Communicate

1. What type of values of n are possible in the bacterial growth expression $25 \cdot 2^n$ and in the United States population growth expression $248{,}718{,}301 \cdot (1.08)^n$?
2. Explain how the United States population growth expression $248{,}718{,}301 \cdot (1.08)^n$ incorporates the growth rate of 8% per decade.
3. What assumption(s) do you make about a population's growth when you make predictions by using an exponential expression?
4. Describe the difference between the procedures for finding the multiplier for a growth rate of 5% and for a decay rate of 5%.

Guided Skills Practice

Find the multiplier for each rate of exponential growth or decay. ***(EXAMPLES 1 AND 2)***

5. 5.5% growth **6.** 0.25% growth **7.** 3% decay **8.** 0.5% decay

Evaluate each expression for $x = 3$. ***(EXAMPLES 1 AND 2)***

9. 2^x **10.** $50(3)^x$ **11.** 0.8^x **12.** $100(0.75)^x$

13. DEMOGRAPHICS The population of Tokyo-Yokohama, Japan, was about 28,447,000 in 1995 and was projected to grow at an annual rate of 1.1%. Predict the population, to the nearest hundred thousand, for the year 2004. [*Source: U.S. Census Bureau*] ***(EXAMPLE 1)***

14. HEALTH A certain medication is eliminated from the bloodstream at a rate of about 12% per hour. The medication reaches a peak level in the bloodstream of 40 milligrams. Predict the amount, to the nearest tenth of a milligram, of the medication remaining 2 hours after the peak level and 3 hours after the peak level. ***(EXAMPLE 2)***

Practice and Apply

Find the multiplier for each rate of exponential growth or decay.

15. 7% growth **16.** 9% growth **17.** 6% decay

18. 2% decay **19.** 6.5% growth **20.** 8.2% decay

21. 0.05% decay **22.** 0.08% growth **23.** 0.075% growth

Given $x = 5$, $y = \frac{3}{5}$, and $z = 3.3$, evaluate each expression.

24. 2^x **25.** 3^y **26.** 2^{2x}

27. $50(2)^{3x}$ **28.** $25(2)^z$ **29.** $25(2)^y$

30. $100(3)^{x-1}$ **31.** $10(2)^{z+2}$ **32.** 2^{2y-1}

33. $100(2)^{4z}$ **34.** $100(0.5)^{3z}$ **35.** $75(0.5)^{2y}$

36. 55 bacteria that double every hour
a. after 3 hours **b.** after 5 hours

37. 125 bacteria that double every hour
a. after 6 hours **b.** after 8 hours

38. 33 *E. coli* bacteria that double every 30 minutes
a. after 1 hour **b.** after 6 hours

39. 75 *E. coli* bacteria that double every 30 minutes
a. after 2 hours **b.** after 3 hours

40. 225 bacteria that triple every hour
a. after 1 hour **b.** after 3 hours

41. 775 bacteria that triple every hour
a. after 2 hours **b.** after 4 hours

CHALLENGE

42. Suppose that you put $2500 into a retirement account that grows with an interest rate of 5.25% compounded once each year. After how many years will the balance of the account be at least $15,000?

CONNECTION

PATTERNS IN DATA **Determine whether each table represents a linear, quadratic, or exponential relationship between *x* and *y*.**

43.

x	y
0	2
1	4
2	8
3	16

44.

x	y
1	1
2	3
3	9
4	27

45.

x	y
0	6
2	10
4	14
6	18

46.

x	y
0	−2
3	7
6	34
9	79

APPLICATIONS

47. **DEMOGRAPHICS** The population of Indonesia was 191,256,000 in 1990 and was growing at a rate of 1.9% per year. Predict the population, to the nearest hundred thousand, of Indonesia in 2010. [*Source: U.S. Census Bureau*]

48. **HEALTH** A dye is injected into the pancreas during a certain medical procedure. A physician injects 0.3 grams of the dye, and a healthy pancreas will secrete 4% of the dye each minute. Predict the amount of dye remaining, to the nearest hundredth of a gram, in a healthy pancreas 30 minutes after the injection.

49. **DEMOGRAPHICS** The population of China was 1,210,005,000 in 1996 and