ملخص الدرس الثالث Maximum and Minimum Values من الوحدة الرابعة تطبيقات التفاضل منهج ريفيل

تم تحميل هذا الملف من موقع المناهج الإماراتية

موقع المناهج ⇦ المناهج الإماراتية ⇦ الصف الثاني عشر المتقدم ⇦ رياضيات ⇦ الفصل الثاني ⇦ ملفات متنوعة ⇦ الملف

تاريخ إضافة الملف على موقع المناهج: 2026-01-06 15:02:19

المزيد من مادة رياضيات:	ملفات ا كتب للمعلم ا كتب للطالب ا اختبارات الكترونية ا اختبارات ا حلول ا عروض بوربوينت ا أوراق عمل منهج انجليزي ا ملخصات وتقارير ا مذكرات وبنوك ا الامتحان النهائي ا للمدرس

التواصل الاجتماعي بحسب الصف الثاني عشر المتقدم

صفحة المناهج الإماراتية على فيسببوك

المواد على تلغرام	التربية الاسلامية	اللغة العربية	اللغة الانجليزية	الرياضيات

المزيد من الملفات بحسب الصف الثاني عشر المتقدم والمادة رياضيات في الفصل الثاني

1	حل تدريبات مراجعة نهائية وفق الهيكل الوزاري باللغتين العربية والانجليزية
2	تدريبات مراجعة نهائية وفق الهيكل الوزاري باللغتين العربية والانجليزية
3	حل تجميعة نماذج وفق الهيكل الوزاري
4	حل أسئلة تجميعة تدريبات وفق الهيكل الوزاري كامل
5	حل بالخطوات أسئلة امتحان نهائي سابق القسم الالكتروني المسار النخبة

Math lessons

Simplification

اللهم إني أسألك فَهْمَ النَّبِيّين وَحِفْظَ الْمُرْسَلِينَ، وَالْمَلَائِكَةَ الْمُقَرَّبِينَ، اللهم اجعل لِسَانِي عَامِرًا بِذِكْرِكَ، وَقَلْبِي بِخَشْيَتِكَ، وَسِرِّي بِطَاعَتِكَ، إِنَّكَ عَلَىٰ كُلِّ شَيْءٍ قَدِيرٌ، وَحَسْبِيَ اللَّهُ وَنِعْمَ الْوَكِيلُ

By: Fa

Some Rules from Term 1 You Should Know::

Chain Rule

$$\frac{d}{dx}f\big(g(x)\big) = f'\big(g(x)\big)\cdot g'(x)$$

Power Rule

$$\frac{d}{dx}x^n = nx^{n-1}$$

Quotient Rule

$$\frac{d}{dx}\left[\frac{f(x)}{g(x)}\right] = \frac{f'(x)g(x) - f(x)g'(x)}{[g(x)]^2}$$

Product Rule

$$\frac{d}{dx}[f(x)g(x)] = f'(x)g(x) + f(x)g'(x)$$

Function	
Polynomials	*Continuous Everywhere*
$\sin x, \cos x, \tan^{-1} x$	*Continuous Everywhere*
$\sqrt[n]{x}$	*Continuous Everywhere when n is <u>odd</u>*
$\sqrt[n]{x}$	*Continuous for $x > 0$ when n is <u>even</u>*
$\ln x$	*Continuous for $x > 0$*
$\sin^{-1}x, \cos^{-1}x$	*Continuous for $-1 < x < 1$*

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Chpt 4: Applications of differentiation

Lesson 4.3: Maximum and Minimum Values

DEFINITION 3.3

A number c in the domain of a function f is called a **critical number** of f if $f'(c) = 0$ or $f'(c)$ is undefined.

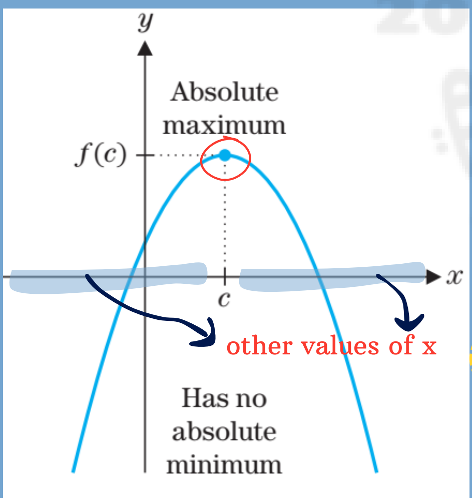
DEFINITION 3.1

For a function f defined on a set S of real numbers and a number $c \in S$,

(i) $f(c)$ is the **absolute maximum** of f on S if $f(c) \geq f(x)$ for all $x \in S$ and
(ii) $f(c)$ is the **absolute minimum** of f on S if $f(c) \leq f(x)$ for all $x \in S$.

