

Logarithms - A Refresher

A logarithm is the exponent of any number that has been raised to a power. For example: $5^3 = 5 \times 5 \times 5 = 125$. Therefore $\log_5(125) = 3$. The subscript 5 in the equation is the base, the number that is being multiplied by itself. The answer tells us how many times we have to multiply 5 by itself in order to arrive at the number in parenthesis.

Although logarithms can use any number as their base, the two most common bases used are 10 and the transcendental number e . Base 10 logarithms are called simple logarithms and abbreviated “log,” and base e logarithms are called natural logarithms and abbreviated “ln.” When using simple logarithms, the base 10 is understood, and the subscript number 10 is generally not written in the equation. Thus, in the equations $\log(1000) = 3$, and $\log(0.00001) = -5$, it is assumed that the base is 10. In this workshop we will be working with simple logarithms only, so you won’t need to worry about subscript numbers.

Logarithms do not always yield whole number answers. Consider the problem: $\log(4,000) = ?$. $10^3 = 1,000$, and $10^4 = 10,000$. Thus $\log(1,000) = 3$ and $\log(10,000) = 4$. Since 4,000 is between 1,000 and 10,000, the answer to $\log(4,000)$ must be a number between 3 and 4.

Different calculators can require slightly different procedures for computing logarithms. In this workshop we will be using Casio *fx-300MS* calculators, which handle logarithms very easily. If you are using a different calculator, you might have to use a slightly different procedure. To use one of the calculators that we have provided, simply push the “log” button, enter the number that you wish to determine the log of, and then hit [=]. To determine the answer to $\log(4,000) = ?$, hit [log], then enter [4000] then hit [=]. You should have gotten the answer 3.602. . . . (plus a lot of other numbers). Try another: $\log(32,500,000) = ?$. (Hint: $10^7 = 10,000,000$ and $10^8 = 100,000,000$, so your answer should be between 7 and 8. Did you get 7.51 . . . ? If so, you entered the equation correctly into your calculator.

There will be a few more complicated equations in some of the exercises we'll be doing. For example, in one exercise you'll have to calculate the answer to an equation like: $14.6 - 7 \cdot \log(42,100,000) + 8 = ?$ You can solve this several different ways. Enter:

[14.6] [-] [(] [7] [X] [log] [42100000] [)] [+] [8] [=].

Notice the parenthesis around the expression $7 \cdot \log(42,100,000)$. This keeps the calculator from subtracting 7 from 14.6 before calculating $7 \cdot \log(42,100,000)$. (Actually, for this particular problem you don't even need the parenthesis since the calculator automatically performs the multiplication step before doing any adding or subtracting.) Another procedure is to use the "Ans" key. This key inserts the answer to the previous calculation into your equation. So you could solve the above equation by entering:

[7] [X] [log] [42100000] [=]. This returns the number 53.36 . . .

Then enter:

[14.6] [-] [Ans] [+] [8] [=]

You should get -30.76 . . . for an answer. Try solving the problem both ways to see which method is more comfortable for you.