

FORECASTING THE FUTURE

★★ Grades 11-12

Skills and Objectives:

- Students will learn about population estimates and population projections.
- Students will compare population projections based on numerical (arithmetic) growth and on percent (geometric) growth.

Getting Started:

● Introduce the lesson by discussing the following terms that are defined in the lesson as they relate to population: enumerations, estimates, projections, components of population change, births, deaths, and net migration. Help the students understand that information about the U.S. population is important for a variety of purposes, including planning in both the public sector (e.g., where to build schools and hospitals) and the private sector (e.g., store location and marketing), and that population figures are used in determining federal and state fund allocations.

Using the Activity Worksheets:

Distribute copies of pages 19 and 20 to students and discuss the problems with them. Have students individually, or in pairs, calculate the answers to questions 1 through 11. Then with the entire class, discuss answers to questions 12 through 16.

Population estimates and projections:

Discuss with students how U.S. Census Bureau population estimates and projections are actually done, and explain that the methodology used by Census Bureau demographers is more complicated than the hypothetical examples given here. There can be many assumptions and variables involving the set of components (fertility, mortality, and net migration) that contribute to the population growth estimates and projections the U.S. Census Bureau publishes.

For further information on population estimates: www.census.gov/population/www/estimates/concepts.html

For further information on population projections: www.census.gov/population/www/projections/aboutproj.html

Chalkboard Definitions

rate: a standard amount used to calculate a total, as in a percentage change in population over the course of a year.

population estimate: a conclusion about the past or present population based on existing data.

population projection: computation of future changes in population size based on assumptions about births, deaths, and migration.

Answers:

- 32,621,613.
- 254,899 and 8.4 percent.
- 568,996 and 14.9 percent.
- 895,990 and 34.6 percent.
- 1,889,829 and 106.4 percent.
- Answers will vary.
- 3,542,015 and 3,563,234.
- 4,944,095 and 5,026,989.
- 4,382,693 and 4,693,102.
- 5,555,057 and 7,565,031.
- Answers will vary.
- Because the percent increase is applied to a larger population in 1990 than in 1970.
- Arizona. Because Arizona had the highest percent increase in population during the 1970–1990 period, it has the largest proportionate difference between a population projection for the year 2010 based on numerical growth versus percent growth.
- The population projection based on percent change would be larger because the percent decline would be applied to the smaller 1990 population.
- Calculate one-half the numerical growth of the 1970–1990 period and then add it to the 1990 population.
- Calculate the ratio of the 1990 to the 1970 population (to six decimal places to minimize rounding error), then take the square root of the ratio and convert it to a percent increase. Multiply the percent increase by the 1990 population, then add the product to the 1990 population. You can't assume one-half of the percent growth for the 1970–1990 period because of the compounding effect of a geometric rate of increase — an analogy would be compound interest rates. Taking South Carolina as an example, the ratio of its 1990 to its 1970 population is 1.345847. The square root of 1.345847 is 1.160, yielding a 16 percent increase in population in the 1990–2000 decade. The increase of 557,872 added to the 1990 population of 3,486,703 yields a population projection for the year 2000 of 4,044,575.





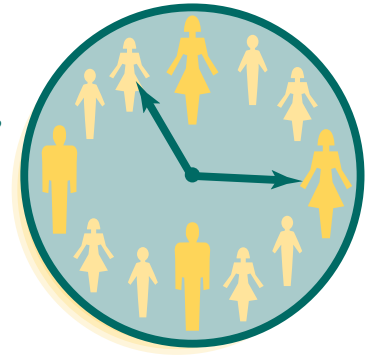
Forecasting the Future

Enumerations, estimates, and projections of population

The U.S. Census Bureau produces three basic types of information about the U.S. population: **enumerations**, **estimates**, and **projections**. **Enumerations** are counts of the population such as in the 1990 census of population. **Estimates** are calculations of the population for a recent date and are usually based on the last census as well as on information about population change since the last census. **Projections** are calculations of the population for a future date and are usually based on the last census or estimate, and on assumptions about future population growth or decline.

Population Estimates

The three basic components of **population change** between two dates are **births**, **deaths**, and **net migration**. For population estimates for states, net migration may be divided into **net international migration** (immigration to the United States minus emigration from the United States) and **net domestic migration** (in-migration from other states minus out-migration to other states).



For California, the population in 1990 was 29,785,857. For the 1990–1998 period, data on the components of population change show the following:

births (B) = 4,708,894, deaths (D) = 1,810,698, net international migration (NIM) = +2,019,488, and net domestic migration (NDM) = -2,081,928. Calculate the 1998 population estimate for California using the following formula:

$$1. P_{1998} = P_{1990} + B - D + NIM + NDM$$

Population Projections

To make population projections for the United States or for individual states, demographers make assumptions about future trends in the components of population change. These assumptions, which reflect professional judgment and take into account past trends, are made in terms of rates for births and deaths, and in terms of rates or numbers for migration.

For simplicity, the population projections discussed below are based on assumptions about past trends in total population, not on assumptions about each component of population change. Table 1 shows the 1970 and 1990 census populations for four states, all with populations that increased between 1970 and 1990. Calculate numerical growth (1990 population minus 1970 population) and percent growth (population growth as a percent of 1970 population, with percent change rounded to one decimal place).

Table 1. Population of Selected States: 1970 and 1990

State	1970	1990	Population growth, 1970–1990	
			Numerical	Percent
2. Connecticut	3,032,217	3,287,116		
3. Minnesota	3,806,103	4,375,099		
4. South Carolina	2,590,713	3,486,703		
5. Arizona	1,775,399	3,665,228		
6. Your State				



Forecasting the **Future** (continued)

Calculate population projections for each state for the year 2010 assuming a continuation of trends for the 1970–1990 period: first based on numerical change (an arithmetic rate of change), then based on percent change (a geometric rate of change) with the results rounded to the nearest integer.

Table 2. Population Projections for Selected States: 2010

State	Based on numerical change	Based on percent change
7. Connecticut		
8. Minnesota		
9. South Carolina		
10. Arizona		
11. Your State		

Questions about population projections

12. Why are the population projections for the year 2010 larger when based on percent change than when based on numerical change for the 1970–1990 period? _____

13. For which of the first four states is the proportionate difference between the two projections the largest and why? _____

14. If the population of a state had declined between 1970 and 1990, which population projection — numerical change or percent change — would be larger for the year 2010 and why? _____

15. How would you use the data in Table 1 to project population for states for the year 2000 assuming past trends in numerical population change? _____

16. How would you use the data in Table 1 to project population for states for the year 2000 assuming past trends in percent population change? _____
