



**International Center
for Leadership
in Education**



Gold Seal Lesson:

Copernicus Education Gateway

Author(s): Ben Lindeman			Lesson Title: Our Town – How Big?			
Grade Span			ICLE Application Model			
<i>K-4</i>	<i>5-8</i>	<i>9-12</i> <i>XX</i>	<i>A</i>	<i>B</i> <i>XX</i>	<i>C</i>	<i>D</i>

Instructional Focus:

Algebraic Concepts and Relationships

Students use algebraic methods to investigate, model, and interpret patterns and functions involving numbers, shapes, data, and graphs in a problem-solving situation. Students evaluate and communicate the reasoning used in solving these problems.

Tools and Technology

Students use appropriate tools and technologies to model, measure, and apply the results in a problem-solving situation. Students communicate the reasoning used in solving these problems.

Reading

Students read a variety of grade level materials, applying strategies appropriate to various situations

Performance Task

Population trends throughout the world, including the United States, have changed over the years. The population growth for any town, city, state, country, or the world has many economic, social, and political implications. Therefore, the ability to project population for some year in the future is most important. Population growth is one example of exponential growth. Your first task in this activity is to express the population, P , of any town as a function of r , the rate of population growth as a constant, and t , the time in years. Show or explain how you arrived at your functional relationship.

After developing the function, you are to use the function to project the population for any 5 towns, cities, states, countries, etc. in intervals of 5 years for a period of 20 years. You can find populations and growth rates in various reference publications in a library or at several web sites on the computer. If you use the web, you will need to do a search. You might start with “population statistics.” Consider the growth rate that you find as being constant. You may use a scientific calculator to do your computations, or you may wish to use a graphing calculator to obtain your results. Tabulate your data in the accompanying chart, “Projected Population.”

Note to the teacher: The students should have an understanding of the exponential function before being assigned this task.

ICLE Essential Skills

Perform *operations with signed* (positive and negative) *numbers*, including decimals, ratios, percents, and fractions (m1)

Graph the *exponential function* and understand its characteristics (m69)

Understand the concepts *recurrence relations* and how they are applicable to such things as compound interest and annuity (m61)

Know how to find and read information from a variety of electronic sources (ela28)

Scoring Guide:

DEVELOPMENT OF FUNCTIONAL RELATIONSHIP [$P = (1 + r)^t$]

- 4 The student obtains the correct functional relationship independently and thoroughly shows how he/she arrived at the answer.
- 3 The student needs some help to arrive at the correct functional relationship. The student's explanation of how he/she arrived at the answer is sketchy.
- 2 The student, even with help, is unable to arrive at the correct functional relationship. The student explanation is unclear and incomplete.
- 1 The student does not ask for help and does not arrive at the correct functional relationship. The student shows no explanation or work.

LOCATION OF DATA – RESEARCH SKILLS

- 4 The student demonstrates a knowledge of research skills necessary to find data. He/she locates the population and growth rates for 5 cities, towns, states, etc.
- 3 The student demonstrates knowledge of research skills, but locates the population and growth rate for less than 5 cities, towns, states, etc.
- 2 The student demonstrates limited knowledge of research skills. He/she lists only the population or the growth rate rather than both.
- 1 The student shows little, if any, knowledge of research skills. He/she needs intensive help to find the required information.

USE OF EXPONENTIAL FUNCTION TO FIND THE PROJECTED POPULATION

- 4 The student has no difficulty finding the projected population. He/she finds the correct projected population for all 5 listed towns, cities, etc.
- 3 The student needs some assistance to find the projected population. With this help, however, he/she correctly finds the projected population for all listed towns, cities, etc.
- 2 The student needs some assistance, but, even with that assistance, is unable to find the projected population for all 5 locations listed.
- 1 The student shows no understanding of how to use the exponential function to find projected population. Even with assistance, the student is unable to complete satisfactory this part of the task.

TABULATION OF DATA IN CHART

- 4 The data are neatly and accurately entered in the table.
- 3 The data are accurately entered in the table, but the presentation is not desirable.
- 2 The data are only partially entered in the table and/or there are some minor errors in the entries.
- 1 The data are poorly entered in the table. Many errors occur and the presentation is undesirable.

Keywords

English Language Arts	Mathematics	Science
Reading Research Technology	Algebra Computation Exponential Patterns Functions Graphing Calculators Growth and Decay	Earth Science
Writing	Geometry	Life Science
Communications Technology	Statistics Charts Data Analysis Inferences Technology	Chemistry
Literature	Calculus	Physics
Other	Trigonometry	Other
	Other	

Picture, Chart, or Graph file:

PROJECTED POPULATIONS

	Locality	Present Population	Growth Rate	Population in 5 years	Population in 10 years	Population in 15 years	Population in 20 years
1							
2							
3							
4							
5							