Lecture 6

1. Calculate the first derivatives of the following functions:

a) $y = 5 + 3x + \frac{1}{2}x^2 + 11x^3 - x^4$

b) $y = \frac{3}{x^4} - 2\sqrt[3]{x} + \frac{4}{\sqrt[4]{x^3}}$

c) $y = 2\ln x + 5\sin x - \cos x + 12e^x + 3^x$

d) $y = 4\mathrm{tg}x - \mathrm{cotg}x + 5\arcsin x$

2. Calculate the derivative of the function at the given point:

a) $f(x) = x^2,\ \ f'(4) = ?$

b) $f(x) = 3x^3 - 2x + 4,\ \ f'(1) = ?$

c) $f(x) = \frac{3}{x},\ \ f'(-2) = ?$

d) $f(x) = 3\ln x + 1,\ \ f'(1) = ?$

3. Calculate the derivative of the product of two functions

a) $y = xe^x$

b) $y = (x^2 + 1)e^x$

c) $y = x^3 \ln x$

d) $y = (x^2 + 4)\sin x$

e) $y = x^3 \text{arctg}\, x$

4. Calculate:

a) $y = \dfrac{2x^2 - 3x + 1}{x}$

b) $y = \dfrac{x}{\ln x}$

c) $y = \dfrac{\sin x}{\cos x}$

d) $y = \dfrac{e^x + 3}{e^x}$

5. Derivate composite function:

In simple words, we say that the derivative of a composite function is **the product of the derivative of the outside function with respect to the inside function and the derivative of the inside function with respect to the variable**.

a) $y = \ln(4x + 1)$

b) $y = \sqrt{x^2 + 4x}$

c) $y = 3\sin^2(2x + 3)$

d) $y = \dfrac{5}{(2x + 4)^3}$

The derivative of a function y = f(x) of a variable x is **a measure of the rate at which the value y of the function changes with respect to the change of the variable x**. It is called the derivative of f with respect to x.

The second derivative is **the rate of change of the rate of change of a point at a graph** (the "slope of the slope" if you will). This can be used to find the acceleration of an object (velocity is given by first derivative).

If a function f′(x) can be differentiated, we obtain the second derivative of f(x), denoted as f′′(x), and so on.

6. Calculate the first, second and third derivatives of the functions:

a) $y = x^4 - 5x^3 + 2x + 20$

b) $y = \ln x$

c) $y = \cos x$

d) $y = 2\sqrt{x}$