October 21, 2026

National Pumpkin Cheesecake Day

Today in History:

USS Constitution launched (1797)

Henry Ford dedicates the Thomas Edison Institute (1929)

Number of the Day: 1845

1845 = 3 x 3 x 5 x 41

1845 is a number that can be expressed as the difference of the squares of primes in just one distinct way.

Fun Fact:

A quarter of a raw potato in each shoe at night will keep the leather soft and shoes smelling fresh and clean.

Quote of the Day:

"Milk is for babies. When you grow up you have to drink beer."

-Arnold Schwarzenegger

Today's Weather:

Sunshine, high near 65°.

Math 121 - Quiz #27

Find the absolute maximum and minimum of

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

on $[-1, 3]$

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

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

$3(x-2)(x+2) = 0$

$x = 2, -2$

$x = -2$ IS NOT IN $[-1, 3]$

x	$f(x)$	
-1	11	MAX
3	-9	
2	-16	MIN

Pg 228 #45

$y = \sqrt{x + x^2} - 2\sqrt{x}$ $\quad [0, 4]$

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

$y' = \frac{1 + 2x}{2(\sqrt{x + x^2})} - \frac{1}{\sqrt{x}}$

$$y' = \frac{\sqrt{x}(1+2x) - 2\sqrt{x+x^2}}{2\sqrt{x+x^2}\sqrt{x}}$$

$$= \frac{\sqrt{x}(1+2x) - 2\sqrt{x}\sqrt{1+x}}{2\sqrt{x+x^2}\sqrt{x}}$$

$= 0$

$$\sqrt{x}(1+2x) - 2\sqrt{x}\sqrt{1+x} = 0$$

$$\sqrt{x}\left(1+2x-2\sqrt{1+x}\right) = 0$$

$\sqrt{x} = 0$

$$1+2x-2\sqrt{1+x} = 0$$

$$\left(1+2x = 2\sqrt{1+x}\right)^2$$

$$1+4x+4x^2 = 4(1+x)$$

$$1+\cancel{4x}+4x^2 = 4+\cancel{4x}$$

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

$$x^2 = \frac{3}{4} \qquad x = \pm\frac{\sqrt{3}}{2}$$

x	$f(x)$
0	
4	
$\frac{\sqrt{3}}{2}$	

ROLLE'S THM.

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

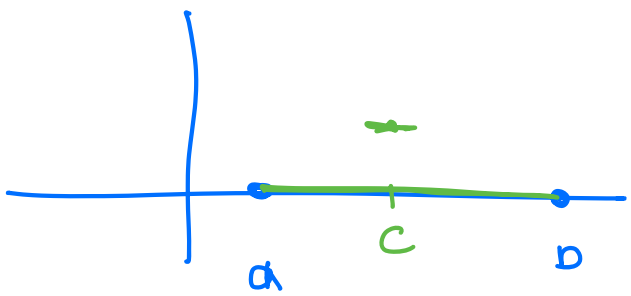
$f(x)$ IS DIFF. ON (a,b)

THEN IF $f(a) = f(b) = 0$ (OR ANY OTHER NUMBER)

THEN $a < c < b$ WHERE $f'(c) = 0$

ASSUME HAS MAX

ENDPOINT OR C.P.



EXAMPLE $f(x) = x^3 - 4x$ $[-2,2]$

$f(x)$ CONT? Y $f(2) = 0$

$f(x)$ DIFF? Y $f(-2) = 0$

$f'(x) = 3x^2 - 4 = 0$

$x^2 = \frac{4}{3}$ $x = \frac{2}{\sqrt{3}} = \pm 1.15$

MEAN VALUE THM. TURNPIKE THM.