An absolute maximum or an absolute minimum is referred to as an **absolute extremum.** (The plural form of extremum is **extrema.**)

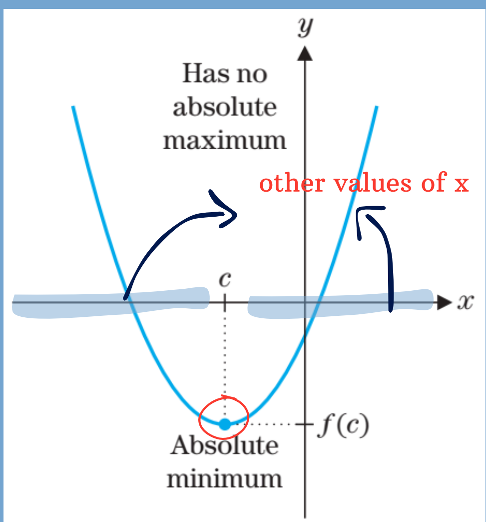
Absolute maximum and absolute minumum are also called absolute extremum



(i) $f(c)$ is the **absolute maximum** of f on S if $f(c) \geq f(x)$ for all $x \in S$ and

this means x=C will consider an absolute maximum if we substitute the value of C in the original function and then we get a number greater than or equal to the other values of x only.

$f(c) \geq f(x)$ ---> absolute max



(ii) $f(c)$ is the **absolute minimum** of f on S if $f(c) \leq f(x)$ for all $x \in S$.

this means x=C will consider an absolute manimum if we substitute the value of C in the original function and then we get a number less than or equal to the other values of x only. $f(c) \leq f(x)$ ---> absolute min.

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THEOREM 3.1 (Extreme Value Theorem)

A continuous function f defined on a *closed, bounded* interval $[a, b]$ attains both an absolute maximum and an absolute minimum on that interval.

*here it means if we have a continuous function and it is defined on a closed, bounded interval [a,b] it must have both absolute max. and min.

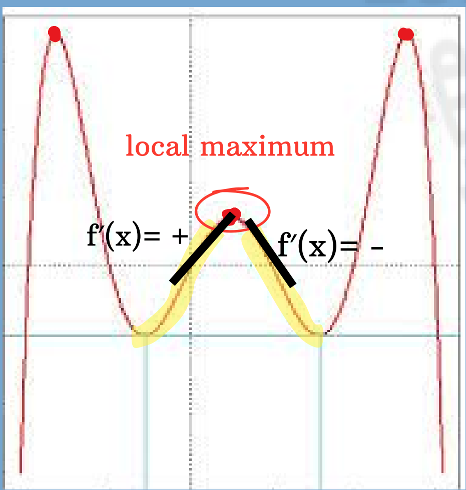
**If we have an absolute max. or min. at x=c, then c must be a critical number

DEFINITION 3.2

(i) $f(c)$ is a **local maximum** of f if $f(c) \geq f(x)$ for all x in some *open* interval containing c.

(ii) $f(c)$ is a **local minimum** of f if $f(c) \leq f(x)$ for all x in some *open* interval containing c.

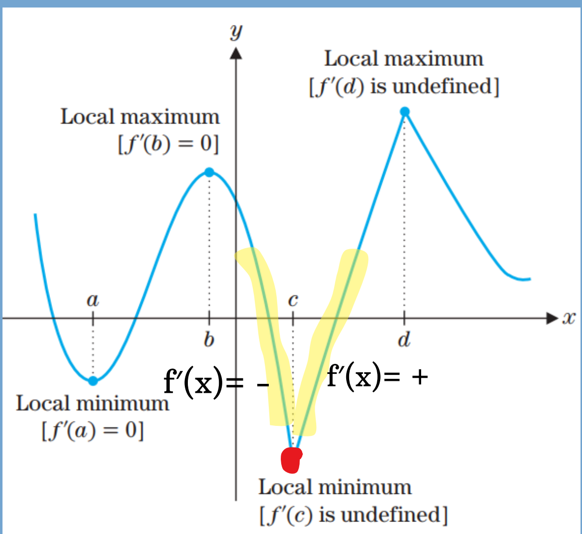
In either case, we call $f(c)$ a **local extremum** of f.



There are points higher than this point, but this point is higher than the values on both the right and left sides, so it is considered a LOCAL MAXIMUM.

