

October 22, 2025

INTERNATIONAL CAPS LOCK DAY

Today in History:

Cuban Missile Crisis (1962)

Armstrong stripped of Tour de France titles (2012)

Number of the Day: 8123

8123 is prime

8123 can be written as a sum of 13 consecutive primes.

8123 and **812318123281233812348123581236812378123881239** is prime.

Fun Fact:

In Kansas, it is illegal to catch bullfrogs in a tomato patch.

Quote of the Day:

“I'll be back' always sounded a little girly to me.”

-Arnold Schwarzenegger

Today's Weather:

Windy with rain early, high 50°.

Math 121 - Quiz #27

Find the absolute maximum and minimum of

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

on $[-1, 3]$

$$f'(x) = 3x^2 - 12$$

$$3x^2 - 12 = 0$$

$$x^2 - 4 = 0$$

$$x = +2, -2$$

x	$f(x) = x^3 - 12x$
-1	11 ← max
3	-9
2	-16 ← min

Pg 228

* 39 $y = \frac{x^2 + 1}{x - 4} \quad \underline{[5, 6]}$

$$\frac{dy}{dx} = \frac{(x-4)(2x) - (x^2+1)}{(x-4)^2}$$

$$= \frac{2x^2 - 8x - x^2 - 1}{(x-4)^2} = \frac{x^2 - 8x - 1}{(x-4)^2}$$

$$x^2 - 8x - 1 = 0$$

$$x = \frac{8 \pm \sqrt{64 - 4(1)(-1)}}{2} = \frac{8 \pm \sqrt{68}}{2}$$

$$x = 4 \pm \sqrt{17}$$

x	f(x)
5	
6	

ROLLE'S THM

$f(x)$ IS CONT. ON $[a, b]$

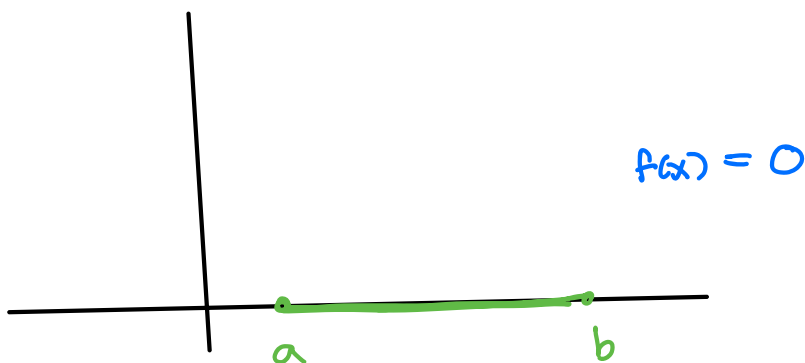
$f(x)$ IS DIFF. ON (a, b)

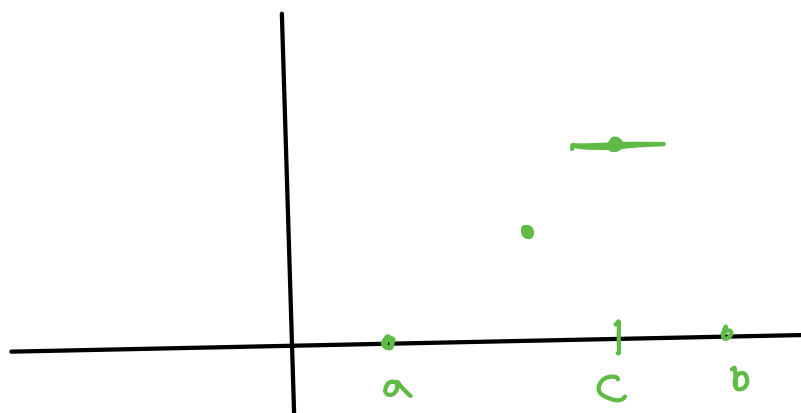
$$f(a) = f(b) = 0 \quad \leftarrow \text{SOME BOOKS USE ANY NUMBER.}$$

