



HIGH SCHOOL

Inquiry: Exponential Functions

From Chapter 9, page 197

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In the Chicago Public Schools, the mathematics curriculum requires that advanced algebra students learn about exponential functions and their practical applications. So teacher Vanessa Brechling launches her students on a study of population trends in various countries. She starts by bringing in a handful of population reports on a variety of countries—Russia, China, India, South Africa, Germany, Japan, and the United States. After initially browsing through documents, kids vote for whichever country they'd like to investigate further, and groups of three to five students are formed for each country.

Each group reads the reports on the country chosen, digs into the available web-site information (which Vanessa has previously bookmarked in case kids need help), and then creates a list of factors they think have had the most influence on that particular population. In Russia, for example, poor health care in the more remote regions appears to play a major role, as has an increased rate of abortion. In some underdeveloped countries, like South Africa, AIDS is a large influence, though high birthrates still ensure population increases there.

The students' task is to create a mathematical model of the population trends affecting their specific country. They begin by graphing the existing data and relating that graph to the factors they identified in the population reports. This graph gives students a visual representation of the population trends. Next, Vanessa asks them to find a mathematical equation to fit the data. The equation needs to incorporate both the general trend of population growth, which is best described by an exponential model, and any specific changes in growth patterns that may have occurred due to wars, the AIDS epidemic, changes in birth control policies, or other factors. Through their investigations, the students learn about using various forms of mathematical models to represent numerical changes in these patterns over time. Ultimately, the kids make predictions about future population trends for their countries.

The level of engagement in this project is high. Students take pride in choosing their countries and learning about them. They decorate their graphs with national symbols—flags, pictures of major exports, scenery, and wildlife. They have fun while performing mathematical analyses similar to those that government statisticians do. They use the reports to find explanations for increases or drops in population. They get the sense of satisfaction that comes from investigating actual phenomena and



explaining data in a way that makes sense to them. As a final performance, each group stands beside its chart and gives a presentation about its findings, answering questions from an audience of invited visitors.

By the completion of this project, Vanessa's class has covered a variety of topics on her Advanced Algebra curriculum list. The students have learned how to

- recognize and become familiar with exponential growth patterns over time
- identify and graph nonlinear functions
- fit data to an exponential model (or other nonlinear models, if appropriate)
- use mathematical models to make predictions about the future

Exponential functions are a great example of a curricular topic that passes all the “screens” for teachability—it is central to the field, requires a little uncovering is interesting to kids, and applies to real life. Working in small inquiry groups, the kids have deeply engaged in the concepts by tackling a concrete, authentic mathematical problem—and a complex social issue.

—Adapted from Harvey Daniels and Steven Zemelman, *Subjects Matter: Every Teacher's Guide to Content Area Reading* (Heinemann, 2004).