AP Calculus BC

From Simple Studies: https://simplestudies.edublogs.org and @simplestudiesinc on Instagram

Unit 5: Analytical Applications of Differentiation

Examine y=x^2

Determine the absolute extreme for the function above under the following domains:

a. $(-\infty, \infty) \rightarrow Min\ (x = 0, y = 0),\ Max = DNE$
b. [0,2] →Min (0,0)   Max(2,4)
c. (0,2] →Min DNE   Max(2,4)
d. (0,2) →Min DNE   Max DNE

As long as your domain or interval is continuous over a close interval- you have brackets- this implies that there MUST be a Maximum AND a Minimum value in that interval …. This is the Extreme Value Theorem (EVT)

Types of Extrema

Relative/local - Nearby there is no point higher or lower than this point

Absolute- Over the entire closed interval, this is no other point that can challenge the extremeness of this point

Things that are common for all types of extremes

- Your slope should change from one sign to the other
- Your derivative needed to pass through zero
- If the derivative fails to exist, the signs still manage to change

The Mean Value Theorem

If you have a continuous function over the closed interval [a,b] and differentiable over the open interval (a,b), then there must be a point (c, f(c)) such that c is the interval of (a,b) such that….

Formula: f´(c) = $\frac{f(b) - f(a)}{b-a} \leftarrow \mathit{Average\ Velocity}$(secant)

How To Use The First Derivative Test, Second Derivative Test, And Candidates Test

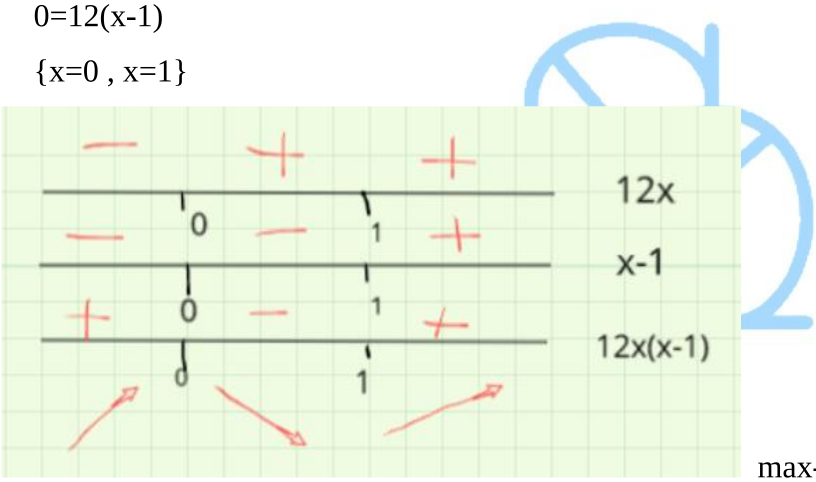
FIRST DERIVATIVE TEST

FInd the extrema for f(x)=$4x^3 - 6x^2 + 3$

f´(x)=$12x^2 + 12x$ **GOAL- is to determine Max & Min**

0=12(x-1)

{x=0 , x=1}

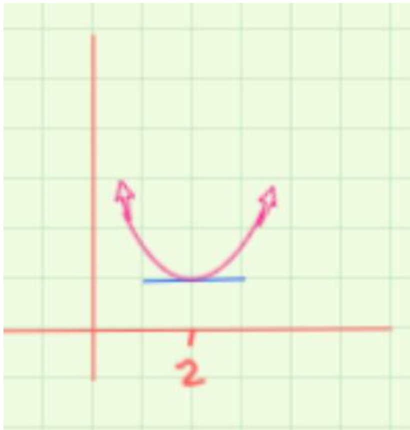


max-0 min-1

THE SECOND DERIVATIVE TEST

It serves if you have a maximum or a minimum for a critical value by using the second derivitive

For example: You have a critical value of x=2. The concavity of the graph at x=2 is concave up. By the second derivative test, x=2 must be a local minimum.



If you have a critical value at x=a, then if:

a. $f''(a) > 0$, you have a minimum
b. $f''(a) < 0$,you have a maximum
c. $f''(a) = 0$, the test is inconclusive

<u>Guide to Determine Inc. and Dec. Intervals</u>

A] Find the Derivative

B] Find all the C.P's→ f'(x)=0 or f'(x)= undefined

C] Graphing C.P's on the number line and writing all in interval notion

D] Choose numbers from each interval to decide the sign [(-) or (+)] for each interval

E] Using first Derivative Test. Determine the Relative extreme

F] Write final answers in interval notation

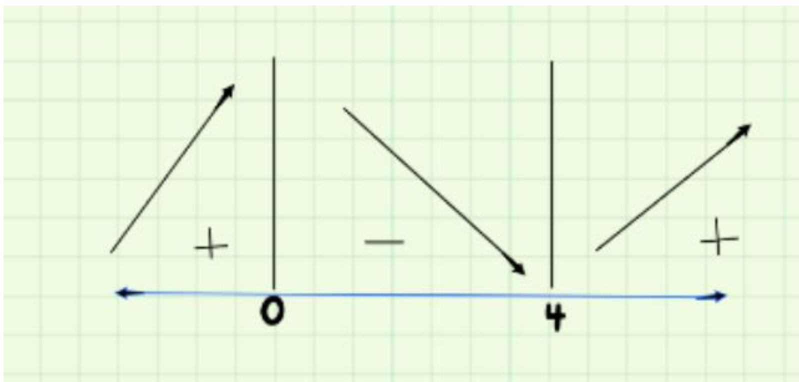
EX: Let f(x)= $x^3 - 6x^2 + 15$

(a) Find increasing and decreasing
(b) Find all relative extrema

f’(x)= $3x^2$ -12x=0 (-∞, 0) $\rightarrow x = -1$ →f’(-1)=15 inc.

3x(x-4)=0 (0,4) →x=2 →f’(2)= -12 dec.

x=0 x=4 (4,+∞)→ x=5 →f’(x)=15 inc.



Inc.→ $(-\infty, 0)\ U(4, +\infty)$

dec.→(0,4)

B] Relative max→(0,15)

Relative min→ (4,-17)

Newton's Method

Used for finding zeros of a function

- Use tangent at some value to approximate zero.
- The first number you use is a guess that gets refined.
- After repeated attempts, you will get your value

$\int_{\square}^{\square}$ f(x) dx=F(b)-F(a)

For incidence evaluate $\int_1^3 \; x^3$ dx you can write $\int_1^3 \; x^3$ dx= $\frac{34}{4}$-$\frac{14}{4}$=20

1. It is not necessary to include a constant of integration C in the antiderivative because

$\int_{\square}^{\square}$ f(x) dx=[F(b)+c]-[F(a)+c]=F(b)-F(a)

FTC: if f is continuous on interval I containing a, then for every x on the interval:

$$\frac{d}{dx}\int_{0}^{2} f(t)dt$$