**Activity 5.1.8A Consequences of Being Inverse Functions**

In this activity, we will use your study of inverse functions from unit 1 to verify two important properties of exponents and logarithms,

$log\_{b}b^{x}=x$ and $b^{log\_{b}x}=x.$

In activity 5.1.2 you noticed a pattern: that log 10a = a. Now that we have the Power Rule for Logarithms we can see that log 10a = a log 10 = a(1) = a.

1. Study the completed rows and fill in the two empty rows

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| x | f(x)=10x |  | x ( column 2 outputs of f) will be the inputs for g(x)= log x | g(x)=log x, the exponent |
| -1 | 0.1 |  | 0.1 | -1 |
| 0 | 1 |  | 1 | 0 |
| 1 | 10 |  | 10 | 1 |
| 2 | 100 |  | 100 | 2 |
| 3 | 1000 |  | 1000 | 3 |
| 5 |  |  |  |  |
| 6 |  |  |  |  |
| a | 10a |  | 10a |  |

So when $f\left(x\right)= 10^{x}$ and $g\left(x\right)=log\_{10}x$. then $g\left(f\left(x\right)\right)=x$.

For what values $x$ does the above statement hold?

1. Simplify the following
2. $log\_{3}3^{2}=$
3. $log\_{2}2^{5}$
4. $log\_{4}\frac{1}{16}=$
5. $log\_{3}27=$
6. $log\_{10}10000000=$
7. $log\_{10}\frac{1}{10}=$
8. Complete the table

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| x | g(x)=log x |  | x (the outputs of g from column 2) will be the inputs for f | f(x)= 10x |
| -10 |  |  |  |  |
| 0 |  |  |  |  |
| 10 | 1 |  | 1 | 10 |
| 100 | 2 |  | 2 | 100 |
| 1000 | 3 |  | 3 | 1000 |
| 10000 |  |  |  |  |
| 189999 |  |  |  |  |
| a | log a |  | log a |  |

1. Let $f\left(x\right)= 10^{x}$ and $g\left(x\right)=log\_{10}x$ then $f\left(g\left(x\right)\right)=x$.

For what values $x$ does this equation hold?

1. Simplify the following
2. $2^{log\_{2}x}=$
3. $10^{log\_{10}x}=$
4. $\frac{1}{2}^{log\_{\frac{1}{2}}x}$=

You have verified two important properties of exponents and logarithms,

$log\_{b}b^{x}=x$ **and** $b^{log\_{b}x}=x.$

The logarithm function undoes the exponential function and the exponential undoes the logarithm function (for the same base of course).You will need to use these properties in future exercises.

Because these two functions are inverses of each other let us stress that these functions undo each other. That is, if (a, b) is on the graph of *f* then (b, a) is on the graph of *f -1*. So if we input a into the formula for *f* and get the output b and then use b as an input for *f -1* the output must be a.