Al-Mustaqbal university

Engineering technical college

Department of Building &Construction Engineering

Mathematics

First class

Lecture no.3

Assist. Lecture

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التاريخ : / /

الموضوع :

lecture -3-

Defferentiation المشتقة

$$\Delta x = x_2 - x_1$$
$$\Delta y = y_2 - y_1$$

$$x_2 = \Delta x + x_1$$

$$\frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1}$$

$$f'(x) = \lim_{\Delta x \to 0} \frac{y_2 - y_1}{\Delta x}$$

$$f'(x) = \lim_{\Delta x \to 0} \frac{f(x_1 + \Delta x) - f(x_1)}{\Delta x}$$

$$f'(x) = \lim_{\Delta x \to 0} \frac{f(x + \Delta x) - f(x)}{\Delta x}$$

↳ قانون المشتقة

التاريخ : / / الموضوع :

Ex(1):

let $f(x) = x^2$ find $\frac{dy}{dx}$

Sol/

$$\frac{dy}{dx} = \lim_{\Delta x \to 0} \frac{f(x+\Delta x) - f(x)}{\Delta x}$$

$$= \lim_{\Delta x \to 0} \frac{(x+\Delta x)^2 - x^2}{\Delta x}$$

$$= \lim_{\Delta x \to 0} \frac{x^2 + 2x\Delta x + \Delta x^2 - x^2}{\Delta x}$$

$$= \lim_{\Delta x \to 0} \frac{2x\Delta x + \Delta x^2}{\Delta x}$$

$$= \lim_{\Delta x \to 0} \frac{\Delta x(2x + \Delta x)}{\Delta x}$$

$$= \lim_{\Delta x \to 0} 2x + \Delta x$$

$$= 2x + 0$$

$$\frac{dy}{dx} = 2x$$

الموضوع : التاريخ : / /

Ex (2): $f(x) = \sqrt{x}$

$$f'(x) = \lim_{\Delta x \to 0} \frac{f(x+\Delta x) - f(x)}{\Delta x}$$

$$= \lim_{\Delta x \to 0} \frac{\sqrt{x+\Delta x} - \sqrt{x}}{\Delta x}$$

$$= \lim_{\Delta x \to 0} \frac{\sqrt{x+\Delta x} - \sqrt{x}}{\Delta x} * \frac{\sqrt{x+\Delta x} + \sqrt{x}}{\sqrt{x+\Delta x} + \sqrt{x}}$$

$$= \lim_{\Delta x \to 0} \frac{x + \Delta x - x}{\Delta x \sqrt{x+\Delta x} - \sqrt{x}}$$

$$= \lim_{\Delta x \to 0} \frac{1}{\sqrt{x+\Delta x} - \sqrt{x}} = \frac{1}{2\sqrt{x}}$$

Ex (3): If $f(x) = \sqrt{2x+1}$ what is the slope of the line tangent when $x = 4$?

sol/

$$f'(x) = \lim_{\Delta x \to 0} \frac{f(x+\Delta x) - f(x)}{\Delta x}$$

$$= \lim_{\Delta x \to 0} \frac{\sqrt{2(x+\Delta x)+1} - \sqrt{2x+1}}{\Delta x}$$

$$= \lim_{\Delta x \to 0} \frac{\sqrt{2(x+\Delta x)+1} - \sqrt{2x+1}}{\Delta x} * \frac{\sqrt{2(x+\Delta x)+1} + \sqrt{2x+1}}{\sqrt{2(x+\Delta x)+1} + \sqrt{2x+1}}$$

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

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

$$= \lim_{\Delta x \to 0} \frac{2}{\sqrt{2x+2\Delta x+1}+\sqrt{2x+1}}$$

$$= \lim_{\Delta x \to 0} \frac{2}{\sqrt{2x+1}+\sqrt{2x+1}} = \frac{2}{2\sqrt{2x+1}}$$

$$f'(x) = \frac{1}{\sqrt{2x+1}} \Rightarrow f'(x) = \frac{1}{\sqrt{2(2)+1}}$$

$$= \frac{1}{\sqrt{5}}$$

H.W

1- let $f(x) = 1 - x^2$

2- let $f(x) = 12 + 5x$

التاريخ : / / الموضوع :

Formal derviatives :

1- $\frac{d(u.v)}{dx} = u\frac{dv}{dx} + v\frac{du}{dx}$

2- $\frac{d}{dx}\left(\frac{u}{v}\right) = \frac{v\,du - u\,dv}{v^2}$

3- $\frac{d}{dx}(u+v) = \frac{du}{dx} + \frac{dv}{dx}$

4- $\frac{d}{dx}(u^n) = n u^{n-1}\frac{du}{dx}$

5- $\frac{d}{dx}(c) = 0$ ∴ c : constant

Ex: $y = x^2 + \frac{1}{x^2}$, $x \neq 0$

$y' = ?$

Sol/ $y = x^2 + x^{-2}$

$y' = 2x - 2x^{-3}$

التاريخ : / /

الموضوع :

Ex: $y = (x^2+1)^5$

$$\frac{dy}{dx} = 5(x^2+1)^4 \cdot 2x$$

$$= 10x(x^2+1)^4$$

Ex: $y = \frac{2x+5}{3x-2}$

Sol/

$$\frac{dy}{dx} = \frac{(3x-2)*2 - (2x+5)*3}{(3x-2)^2}$$

$$= \frac{6x-4-6x-15}{(3x-2)^2}$$

$$= \frac{-19}{(3x-2)^2}$$

Ex: $y = (x-1)(x+2)$

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

$$= x-1+x+2$$

$$= 2x+1$$