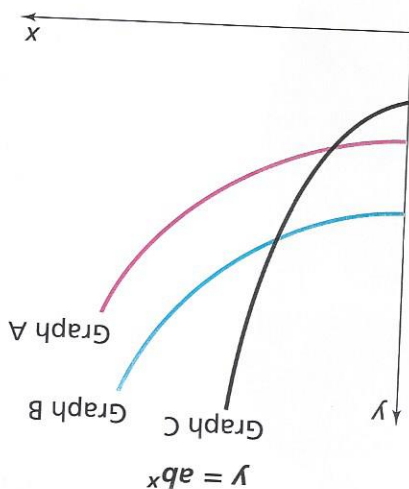


Connections

- For Exercises 44 and 45, tell whether the statement is true or false. Do not do an exact calculation. Explain your reasoning.
44. $(1.56892 \times 10^5) - (2.3456 \times 10^4) < 0$
45. $\frac{3.96395 \times 10^5}{2.888211 \times 10^7} > 1$



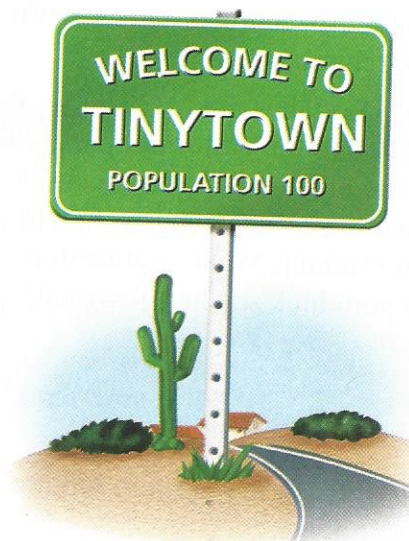
43. Each graph below represents an exponential equation of the form $y = ab^x$.
- a. For which of the three functions is the value of a greatest?
- b. For which of the three functions is the value of b greatest?

42. Without actually graphing these equations, describe and compare their graphs. Be as specific as you can.
- $y = 4^x$ $y = 0.25^x$ $y = 10(4^x)$ $y = 10(0.25^x)$

- For Exercises 38–41, tell whether the expression is equivalent to $(1.5)^7$. Explain your reasoning.
38. $1.5^5 \times 1.5^2$
40. 1.5×7
41. $(1.5) + 7$
39. $1.5^3 \times 1.5^4$

- Tell whether the expression is equivalent to 1.25^{10} . Explain your reasoning.
32. $(1.25)^5 \cdot (1.25)^5$
34. $(1.25) \times 10$
36. $(1.25)^2$
33. $(1.25)^3 \times (1.25)^7$
35. $(1.25) + 10$
37. $(1.25)^5 \cdot (1.25)^2$

46. Suppose you start with a unit cube (a cube with edges of length 1 unit). In parts (a)–(c), give the volume and surface area of the cube that results from the given transformation.
- Each edge length is doubled.
 - Each edge length is tripled.
 - Each edge is enlarged by a scale factor of 100.
47. Suppose you start with a cylinder with a radius of 1 unit and a height of 1 unit. In parts (a)–(c), give the volume of the cylinder that results from the given transformation.
- The radius and height are doubled.
 - The radius and height are tripled.
 - The radius and height are enlarged by a scale factor of 100.
48. a. Tell which of the following numbers are prime. (There may be more than one.)
 $2^2 - 1$ $2^3 - 1$ $2^4 - 1$ $2^5 - 1$ $2^6 - 1$
- b. Find another prime number that can be written in the form $2^n - 1$.
49. In parts (a)–(d), find the sum of the proper factors for the number.
- 2^2
 - 2^3
 - 2^4
 - 2^5
- e. What do you notice about the sums in parts (a)–(d)?
50. Grandville has a population of 1,000. Its population is expected to decrease by 4% a year for the next several years. TINYTOWN has a population of 100. Its population is expected to increase by 4% a year for the next several years. Will the populations of the two towns ever be the same? Explain.



Extensions

51. The expression $\frac{10^2}{20}$ can be written in equivalent forms, including $\frac{2}{10}$, $\frac{1}{5}$, 0.2, and $\frac{10^3}{10^3}$. In parts (a) and (b), write two equivalent forms for the expression.
- a. $\frac{3(10)^5}{10^7}$
- b. $\frac{5(10)^5}{2.5(10)^7}$

52. a. Find the sum for each row.

