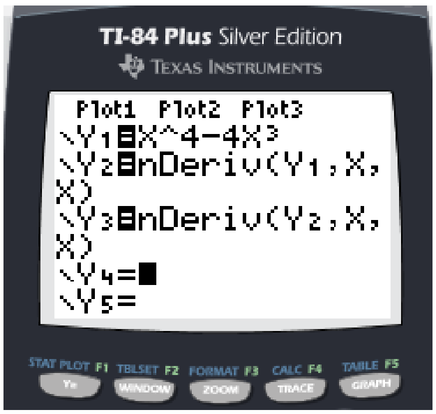
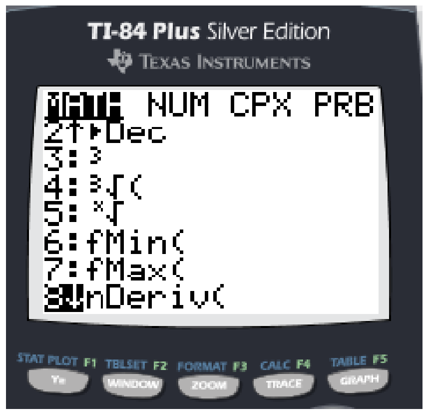
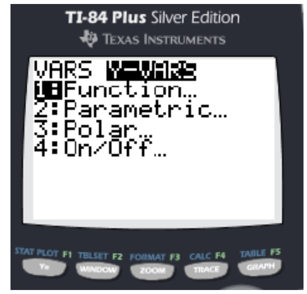
⇒ Look at f, f', & f''

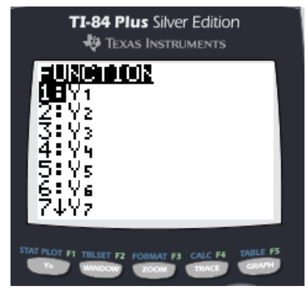
Graphing 1^{st} & 2^{nd} derivatives on the TI

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









1997 77. The graph of the function $y = x^3 + 6x^2 + 7x - 2\cos x$ changes concavity at $x =$

(A) -1.58 (B) -1.63 (C) -1.67 (D) -1.89 (E) -2.33

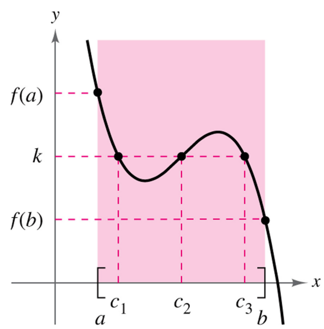
⇒ Intermediate Value Theorem

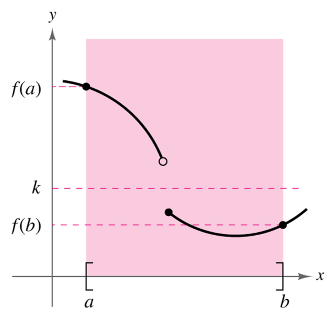
requires continuity → not differentiability

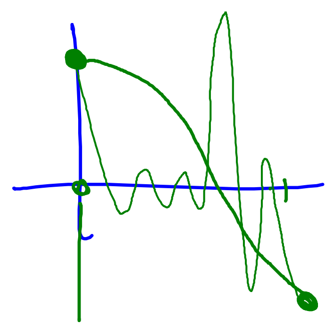
THEOREM 1.13 Intermediate Value Theorem

If f is continuous on the closed interval $[a, b]$ and k is any number between $f(a)$ and $f(b)$, then there is at least one number c in $[a, b]$ such that

$$f(c) = k.$$







How do you know f has a relative extremum?
(f is differentiable everywhere)
How many? What type?

x	-3	-1	4	7	11
f'	3	0	1	-3	2

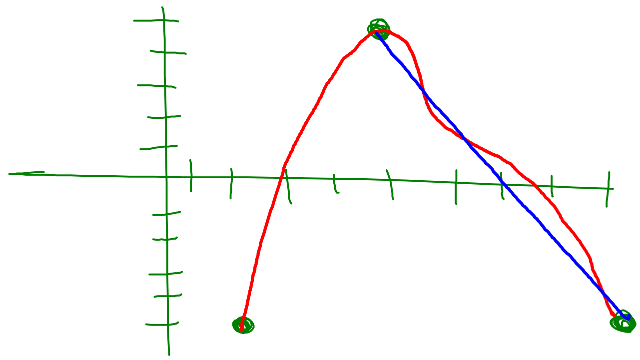
1998 91. Let f be a function that is differentiable on the open interval $(1, 10)$. If $f(2) = -5$, $f(5) = 5$, and $f(9) = -5$, which of the following must be true?

