

Lesson 5.1 • Exponential Functions

Name _____ Period _____ Date _____

1. Evaluate each function at the given value. Round to four decimal places if necessary.
 - a. $f(x) = 250(0.5)^x$, $x = 3$
 - b. $g(x) = 45.5(0.85)^x$, $x = 5$
 - c. $h(t) = 8.72(1.02)^t$, $t = 10$
 - d. $h(y) = 35(1.3)^y$, $y = 7$
 - e. $r(t) = 325(1 + 0.035)^t$, $t = 8$
 - f. $j(x) = 59.5(1 - 0.095)^x$, $x = 10$
 - g. $k(z) = 895(1.0675)^z$, $z = 20$
 - h. $q(z) = 2500(1.001)^z$, $z = 6$
2. Record the next three terms for each sequence. Then write an explicit function for the sequence.
 - a. $u_0 = 12$
 $u_n = 0.8u_{n-1}$ where $n \geq 1$
 - b. $u_0 = 45$
 $u_n = 1.2u_{n-1}$ where $n \geq 1$
 - c. $u_0 = 50.5$
 $u_n = 2.1u_{n-1}$ where $n \geq 1$
 - d. $u_0 = 256$
 $u_n = 0.65u_{n-1}$ where $n \geq 1$
3. Evaluate each function at $x = 0$, $x = 1$, and $x = 2$. Then write a recursive formula for the pattern.
 - a. $f(x) = 5(3)^x$
 - b. $f(x) = 250(0.5)^x$
 - c. $f(x) = 15.5(1.1)^x$
 - d. $f(x) = 0.75(2.2)^x$
 - e. $f(x) = 575(0.08)^x$
 - f. $f(x) = 66(1.01)^x$
4. Indicate whether each equation is a model for exponential growth or decay.
 - a. $f(x) = 2000(0.9)^x$
 - b. $f(x) = 0.8(1.2)^x$
 - c. $f(x) = 3000000(2.5)^x$
 - d. $f(x) = 8.2(1 - 0.22)^x$
 - e. $f(x) = 3000(1 + 0.001)^x$
 - f. $f(x) = 0.1(1 - 0.5)^x$
5. Calculate the ratio of the second term to the first term, and express the answer as a decimal value. State the percent increase or decrease.
 - a. 80, 60
 - b. 40, 45
 - c. 88, 198
 - d. 36, 32
 - e. 110, 96.8
 - f. 63, 100.8
6. Rohit bought a new car for \$17,500. The value of the car is depreciating at a rate of 16% a year.
 - a. Write a recursive formula that models this situation. Let u_0 represent the purchase price, u_1 represent the value of the car after 1 year, and so on.
 - b. Make a table recording the value of the car after 1 year, 2 years, 3 years, 4 years, and 5 years. (Round values to the nearest dollar.)
 - c. Define variables and write an exponential equation that models this situation.

Lesson 5.2 • Properties of Exponents and Power Functions

Name _____ Period _____ Date _____

1. Rewrite each expression as a fraction without exponents. Verify that your answer is equivalent to the original expression using your calculator.

a. 3^{-2}

b. 4^{-3}

c. 5^{-4}

d. 25^{-1}

e. 7^{-3}

f. 10^{-6}

g. -4^{-4}

h. $(-4)^{-4}$

i. $(-5)^{-3}$

j. $\left(\frac{1}{2}\right)^{-5}$

k. $-\left(\frac{3}{5}\right)^{-2}$

l. $\left(-\frac{5}{6}\right)^{-2}$

2. Rewrite each expression in the form x^n or ax^n .

a. $x^5 \cdot x^8$

b. $x^{12} \cdot x^{-5}$

c. $x^{-10} \cdot x^{-5}$

d. $4x^0 \cdot 9x^8$

e. $(-10x^{-8})(-12x^{-3})$

f. $(8x^{-6})(-15x^{-14})$

g. $\frac{x^9}{x^{-9}}$

h. $\frac{-88x^{10}}{-8x^3}$

i. $\frac{35x^0}{25x^{-5}}$

j. $\left(\frac{x^{-8}}{x^{-9}}\right)^2$

k. $\left(\frac{-35x^7}{-7x^2}\right)^3$

l. $\left(\frac{40x^{-8}}{-8x^{-2}}\right)^{-3}$

3. Solve.

a. $2^x = \frac{1}{32}$

b. $125^x = 25$

c. $3^x = \frac{1}{81}$

d. $\left(\frac{1}{2}\right)^x = 128$

e. $\left(\frac{4}{9}\right)^x = \frac{81}{16}$

f. $\left(\frac{1}{8}\right)^x = \frac{1}{16}$

4. Solve each equation. If answers are not exact, approximate them to two decimal places.

a. $x^5 = 895$

b. $x^{0.8} = 45$

c. $x^{-3} = 1234$

d. $6x^{1.5} = 80$

e. $20x^{1/2} - 8 = 4.5$

f. $5x^{-1/3} = 0.06$

g. $8x^9 = 6x^6$

h. $15x^{-3} = 10x^{-2}$

i. $200x^{-1} = 125x^{-3}$

Lesson 5.3 • Rational Exponents and Roots

Name _____ Period _____ Date _____

1. Identify each function as a power function, an exponential function, or neither of these. (It may be translated, stretched, or reflected.)

