المادة: الرياضيات

المرحلة: الاولى

2023-2022

Lecture (6)

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(LIMITS) الغاية

Properties of limits

1- If f(x)=k then $\lim_{x\to a} f(x) = k$

2- If $\lim_{x\to a} f_1(x) = L_1$ $\lim_{x\to a} f_2(x) = L_2$

a) Sum rule: $\lim_{x\to a}[f_1(x) + f_2(x)] = L_1 + L_2$

b) Difference rule: $\lim_{x\to a}[f_1(x) - f_2(x)] = L_1 - L_2$

c) Product rule : $\lim_{x\to a}[f_1(x) * f_2(x)] = L_1 * L_2$

d) Quotient rule: $\lim_{x\to a}[\frac{f_1(x)}{f_2(x)}] = \frac{L_1}{L_2}$

3- Polynomial $\lim_{x\to a}(c_0 + c_1 x + c_2 x^2 + \cdots + c_n x^n) = c_0 + c_1 a + c_2 a^2 + \cdots + c_n a^n$

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Example: Find the limits of the following:

1- $\lim\limits_{x\to 2}(x^2 - 4x) = 2^2 - 4 * 2 = -4$

2- $\lim\limits_{x\to 1}(x^3 - 2x^2) = 1^3 - 2 * 1^2 = -1$

3- $\lim_{x\to 1}[\frac{(3x-1)^2}{(x+1)^3}] = \frac{(3*1-1)^2}{(1+1)^3} = \frac{(2)^2}{(2)^3} = \frac{4}{8}$

4- $\lim_{x\to 2}[\frac{(x^2-4)}{x-2}] = \frac{0}{0}$ (Indeterminate quantities كمية غير محددة)

So $\lim_{x\to 2}[\frac{(x-2)(x+2)}{x-2}] = \lim_{x\to 2}(x + 2) = 2 + 2 = 4$

5- $\lim_{x\to 2}[\frac{(x^2-4)}{x^2-5x+6}] = \frac{0}{0}$ (Indeterminate quantities كمية غير محددة)

So $\lim_{x\to 2}[\frac{(x-2)(x+2)}{(x-2)(x-3)}] = \lim\limits_{x\to 2}\left[\frac{(x+2)}{(x-3)}\right] = \frac{4}{-1} = -4.$

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(Continuous Functions) : الدوال المستمرة

The Continuity Test:

The function **y= f (x)** is continuous at **x=c** if and only if the following statements are true:

1- **f (c) exists**

2- $\lim_{x\to c} f(x)$ **exists**

3- $f(c) = \lim_{x\to c} f(x)$

Example: **did the function $f(x) = 8 - x^3 - 2x^2$ is continuous at the x=2 ?**

Sol:

$$f(2) = 8 - 2^3 - 2 * (2)^2 = 8$$

$$\lim_{x\to 2}[\, 8 - x^3 - 2x^2 \,] = 8 - 2^3 - 2 * (2)^2 = 8$$

$$f(2) = \lim_{x\to 2} f(x).$$

So the function is continuous at x=2.

Example: **did the function $f(x) = \frac{(x^2-4)}{x-2}$ is continuous at the x=2 ?**

Sol:

$$f(2) = \frac{(2^2-4)}{2-2} = \frac{0}{0}$$ not exists

So the function is not continuous at x=2.

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H.W:

1- did the function $f(x) = \frac{(x^2-9)}{x-3}$ is continuous at the x=3 ?

2- Find the limit of the function $f(x) = \frac{(x^2-1)}{x-\sqrt{1}}$ is continuous at the $x=\sqrt{1}$?