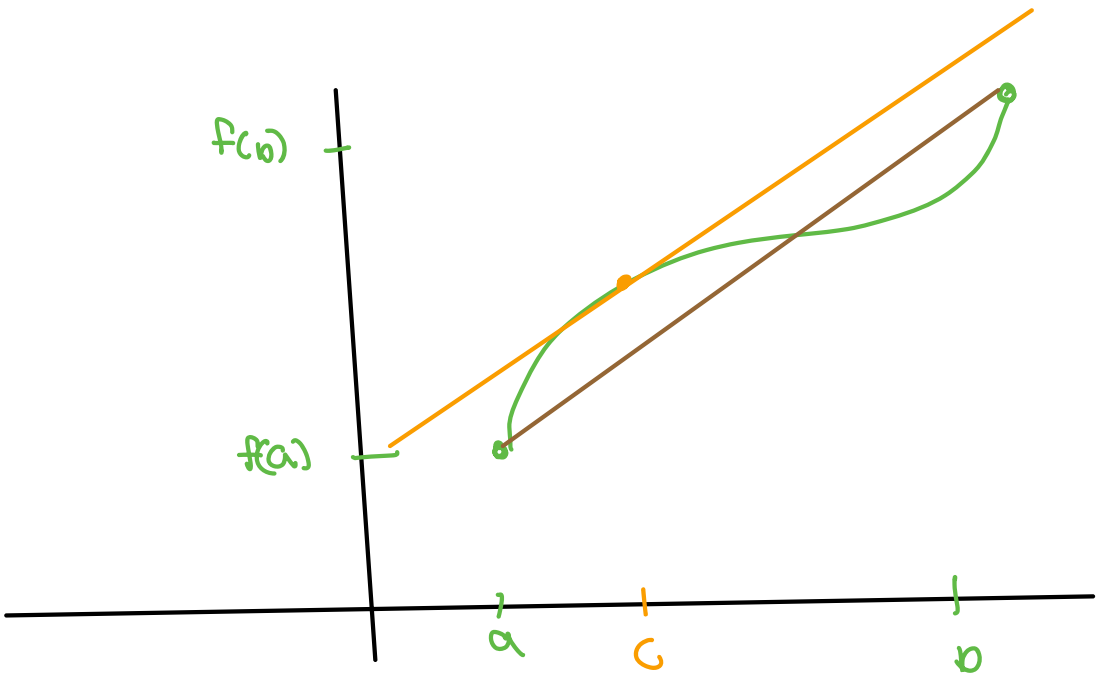
$f(x)$ IS CONT $[a,b]$

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

THEN THERE IS A c

$a < c < b$ SUCH THAT

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



EXAMPLE $f(x) = x^3 - 2x + 4$ $[0,2]$

$f(x)$ CONT? ✓

$f(x)$ DIFF? ✓

$f(2) = 8$

$f(0) = 4$

$$f'(c) = \frac{8-4}{2-0} = \frac{4}{2} = 2$$

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

$$3x^2 = 4$$

$$x = \frac{2}{\sqrt{3}} \approx 1.15\ldots$$

IF $f(b) > f(a)$ $\quad a < b$

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

$$b - a > 0$$

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

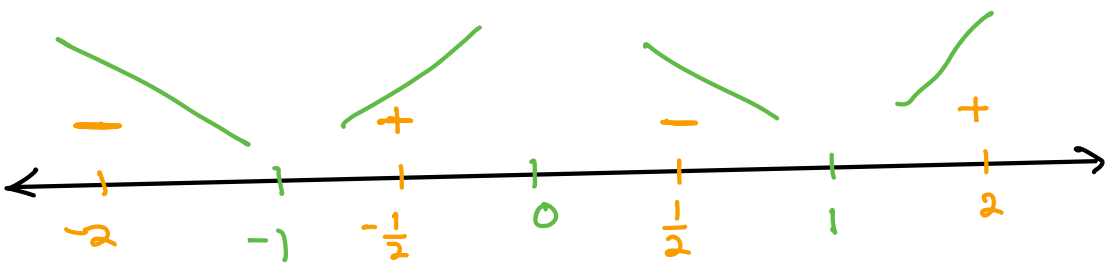
$f'(x) > 0 \Rightarrow f(x)$ IS INCREASING.

$f'(x) < 0 \Rightarrow f(x)$ IS DECREASING.

EXAMPLE $\quad f(x) = x^4 - 2x^2$

$$f'(x) = 4x^3 - 4x = 4x(x^2 - 1) = 0$$

$$x = 0, \pm 1$$



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

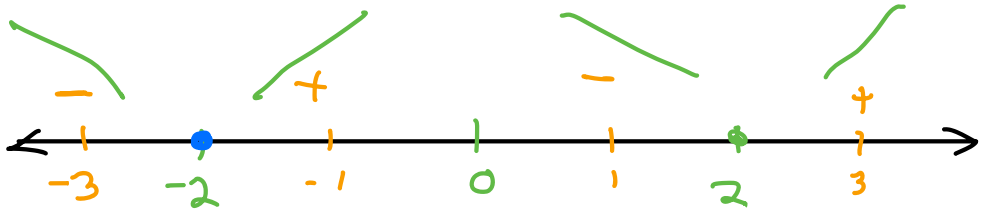
DEC: $(-\infty, -1) \cup (0, 1)$

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

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

$f'(x) = C$ $\quad 4x = 0$ $\quad x = 0$

$f'(x)$ UND. $\quad 3(x^2-4)^{\frac{1}{3}} = 0$ $\quad x = \pm 2$



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

DEC: $(-\infty,-2) \cup (0,2)$

LOCAL MAX / MIN

1ST DER TEST

IF $f(c)$ IS A C.P.