THEN THERE IS A c

$$a < c < b$$

$$\text{AND } f'(c) = 0$$





$$f(x) \neq 0$$

EXAMPLE

$$f(x) = x^3 - 4x \quad \underline{\underline{[-2, 2]}}$$

$$f(-2) = 0$$

$$f(2) = 0$$

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

$$3x^2 - 4 = 0$$

$$x^2 = \frac{4}{3}$$

$$x = \pm \sqrt{\frac{4}{3}}$$

$$\approx \pm 1.15$$

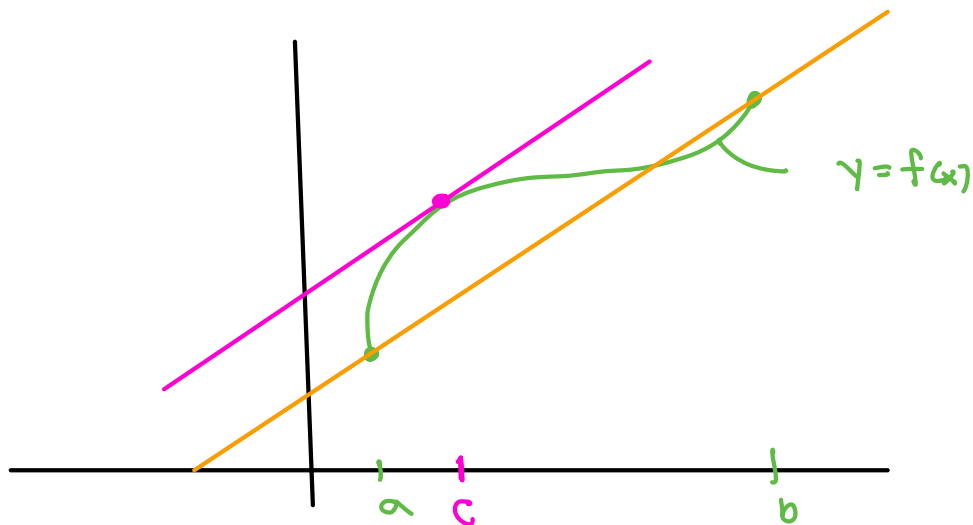
MEAN VALUE THM
(M.V.T.)

$f(x)$ IS CONT. ON $[a, b]$

$f(x)$ IS DIFF ON (a, b)

THEN THERE IS A c
 $a < c < b$

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



$$\frac{f(b) - f(a)}{b - a}$$

$$\frac{240 \text{ miles}}{3 \text{ hr}} = 80 \text{ mph}$$

$$f'(c) = \frac{f(b) - f(a)}{b - a} > 0$$

$$\underline{a < b} \quad f'(c) > 0$$

$$\Rightarrow f(b) - f(a) > 0$$

$$f(b) > f(a)$$

$$\underline{f'(c) > 0} \quad f(x) \text{ IS INCREASING.}$$

$$\underline{f'(c) < 0}$$

$$\frac{f(b) - f(a)}{b - a} < 0$$

$$f(b) - f(a) < 0$$

$$f(b) < f(a)$$

$$f(x) \text{ IS DEC.}$$

EXAMPLE

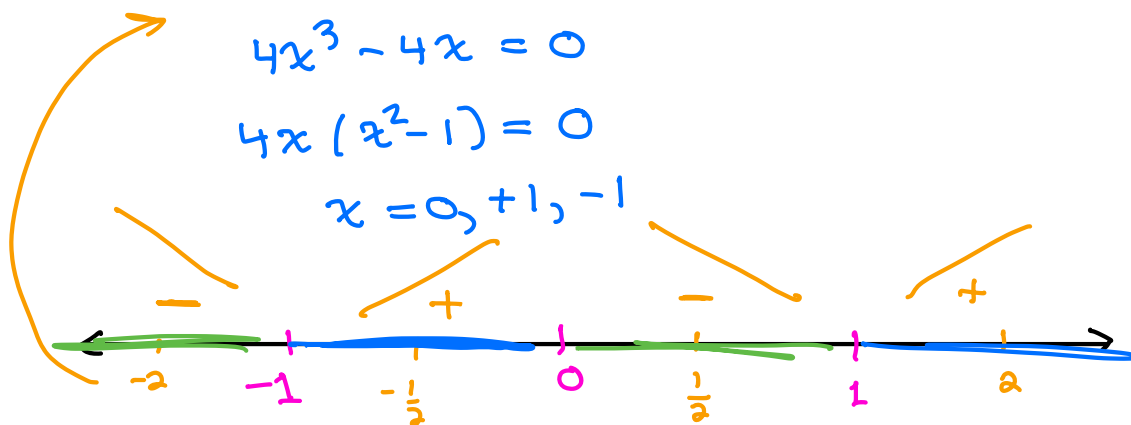
$$f(x) = x^4 - 2x^2$$

$$\rightarrow f'(x) = 4x^3 - 4x$$

$$4x^3 - 4x = 0$$

$$4x(x^2 - 1) = 0$$

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



$$\text{INC: } (-1, 0) \cup (1, \infty)$$

$$\text{DEC: } (-\infty, -1) \cup (0, 1)$$

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

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

$$= \frac{4x}{3(x^2 - 4)^{\frac{1}{3}}}$$

$$= 0$$

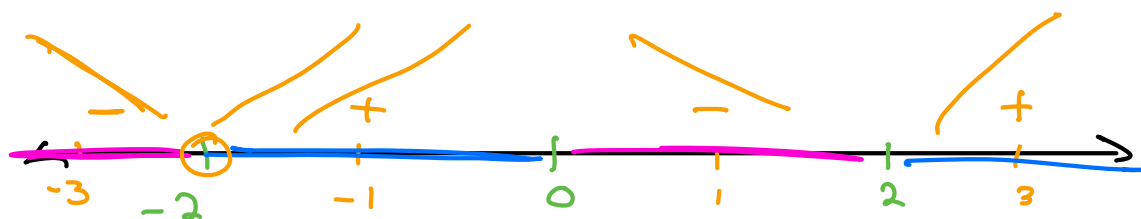
$$4x = 0$$

$$x = 0$$

UND

$$3(x^2 - 4)^{\frac{1}{3}} = 0$$

$$x = \pm 2$$



$$\text{INC: } (-2, 0) \cup (2, \infty)$$

$$\text{DEL: } (-\infty, -2) \cup (0, 2)$$

$$x = -2 \quad \text{LOCAL MIN}$$

$$x = 0 \quad \text{LOCAL MAX}$$

$$x = 2 \quad \text{LOCAL MIN}$$

1ST DERIVATIVE TEST