Row 1: $\frac{1}{2}$

Row 2: $\frac{1}{2} + \left(\frac{1}{2}\right)^2$

Row 3: $\frac{1}{2} + \left(\frac{1}{2}\right)^2 + \left(\frac{1}{2}\right)^3$

Row 4: $\frac{1}{2} + \left(\frac{1}{2}\right)^2 + \left(\frac{1}{2}\right)^3 + \left(\frac{1}{2}\right)^4$

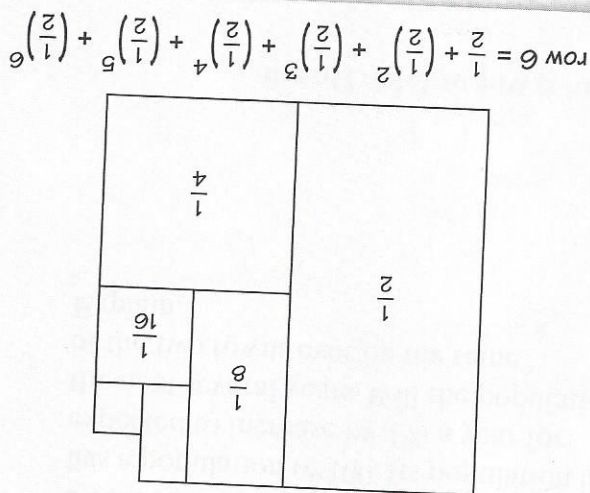
- b. Study the pattern. Suppose the pattern continues. Write the expression that would be in row 5, and find its sum.

- c. What would be the sum of the expression in row 10? What would be the sum for row 20?

- d. Describe the pattern of sums in words and with a symbolic expression.

- e. For which row does the sum first exceed 0.9?
- f. As the row number increases, the sum gets closer and closer to what number?

- g. Celeste claims the pattern is related to the pattern of the areas of the ballots cut in Problem 4.1. She drew this picture to explain her thinking. What relationship do you think she has observed?



56. If you use your calculator to compute $2 \div 2^{12}$, the display will probably show one of the following:
- 4.8828125E-4 or 4.8828125-4
- Both displays mean 4.8828125×10^{-4} . This number is in scientific notation because it is a number greater than or equal to 1, but less than 10 (in this case, 4.8828125), times a power of 10 (in this case, 10^{-4}). You can convert 4.8828125×10^{-4} to standard form as shown:
- $$4.8828125 \times 10^{-4} = 4.8828125 \times \frac{1}{10,000} = 0.00048828125$$
- a. Write each number in standard notation.
- 1.2×10^{-1} 1.2×10^{-2} 1.2×10^{-3} 1.2×10^{-8}
- b. Using what you discovered in part (a), explain how you would write 1.2×10^{-n} in standard notation where n is any whole number greater than or equal to 1.
- c. Write each number in scientific notation.
- 2,000,000 28,000,000 0.0058421998 19,900,000,000
- 0.12489 0.0010201

Standard Form	Exponential Form
10,000	10^4
1,000	10^3
100	10^2
10	10^1
1	10^0
$\frac{1}{10} = 0.1$	10^{-1}
$\frac{1}{100} = 0.01$	10^{-2}
$\frac{1}{1,000} = 0.001$	10^{-3}
$\frac{1}{10,000} = 0.0001$	10^{-4}
	10^{-5}
	10^{-6}

55. a. Copy and complete this table.

- 53. a.** Find the sum for each row.

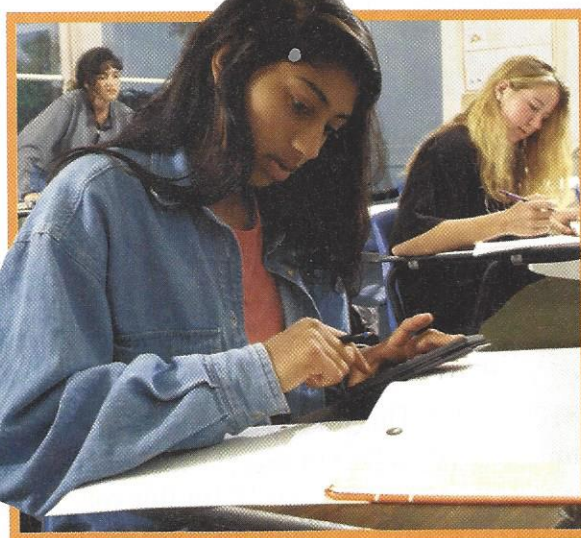
Row 1: $\frac{1}{3}$

Row 2: $\frac{1}{3} + \left(\frac{1}{3}\right)^2$

Row 3: $\frac{1}{3} + \left(\frac{1}{3}\right)^2 + \left(\frac{1}{3}\right)^3$

Row 4: $\frac{1}{3} + \left(\frac{1}{3}\right)^2 + \left(\frac{1}{3}\right)^3 + \left(\frac{1}{3}\right)^4$

- b.** Study the pattern. Suppose the pattern continues. Write the expression that would be in row 5, and find its sum.
- c.** What would be the sum of the expression in row 10? What would be the sum for row 20?
- d.** Describe the pattern of sums in words and with an equation.
- e.** As the row number increases, the sum gets closer and closer to what number?



- 54.** Negative numbers can be used as exponents. Parts (a) and (b) will help you understand negative exponents.
- a.** Use your calculator to find the value of 2^x for x -values -1 , -2 , and -3 .
- b.** Use your calculator to find the value of $\left(\frac{1}{2}\right)^x$ for x -values 1 , 2 , and 3 .
- c.** What observation can you make from your computations in parts (a) and (b)?
- d.** Write each number as a power with a positive exponent.
- 3^{-1} 4^{-2} 5^{-3}