



Exponential Growth

(Resource ID: 4)

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This teaching resource is allocated to following University:

BOKU - University of Natural Resources and Life Sciences Vienna

Institution:

Center for Global Change and Sustainability (BOKU Vienna)

<http://www.sustainicum.at/en/modules/view/4.Exponential-Growth>



Work in pairs
Group work
Plenum



Less than 5
students
5 to 10 students



Up to 3 lecture
units



English, German

On the basis of a thought experiment about the growth rate of the world's population and its extrapolation into the future ("When will mankind have populated the entire universe?"), students shall deal with the characteristics of exponential growth and learn to perform – and understand – their own calculations.

This mini-project shall help students to understand that **exponentially growing quantities** will **grow beyond any practical limit**, even if the rate of growth does not look particularly alarming. This is demonstrated using the current rate of growth of the earth's population. After introducing the notion of doubling time and a reflection about the properties of exponential growth, the question "When will mankind have populated the entire universe?" is posed, whereby it is understood that its growth rate remains constant. The surprising answer shall stimulate students to think

about properties of dynamical systems of this type, as well as about the evolution of real systems that show exponential (or approximately exponential) growth. The computations necessary shall be performed by the students themselves.

The **material** provided consists of a lesson plan, 7 worksheets for students and a summary of the solutions the students should achieve.

The mini-project is appropriate for a little more than one hour of work in **small groups** (preferably teams of 3 students). The worksheets shall be handed out to the groups one after another.

Prerequisites are either some familiarity with the notion of logarithm (and the ability to solve an equation of the form $a^x = b$ with respect to x) or the use of a scientific calculator allowing to compute arbitrary powers a^b .

The **worksheets** are designed so that students can record their results on them. If they are re-collected in the end, the teachers get an idea of which pieces of content were understood how well.

The file [ExponentialGrowth.zip](#) contains

a lesson plan

7 worksheets for students

and the solutions of the problems as the students should achieve them.

As background information on exponential functions and the logarithm, a web page such as <http://www.themathpage.com/aprecalc/logarithmic-exponential-functions.htm> can be recommended to the students.

Teaching Tools & Methods



Mini-project



Written material

Learning Outcomes

The students shall understand in which sense and on account of which mathematical properties exponential growth transcends all practical limits, and they shall – in simple cases – be able to perform their own computations.

Relevance for Sustainability

Aspects of exponential growth are part of many models of system dynamics and thus of crucial importance for estimating future developments and threats.

Related Teaching Resources

No specific previous knowledge / related resources required

Preparation Efforts

Low

Access

Free

Sources and Links

- <http://www.themathpage.com/aprecalc/logarithmic-exponential-functions.htm>
Background information on exponential functions and the logarithm

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