a. $f(x) = 2^x$

b. $f(x) = x^2 - 2x + 3$

c. $f(x) = 0.5x^3 - 4$

d. $f(x) = \frac{1}{3^x}$

e. $f(x) = \frac{1}{x} + 2$

f. $f(x) = \frac{1}{2x^2 - x}$

2. Rewrite each expression in the form b^x in which x is a rational exponent.

a. $\sqrt[4]{b}$

b. $\sqrt{c^3}$

c. $\sqrt[5]{d^7}$

d. $\frac{1}{\sqrt[3]{a}}$

e. $(\sqrt[3]{d})^4$

f. $\frac{1}{\sqrt{r^5}}$

3. Solve each equation. If answers are not exact, approximate them to the nearest hundredth.

a. $\sqrt[5]{x} = 12$

b. $\sqrt[3]{x^2} = 5.5$

c. $\sqrt[5]{x^3} = 27$

d. $\frac{1}{\sqrt{x}} = 0.77$

e. $\sqrt{8x^3} = 20$

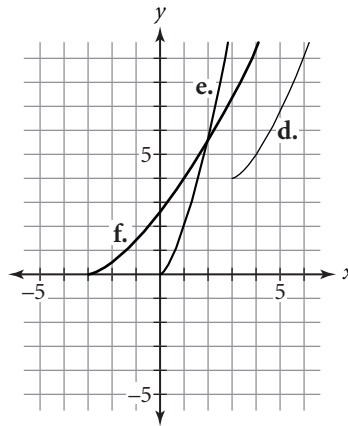
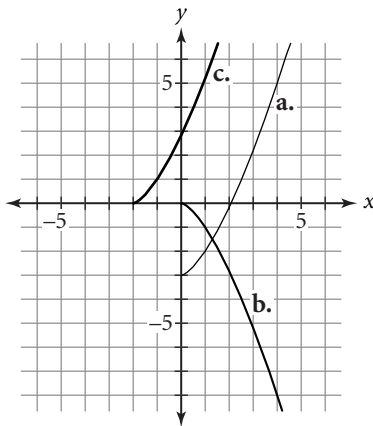
f. $4\sqrt[3]{x} + 18 = 32$

g. $\sqrt[5]{x^3} - 23 = -15$

h. $\sqrt[3]{4x^2} + 8.5 = 19.8$

i. $\sqrt[8]{x^5} = 12.75$

4. Each of the following graphs is a transformation of the power function $y = x^{3/2}$. Write the equation for each curve.



Lesson 5.4 • Applications of Exponential and Power Equations

Name _____ Period _____ Date _____

1. Solve each equation. If answers are not exact, approximate them to the nearest hundredth.

a. $x^4 = 48$

b. $\sqrt[3]{x} = 2.6$

c. $x^{2/3} = 8.75$

d. $x^{-1/4} = 0.2$

e. $0.75x^5 - 8 = -3$

f. $4(x^{5/6} + 7) = 159$

g. $128.5 = 36 \cdot x^{2.5}$

h. $224 = 200\left(1 + \frac{x}{4}\right)^9$

i. $1500\left(1 + \frac{x}{12}\right)^{6.5} = 1525$

2. Rewrite each expression in the form ax^n .

a. $(8x^9)^{2/3}$

b. $(81x^{12})^{3/4}$

c. $(49x^{-10})^{1/2}$

d. $(-27x^{-9})^{4/3}$

e. $(100,000x^{10})^{3/5}$

f. $(-125x^{-15})^{1/3}$

g. $(-216x^9)^{4/3}$

h. $(16x^{28})^{-5/4}$

i. $(-32x^{-30})^{-6/5}$

3. Give the average annual rate of inflation for each situation described. Give your answers to the nearest tenth of a percent.

a. The cost of a 20-ounce box of cereal increased from \$4.25 to \$5.50 over 5 years.

b. The cost of a gallon of milk increased from \$2.75 to \$3.40 over 3 years.

c. The cost of a movie ticket increased from \$6.00 to \$8.50 over 10 years.

d. The monthly rent for Hector's apartment increased from \$650 to \$757 over 4 years.

e. The starting hourly wage for a salesclerk increased from \$5.85 to \$7.65 over 6 years.

f. The value of an antique table increased from \$3500 to \$5700 over 7 years.

