



The mini-project

Exponential Growth

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. A surprising effect shall stimulate students to think about exponential growth models as well as about the evolution of real systems that show exponential (or approximately exponential) growth.

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.

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:

- Worksheet 1 (approx. 4 minutes)
- Worksheet 2 (approx. 10 minutes)
- Worksheet 3 (approx. 10 minutes)
- Worksheet 4 (approx. 3 minutes)
- Worksheet 5 (approx. 10 minutes)
- Worksheet 6 (approx. 10 minutes)
- Worksheet 7 (approx. 20 minutes)

The recommended time durations should be understood as brief estimations. Alternatively, the teacher may give the groups as much time as they need, in particular when the students do not cope well with mathematical computations.

After having finished, the groups shall report on their estimations, their results as filled in on the Worksheets 1 – 4 and their discussions. A final discussion of all participants may give the teacher the opportunity to correct remaining misconceptions. In order to get and to consolidate an appropriate conceptual grasp on the notion of exponential growth, the (hypothetical) observer as introduced in Worksheet 7 may be re-considered. In the Solutions Sheet some hints are given how the situation may be summarized.

Finally, the teacher may collect all Worksheets and go through the students' results in order to get an idea of which pieces of content were understood how well!

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.