DATE: _____

3.3 Logarithmic Functions & Their Graphs

Target 3B: Know and understand the inverse relationships of exponential and logarithmic equations

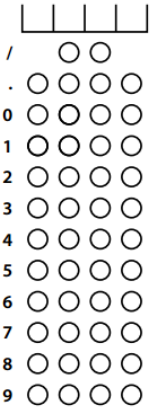
SAT Connection

Passport to Advanced Math

14. Use structure to isolate or identify a quantity of interest in an expression

Example: Jessica opened a bank account that earns 2 percent interest compounded annually. Her initial deposit was \$100, and she uses the expression $\$100(x)^t$ to find the value of the account after t years.

What is the value of x in the expression?



NOTE: You may start your answers in any column, space permitting. Columns you don't need to use should be left blank.

Solution

Logarithmic Functions

Logarithmic Form

$\log_b a = r$

Exponential Form

$b^r = a$

Examples

Evaluate the logarithmic expression.

1. $\log_3 9$ **2.** $\log_3 \frac{1}{27}$ **3.** $\log_2 \sqrt{8}$ **4.** $\ln e^2$

Common Log → has base _____ Natural Log → has base _____

Examples

Using a calculator, evaluate the logarithmic expression.

1. $\log 4$ **2.** $\ln 2$ **3.** $\log_2 5$

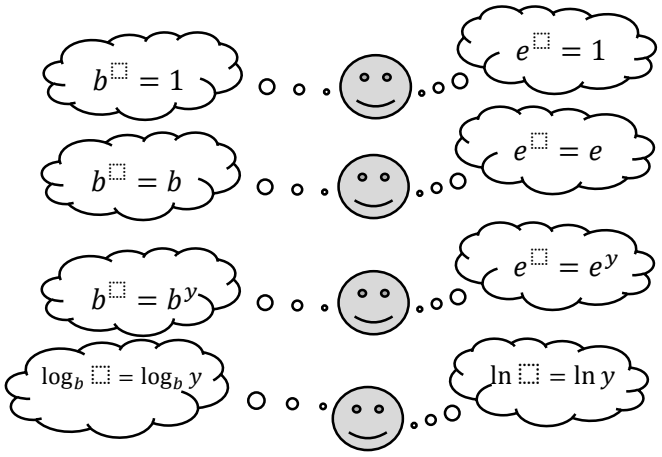
Properties of Logs/Natural Logs

$\log_b 1 =$ ____ $b^{\square} = 1$ $e^{\square} = 1$ $\ln 1 =$____

$\log_b b =$ ____ $b^{\square} = b$ $e^{\square} = e$ $\ln e =$____

$\log_b b^y =$ ____ $b^{\square} = b^y$ $e^{\square} = e^y$ $\ln e^y =$____

$b^{\log_b y} =$ ____ $\log_b \square = \log_b y$ $\ln \square = \ln y$ $e^{\ln y} =$____



Examples

Using the properties of logarithms, evaluate the logarithmic expression.

1. $\log_3 9$ **2.** $\log_5 125$ **3.** $e^{\ln 4}$ **4.** $5^{\log_5 8}$

5. $\log_4 1$ **6.** $\log_{10} \frac{1}{100}$ **7.** $\ln e^8$ **8.** $x^{\log_x 7}$

Solve the equation for *x*.

9. $\log x = 5$ **10.** $2 \log x = -6$ **11.** $\ln x^2 = 4$

More Practice

Logarithms

https://www.khanacademy.org/math/algebra2/exponential-and-logarithmic-functions/introduction-to-logarithms/a/intro-to-logarithms
http://www.themathpage.com/aprecalc/logarithmic-exponential-functions.htm
http://www.sosmath.com/algebra/logs/log4/log41/log41.html
http://www.regentsprep.org/regents/math/algtrig/ATE9/logs.htm
https://youtu.be/Z5myJ8dg_rM

Homework Assignment

p.308 #1-35 odd,59,61

SAT Connection

Solution

The correct answer is 1.02. The initial deposit earns 2 percent interest compounded annually. Thus at the end of 1 year, the new value of the account is the initial deposit of \$100 plus 2 percent of the initial deposit: $\$100 + \frac{2}{100}(\$100) = \$100(1.02)$. Since the interest is compounded annually, the value at the end of each succeeding year is the sum of the previous year's value plus 2 percent of the previous year's value. This is again equivalent to multiplying the previous year's value by 1.02. Thus, after 2 years, the value will be $\$100(1.02)(1.02) = \$100(1.02)^2$; after 3 years, the value will be $\$100(1.02)^3$; and after t years, the value will be $\$100(1.02)^t$. Therefore, in the formula for the value for Jessica's account after t years, $\$100(x)^t$, the value of x must be 1.02.