I. f has at least 2 zeros.

II. The graph of f has at least one horizontal tangent.

III. For some c, $2 < c < 5$, $f(c) = 3$.

~~(A)~~ None
~~(B)~~ I only
(C) I and II only
(D) I and III only
(E) I, II, and III

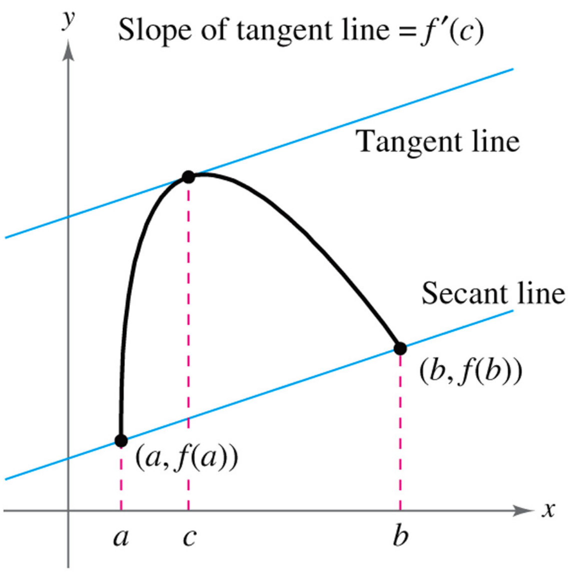


⇒ Mean Value Theorem

THEOREM 3.4 The Mean Value Theorem

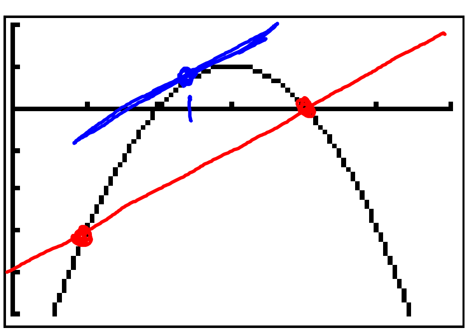
If f is continuous on the closed interval $[a, b]$ and differentiable on the open interval (a, b), then there exists a number c in (a, b) such that

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



ex/ find c such that $f'(c)$ equals the average rate of change on $[a, b]$

$$f(x) = -(x-3)^2 + 1 \quad \text{on} \quad [\underset{a}{1}, \underset{b}{4}]$$



avg rate of change ⇒ $\dfrac{f(4) - f(1)}{4 - 1}$

$$\frac{0 - -3}{3} = 1$$

$f'(x) = -2(x-3)' = -2x + 6$

$f'(x) = 1$? $\quad -2x+6 = 1$

$-2x = -5 \Rightarrow x = \frac{5}{2}$

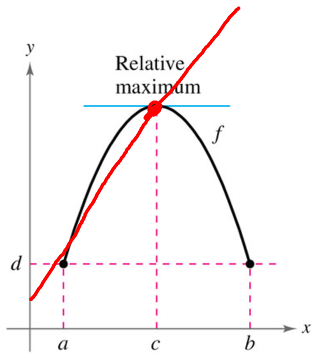
⇒ Rolle's Theorem

THEOREM 3.3 Rolle's Theorem

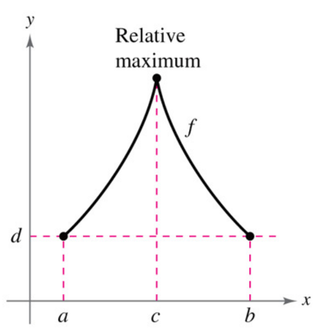
Let f be continuous on the closed interval $[a, b]$ and differentiable on the open interval (a, b). If

$$f(a) = f(b)$$

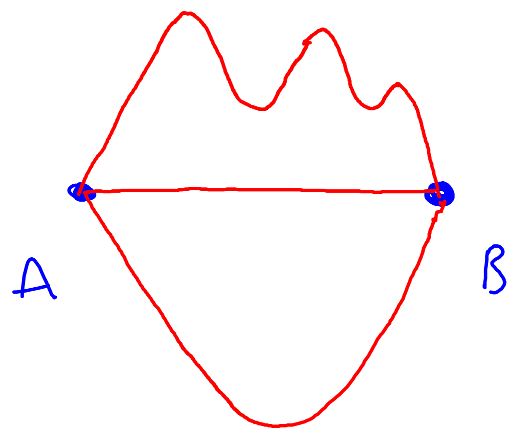
then there is at least one number c in (a, b) such that $f'(c) = 0$.



(a) f is continuous on $[a, b]$ and differentiable on (a, b).



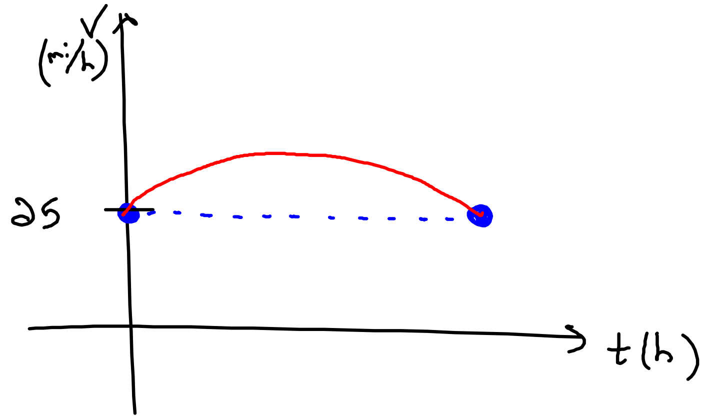
(b) f is continuous on $[a, b]$.



Application of Rolle's Theorem

Speed limit is $25 \frac{\text{miles}}{h}$

A car covers 25 miles in $5/6$ hr (50 minutes)
It is "clocked" at the start & end at $25 \text{ miles}/h$



assign hw

☆ Homework Assignment ☆

- Larson 1.4 #'s 75, 83
- Larson 3.2 #'s 13, 19, 40, 45
- ~~Larson 3.5 #'s 17, 19, 22, 24, 26, 29,~~ 32
- ~~Larson 3.7 #'s 7, 20, 21~~
- Larson 3.3 #'s 61 → 64

☆ GRADE SHEETS SIGNED ?

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