**All absolute maximum is considered a local maximum BUT, local maximum is not always an absolute maximum.

same for local minimum>>



There are points lower than this point, but this point is lower than the values on both the right and left sides, so it is considered a LOCAL MINIMUM.

In summary, local max. or min. doesn't mean it has to be the highest or lowest point, but the point should be higher or lower than the values on both the right and left sides.

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LET'S APPLY WHAT WE'VE LEARNED

Find the absolute extrema of $f(x) = 2x^3 - 3x^2 - 12x + 5$ on the interval $[-2, 4]$.

step 1: Determine the domain of the function.

since it's a polynomial function in this qn the domain will be $(-\infty,\infty)$

step 2: Find the derivative of the original function.

$f'(x)= 6x^2 - 6x - 12$

step 3: equate the resulting function to 0 and find the value of x.

$f'(x)=0$ ---> $6x^2 - 6x - 12 =0$

$x=2$, $x=-1$

Now see.. are the values of x within the interval or not, and then cancel the numbers if they are outside the interval.

step 4: Find both absolute max. and absolute min.

*substitute the given interval in the qn and both critical numbers we found in the original function.. $[-2,4]$ $x=2$, $x=-1$

$f(-2) = 2x^3 - 3x^2 - 12x + 5 = 1$

$f(4) = 2x^3 - 3x^2 - 12x + 5 = 37$ ---> Absolute maximum

$f(2) = 2x^3 - 3x^2 - 12x + 5 = -15$ ---> Absolute minimum

$f(-1) = 2x^3 - 3x^2 - 12x + 5 = 12$

Summary of the steps::

step 1: Determine the domain of the function.

step 2: Find the derivative of the original function.

step 3: equate the resulting function to 0 and find the value of x. (here x is considered a critical number (c).

**DON'T forget to check if the resulting values of x are within the interval or not. if not cancel them.

step 4: Find both absolute max. and absolute min.

READ THE STEPS CAREFULLY AND ATTENTIVELY. ONCE YOU ARE SURE YOU UNDERSTAND, GO TO THE NEXT SLIDE TO SOLVE ANOTHER QUESTION ON YOUR OWN.

By: Fa

CHECK YOUR UNDERSTANDING

Find the absolute extrema of $f(x) = 4x^{5/4} - 8x^{1/4}$ on the interval [0, 4].

step 1: Determine the domain of the function.

$f(x) = 4\sqrt[4]{x^5} - 8\sqrt[4]{x}$ for any even root the domain must be only positive numbers, $[0,\infty)$

step 2: Find the derivative of the original function.

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

Multiply the numerator and denominator to unify the denominators

step 3: equate the resulting function to 0 and find the value of x.

$$\frac{5x - 2}{x^{3/4}} = 0 \qquad 5x - 2 = 0$$

$$x = 0.4$$

Now see.. is the values of x are within the interval or not, and then cancel the numbers if they are outside the interval.

step 4: Find both absolute max. and absolute min.

*substitute the given interval in the qn and the critical numbers we found in the original function..

[0,4] x=0.4

$f(0) = 4x^{5/4} - 8x^{1/4} = 0$

$f(4) = 4x^{5/4} - 8x^{1/4} = 11.3$ ---> Absolute maximum

$f(0.4) = 4x^{5/4} - 8x^{1/4} = -5.1$ ---> Absolute minimum

By: Fa

LAST QN

Find the absolute extrema (absolute minimum and absolute maximum) of $f(x) = x^3 - 3x + 1$ on the interval $[0, 2]$.

step 1: Determine the domain of the function.

since it's a polynomial function in this qn the domain will be (-∞,∞)

step 2: Find the derivative of the original function.

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

step 3: equate the resulting function to 0 and find the value of x.

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

$x=1$, $\cancel{x=-1}$

Now see.. are the values of x are within the interval or not, and then cancel the numbers if they are outside the interval.

we will cancel x=-1 because it's outside the given interval in the qn, which is [0,2]

step 4: Find both absolute max. and absolute min.

*substitute the given interval in the qn and the critical number we found in the original function.. [0,2] x=1

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

$f(2) = x^3 - 3x + 1 = 3$ ---> Absolute maximum

$f(1) = x^3 - 3x + 1 = -1$ ---> Absolute minimum

By: Fa

Done with lesson 4.3..
Hope you understand!

اللهم إني أستودعُكَ ما قرأتُ وما حفظتُ وما تعلمتُ، فردّه إليَّ عند حاجتي إليه، إنك على كل شيءٍ قدير.

اللهم ذكرني منه ما نسيتُ، وعلمّني منه ما جهلتُ

By: 'Fa