

Assignment

Write

Write the term that best completes each sentence.

1. The _____ of a number for a given base is the exponent to which the base must be raised in order to produce that number.
2. A _____ is a logarithm with base e , and is usually written as \ln .
3. A _____ is a function involving a logarithm.
4. A _____ is a logarithm with a base 10 and is usually written without a base specified.

Remember

All exponential functions are invertible.

A logarithm is an exponent. If $y = b^x$, then x is the logarithm and can be written as $x = \log_b y$.

Key characteristics of the basic logarithmic function include a domain of positive numbers, a range of all real numbers, and a vertical asymptote at $x = 0$.

Practice

1. Given $f(x) = 3^x$.
 - a. Write the function $f^{-1}(x)$, the inverse of $f(x) = 3^x$.
 - b. Graph and label the functions $f(x)$ and $f^{-1}(x)$ on the same coordinate plane.
 - c. Describe how to calculate $f^{-1}(3)$ without a calculator. Then, calculate $f^{-1}(3)$, $f^{-1}(9)$, and $f^{-1}(27)$.
 - d. Determine the domain, range, asymptotes, intercepts, end behavior, and intervals of increase and decrease for $f^{-1}(x)$.
2. The loudness of sounds is measured in decibels (dB). The loudness, L , of a sound is a function of its intensity, I , and can be determined using the function $L(I) = 10 \log\left(\frac{I}{I_0}\right)$, where both I and I_0 are measured in watts per square meter (W/m^2). In the function, I_0 represents a barely audible sound or “threshold sound” and is equal to 10^{-12} W/m^2 .
 - a. The Guinness World Record for the Loudest Crowd Roar at an Outdoor Stadium was set during an NFL game in Seattle. The roar measured 136.6 dB. During an NFL game in Kansas City, the roar of the crowd was measured at 133.1 dB. How many times more intense was the roar at the Seattle game?
 - b. The fans in Kansas City attempted to break the Guinness World Record for the Loudest Crowd Roar. Their goal was to create a roar that was 2 times as intense as the Seattle roar. In order for the fans in Kansas City to be successful, how many decibels did their roar need to be?
 - c. In fact, the fans in Kansas City successfully recorded a new record of 140 dB. Determine the intensity of the roar.

Stretch

Evaluate each logarithm.

- $\log_{49} 7 - \log_8 64$
- $\log_{100} 10 + \log_{81} 3$

Review

- Drew wants to invest \$5000 in a savings account. Sun Bank is offering 4.5% interest compounded monthly. Brightside Bank is offering 4.75% interest compounded quarterly.
 - For each bank, write an exponential function to represent the amount of money Drew would have in the account after t years.
 - Determine which bank Drew should choose if she plans to invest her money for 5 years. If Drew decides to leave the money in the bank for a longer period of time, will the other bank be a better deal in the long run? Explain your reasoning.
- In the year 2012, Graceville had a population of 1.4 million people and an annual growth rate of 1.35%.
 - Write a function in the form $N(t) = N_0 e^{rt}$ to model Graceville's population with respect to t , the number of years since 2012.
 - Use your model to predict what Graceville's population will be in the year 2025.
 - Use your model to estimate Graceville's population in the year 1989.
 - Use technology to estimate when Graceville's population will reach 2 million people.
- Multiply $8\sqrt[3]{a^2}(-2\sqrt{a} + 5\sqrt[3]{a^4})$, given $a \geq 0$. Extract all roots and write your answer in radical form.
- Determine the domain of $f(x)$. Explain your reasoning. $f(x) = \frac{x^2 + 2x + 1}{x^2 - 1}$