4. The population of a small town has been declining because jobs have been leaving the area. The population was 23,000 in 1996 and 18,750 in 2001. Assume that the population is decreasing exponentially.

a. Define variables and write an equation that models the population in this town in a particular year.

b. Use your model to predict the population in 2004.

c. According to your model, in what year will the population first fall below 12,000?

Lesson 5.5 • Building Inverses of Functions

Name _____ Period _____ Date _____

1. Each of the functions below has an inverse that is also a function. Find four points on the graph of each function f , using the given values of x . Use these points to find four points on the graph of f^{-1} .
 - a. $f(x) = 3x - 4$; $x = -2, 0, \frac{4}{3}, 4$
 - b. $f(x) = x^3 - 2$; $x = -3, -1, 2, 5$
2. Given $h(t) = 15 - 3t$, find each value.
 - a. $h(4)$
 - b. $h(1.5)$
 - c. $h^{-1}(0)$
 - d. $h^{-1}(1.5)$
3. For each function below, determine whether or not the inverse of this function is a function. Find the equation of the inverse and graph both equations on the same axes.
 - a. $y = -2x + 5$
 - b. $y = |x|$
 - c. $y = x^2 - 4$
 - d. $y = -\sqrt{1 - x^2}$
 - e. $y = x^3$
 - f. $y = -(x + 3)^2$
4. Balloons and Laughs Inc. is a small company that entertains at children's birthday parties. B & L uses a complicated formula to calculate its prices, taking into account all of its costs. The price equation is $p(x) = 4\sqrt[3]{(8x + 3)^2} + 25$, where x is the number of person-hours supplied for the party at a price of $p(x)$. For example, if $x = 4$, four clowns will come for one hour, two clowns will come for two hours, or one clown will come for four hours.
 - a. What is the price if two clowns come to a party for 90 minutes?
 - b. Many customers want to know what they can get for a particular amount of money. Rewrite the price equation for B & L so that it can input the amount of money a customer wants to spend and the output will be the number of person-hours they will get for their money. Call the new function $p^{-1}(x)$.
 - c. B & L's Ultimate Party costs \$125. How many person-hours do you get at an Ultimate Party?

Lesson 5.6 • Logarithmic Functions

Name _____ Period _____ Date _____

1. Write an equation for the inverse of each function.

a. $f(x) = 5^x$

b. $f(x) = \log_2 x$

c. $f(x) = \log x$

2. Rewrite each logarithmic equation in exponential form using the definition of logarithm. Then solve for x .

a. $\log_2 128 = x$

b. $\log_3 \frac{1}{81} = x$

c. $x = \log 0.001$

d. $\log_{12} \sqrt[4]{12} = x$

e. $x = \log_4 32$

f. $\log 1 = x$

g. $x = \log_5 125$

h. $\log_8 1 = x$

i. $\log_{20} 20 = x$

j. $\log_4 \frac{1}{16} = x$

k. $x = \log_9 \sqrt[3]{9}$

l. $x = \log 0.00001$

3. Find the exact value of each logarithm without using a calculator. Write answers as integers or fractions in lowest terms.

a. $\log_2 8$

b. $\log_3 81$

c. $\log_7 49$

d. $\log_5 \sqrt{5}$

e. $\log_3 \frac{1}{3}$

f. $\log_2 \frac{1}{32}$

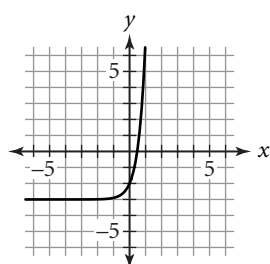
g. $\log_4 8$

h. $\log_8 4$

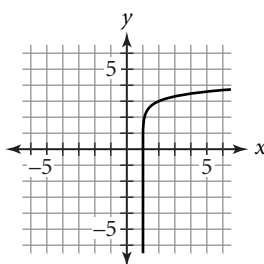
i. $\log 1,000,000,000$

4. Each graph is a transformation of either $y = 10^x$ or $y = \log x$. Write the equation for each graph.

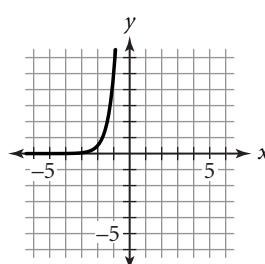
a.



b.



c.



