

## Homeworks for 4<sup>th</sup> week

Compute and simplify (as much as possible) the derivatives of following functions.

1. (a)  $f(x) = \frac{\sqrt{x-2}}{1-3x}$   
(b)  $f(x) = \cos^2 x \cdot 2^x + \sqrt{x+2} \ln 3x$   
(c)  $f(x) = \ln(x + 7x^2)$   
(d)  $f(x) = \left(\frac{1}{x+1}\right)^x$

2. (a)  $f(x) = \frac{2x}{\sqrt{1-2x}}$   
(b)  $f(x) = \log_2 x \cdot \sin x - x e^{2x}$   
(c)  $f(x) = \cos(\ln(2x^3))$   
(d)  $f(x) = (\ln x)^{\ln x}$

3. (a)  $f(x) = \frac{x^2+1}{\sqrt{x+1}}$   
(b)  $f(x) = \cos x \cdot \cotg x + x^3 \sqrt{x}$   
(c)  $f(x) = \sqrt{\frac{1}{\ln(x^2+1)}}$   
(d)  $f(x) = x^{\cos x}$

4. (a)  $f(x) = \frac{\sqrt{3-x}}{1-x^2}$   
(b)  $f(x) = \frac{1}{3^x} \cdot \ln x + \cos x^2 \cdot \frac{1}{x}$   
(c)  $f(x) = \arctg \sqrt{x^2 - 1}$   
(d)  $f(x) = x^{\frac{1}{x}}$

5. Determine the domain of the function and find the limits at endpoints of the domain.

(a)

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

(b)

$$f(x) = \frac{x^2 - 1}{\log_{0,5}(x - 1)}$$

(c)

$$f(x) = \frac{e^x}{\ln|x - 1|}$$

(d)

$$f(x) = e^{-2x} \sqrt{x^2 - 3x - 4}$$

6. Compute the derivatives (or one-handed derivatives) of the function.

$$f(x) = \begin{cases} \arctg x, & x \leq 0, \\ x^2, & x > 0. \end{cases}$$

7. From definition compute the derivative of the function  $f$  at point  $x = 1$ .

$$f(x) = \begin{cases} \sqrt{x-1}, & x > 1, \\ x^3 - 1, & x \leq 1. \end{cases}$$

## Recommended exercises

1. Compute and simplify the derivatives of the functions.

(a)  $f(x) = x \arcsin \frac{1}{x} + \ln(x + \sqrt{x^2 - 1})$

(b)  $f(x) = \ln \frac{1-e^{-2x}}{1+e^{-2x}}$

(c)  $f(x) = \ln \frac{x-2}{x+2}$

(d)  $f(x) = x^{\sqrt{x}}$

2. Compute the second derivatives of the following functions.

(a)  $f(x) = (\log(\ln x))^3$

(b)  $f(x) = x \cdot x^{\frac{1}{\ln x}}$

3. Compute the derivative of the function  $f$ .

$$f(x) = \begin{cases} x \operatorname{arctg} \frac{1}{x}, & x \neq 0, \\ 0, & x = 0. \end{cases}$$