University of Oum El Bouaghi

Faculty of Economic Sciences, Commercial Sciences and Management Sciences

First year, common trunk

Academic year : 2023-2024

Mathematics 1 Module
Solution of Series 04 (Derivative).

Exercise 01:

$$f'(x) = 20x^3 - 45x^2$$

$$g'(x) = \frac{(2x-5)(x-3)-(x^2-5x)}{(x-3)^2}$$

$$h'(x) = \frac{-xsinx - cosx}{x^2}$$

Exercise 02:

1) $f'(x) = 7(3x^2 - 10x)(x^3 - 5x^2 - 4)^6$

2) $g'(x) = \dfrac{-3(2x-2)(x^2-2x-3)^2}{(x^2-2x-3)^6}$

3) $h'(x) = \dfrac{2x}{2\sqrt{x^2-4}}$

Exercise 03:

1)

$$f'(x) = e^x(x^5 - x^3 + 4)+e^x(5x^4 - 3x^2)$$

$$f''(x) = e^x(x^5 + 5x^4 - x^3 - 3x^2 + 4)+e^x(5x^4 + 20x^3 - 3x^2 - 6x)$$

2)

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

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

Exercise 04:

1) **Let**

$$f(x) = \ln(1+|x|)$$

For $x > 0$, we have :

$$\lim_{x\to 0^+} \frac{f(x)-f(0)}{x-0} = \lim_{x\to 0^+} \frac{\ln(1+x)}{x} = 1.$$

For $x < 0$, we have :

$$\lim_{x\to 0^-} \frac{f(x)-f(0)}{x-0} = \lim_{x\to 0^+} \frac{\ln(1-x)}{x} = -1.$$

Then, f does not have a derivative at 0.

2) **Let**

$$f(x) = \sqrt{x+5} \quad ; \quad x_0 = 1$$

$$\lim_{x\to 1} \frac{f(x)-f(1)}{x-1} = \lim_{x\to 1} \frac{\sqrt{x+5}-\sqrt{6}}{x-1} = \frac{1}{2\sqrt{6}}.$$

Then $f'(1) = \frac{1}{2\sqrt{6}}$.