**Mathematics in Economics – lecture 3**

1. Composite derivative (Chain rule)

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**.





1. The second derivative

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.

1. Find
2. Find
3. Find
4. Taylor and Maclaurin series

The **Taylor series** of a [function](https://en.wikipedia.org/wiki/Function_(mathematics)) is an [infinite sum](https://en.wikipedia.org/wiki/Series_(mathematics)) of terms that are expressed in terms of the function's [derivatives](https://en.wikipedia.org/wiki/Derivative) at a single point. For most common functions, the function and the sum of its Taylor series are equal near this point. Taylor series are named after [Brook Taylor](https://en.wikipedia.org/wiki/Brook_Taylor), who introduced them in 1715.

If 0 is the point where the derivatives are considered, a Taylor series is also called a **Maclaurin series**, after [Colin Maclaurin](https://en.wikipedia.org/wiki/Colin_Maclaurin), who made extensive use of this special case of Taylor series in the 18th century.

Let a function *y* = *f*(*x*) be differentiable of the order *n* at a point *a*, then it can be approximated by the Taylor series of the form:



* If *a* = 0, we obtain a special case of the Taylor series, called Maclaurin series:



**Maclaurin series of selected functions**

|  |  |
| --- | --- |
| **Function** | **Maclaurin series** |
| **sinx** |  |
| **cosx** |  |
| **exp(x)** |  |

1. Find the Taylor series of the function at the point .
2. Find the Maclaurin series of the function .