5. Use the change-of-base property to solve each equation. (Round to four decimal places.)

a. $\log_4 9 = x$

b. $\log_5 120 = x$

c. $\log_3 0.9 = x$

d. $3^x = 21$

e. $4^x = 99$

f. $6^x = 729$

g. $2^x = 1.5$

h. $7^x = 4.88$

i. $12^x = 5.75$

j. $5^x = 0.75$

k. $8^x = 0.523$

l. $20^x = 0.04$

Lesson 5.7 • Properties of Logarithms

Name _____ Period _____ Date _____

1. Change the form of each expression below using properties of logarithms or exponents. Name each property you use.

a. $\log r - \log s$

b. $(x^y)^z$

c. $\frac{1}{a^b}$

d. $\log_r s$

e. q^{a+b}

f. $\log_b x^m$

g. $(cd)^m$

h. $\log_b xy$

i. $\left(\frac{r}{s}\right)^m$

j. $c^{m/n}$

k. $\frac{\log_a x}{\log_a y}$

l. $t \log_a y$

2. Determine whether each equation is true or false.

a. $\log 45 = \log 5 + \log 9$

b. $\log 8 = \frac{\log 32}{\log 4}$

c. $\log_5 9 - \log_5 2 = \log_5 4.5$

d. $\log 32 = \frac{1}{5} \log 2$

e. $\log 12 - \log 4 = \log 8$

f. $\log \frac{1}{5} = \frac{1}{\log 5}$

g. $\log 4 = \frac{2}{3} \log 8$

h. $\log \sqrt[3]{5} = \frac{1}{3} \log 5$

i. $\log_2 \frac{1}{81} = -2 \log_2 9$

j. $\log \sqrt{6} = -2 \log 6$

k. $\log 75 = 3 \log 25$

l. $\log_3 15 - \log_3 5 = 1$

3. Write each expression as a sum or difference of logarithms (or constants times logarithms). Simplify the result if possible.

a. $\log xyz$

b. $\log_2 \frac{xy}{z}$

c. $\log \frac{p^2}{q^3}$

d. $\log_5 \frac{a\sqrt{b}}{c^4}$

e. $\log_4 (\sqrt{r} \cdot \sqrt[3]{s} \cdot \sqrt[4]{t^3})$

f. $\log_3 \left(\frac{\sqrt[3]{abc}}{\sqrt[4]{x}} \right)$

4. Solve each equation. (Round answers to the nearest hundredth.)

a. $5.2^x = 375$

b. $82 + 2.5^x = 130$

c. $32(0.87)^x = 260$

d. $48(1.04)^x = 90$

e. $32 + 16(1.035)^x = 315$

f. $105 + 30(0.95)^x = 210$

Lesson 5.8 • Applications of Logarithms

Name _____ Period _____ Date _____

1. Solve each equation. Round answers that are not exact to four decimal places.
 - a. $10^x = 650$
 - b. $19683 = 3^x$
 - c. $0.5^x = 64$
 - d. $9.5(8^x) = 220$
 - e. $0.405 = 15.6(0.72)^x$
 - f. $32(1.08)^x = 275$
2. Suppose that you invest \$5000 in a savings account. How long would it take you to double your money under each of the following conditions?
 - a. 5% interest compounded annually
 - b. 6% interest compounded quarterly
 - c. 5.4% interest compounded twice annually
 - d. 3.6% interest compounded monthly
 - e. 6.75% interest compounded quarterly
 - f. 4.5% interest compounded monthly
3. The Richter scale rating of the magnitude of an earthquake is given by the formula $\log\left(\frac{I}{I_0}\right)$, where I_0 is a certain small magnitude used as a reference point. (Richter scale ratings are given to the nearest tenth.)
 - a. Find the Richter scale rating for an earthquake with magnitude $100,000I_0$.
 - b. Find the Richter scale rating for an earthquake with magnitude $2,000,000I_0$.
 - c. A devastating earthquake occurred in western Turkey in 1999, resulting in about 17,000 deaths. This earthquake measured 7.4 on the Richter scale. Express the magnitude of this earthquake as a multiple of I_0 .
 - d. Another earthquake in 1998, centered in Adana, Turkey, caused 144 deaths. This earthquake measured 6.3 on the Richter scale. Express the magnitude of this earthquake as a multiple of I_0 .
 - e. Compare the magnitudes of the two earthquakes in Turkey described in 3c and d.
4. The population of an animal species introduced into an area sometimes increases rapidly at first and then more slowly over time. A logarithmic function models this kind of growth. Suppose that a population of N deer in an area t months after the deer are introduced is given by the equation $N = 325 \log(4t + 2)$.
 - a. Use this model to predict the deer population 3 months, 6 months, 12 months, and 18 months after the deer are introduced.
 - b. According to this model, how long will it take for the deer population to reach 800? Round to the nearest whole month.