Predicting Populations

Let's use linear and exponential models to represent and understand population changes.

21.1 Notice and Wonder: Changing Populations

Here are the populations of three cities during different years.

What do you notice? What do you wonder?

City	1950	1960	1970	1980	1990	2000
Paris	6,300,000	7,400,000	8,200,000	8,700,000	9,300,000	9,700,000
Austin	132,000	187,000	254,000	346,000	466,000	657,000
Chicago	3,600,000	3,550,000	3,400,000	3,000,000	2,800,000	2,900,000

21.2 Population Predictions 1

Here are population data for three cities at different times between 1950 and 2000. What does the data tell us, if anything, about the current population in the cities or what the population will be in 2050?

City	1950	1960	1970	1980	1990	2000
Paris	6,300,000	7,400,000	8,200,000	8,700,000	9,300,000	9,700,000
Austin	132,000	187,000	254,000	346,000	466,000	657,000
Chicago	3,600,000	3,550,000	3,400,000	3,000,000	2,800,000	2,900,000

1. How would you describe the population change in each city during this time period? Write one to two sentences for each city. Then discuss with your group.

2. What kind of model, linear or exponential, both, or neither do you think is appropriate for each city population?

3. For each population that you think can be modeled by a linear and or exponential function:
   a. Write an equation for the function(s).

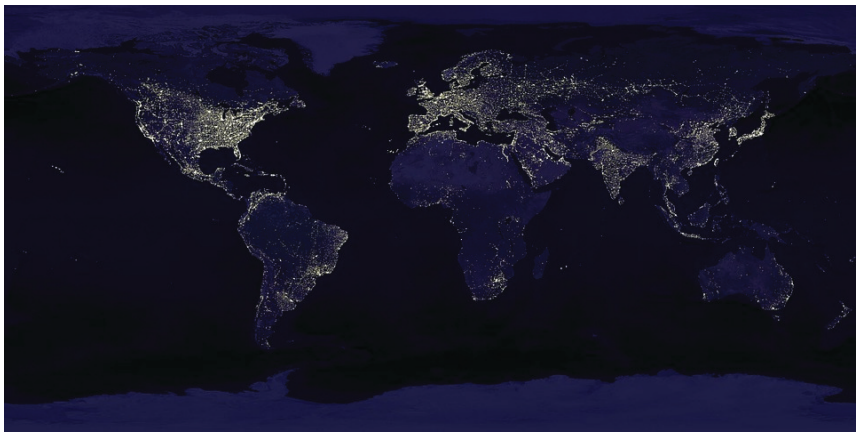
b. Graph the function(s).

4. Compare the graphs of your functions with the actual population data. How well do the models fit the data?

5. a. Use your models to predict the population in each city in 2010, the current year, and 2050.

b. Do you think that these predictions are (or will be) accurate? Explain your reasoning.

21.3 Population Predictions 2



year	1804	1927	1960	1974	1987	1999	2011
world population in billions	1	2	3	4	5	6	7

1. Would a linear function be appropriate for modeling the world population growth over the last 200 years? Explain. If you think it is appropriate, find a linear model.

2. Would an exponential function be appropriate for modeling the world population growth over the last 200 years? Explain. If you think it is appropriate, find an exponential model.

3. From 1950 to the present day, by about what percentage has the world population grown each year?

4. From 1950 to the present day, by about how many people has the world population grown each year?

5. If the growth trend continues, what will the world population be in 2050? How long do you think the growth will continue? Explain your reasoning.

Are you ready for more?

Another common model for population growth, which fixes some of the improbable predictions of the exponential model, is called a logistic model. A sample function, f, of this type is the function

$$f(t) = \frac{10}{1 + 50 \cdot 2^{-t}}.$$

Use technology to graph this function, and explain why it could make sense as a population model.