

MATH 104: Week 3 Learning Goals

(a) The Chain Rule. (b) Marginals in Economics. (c) Natural logarithm

Learning Goals

This week we work with the chain rule, which tells us how to differentiate the composition of two functions. We will be interested in understanding the application of average rates of change and instantaneous rates of change to some basic economics and business concepts: mostly this is a matter of vocabulary, where the term “marginal” is related to the derivative. (Caution: ECON 101 is typically taught without the use of calculus, so the use of “marginal” in ECON 101 avoids reference to derivatives.)

We also will cover section 2.10 of the Course Notes, which is on the natural logarithm, though it also covers some basic ideas for general logarithms. Students will learn the technique of logarithmic differentiation, which will be important when we cover elasticity of demand and relative rates of change.

Lectures, Readings

- **Readings:** In the CLP Notes: Chapter 2.9 on the Chain Rule and 2.10 on Natural logarithms. There is a short set of notes on the idea of marginal in economics and business posted in the course schedule.
- **Problems:** We encourage you to do some of the problems in each section as you work through it to test your understanding of the material. Answers and solutions to the problems are provided in the text. If the material is new to you, start with the basic problems and work towards more difficult problems. Even doing a small number of problems while you work through the material in the text will help build your understanding.

Some Food for Thought as You Study This Week

1. Our approach to logarithmic and exponential functions will be to first focus on e^x and $\ln x$. You can then use the inverse function relationship and implicit differentiation to find the derivative of $\ln x$ from the derivative of e^x . You can then approach general logarithms and exponentials.
2. One of your most important learning goals is to build a computational proficiency in computing derivatives of functions involving logarithms and exponentials.
3. Pay attention to logarithmic differentiation. Besides being a useful tool, in the future we will use this idea to explore some concepts in economics. One key point: you can define the relative rate of change of a function $f(x)$ as $f'(x)/f(x)$, which is equal to the derivative of $\ln(f(x))$ (when this is defined).

Learning Goals

The specific learning goals for this week are that by the end of the week and review homework, you should be able to:

1. state the Chain Rule, including its hypotheses, and identify when it can be used,
2. make use of the Chain Rule in computations,

3. explain the notion of marginal cost (or revenue or profit, etc.) in terms of the derivative of the cost (or revenue or profit) function,
4. solve basic problems involving average and marginal costs (revenue/profit/etc.).
5. work with the inverse properties of e^x and $\ln x$;
6. use the derivatives of general logarithmic functions in computations;
7. use the derivatives of general exponential functions in computations;
8. use the technique of logarithmic differentiation.