

## Changing from Logarithmic to Exponential Form

### Changing Forms?

Consider the equation  $y = \sqrt{x}$ , is there a different way to write this equation without changing the meaning? The answer is “yes” because radicals can also be written as rational (fractional) exponents. The equation  $y = \sqrt{x}$  can also be written as  $y = x^{1/2}$ . Both of the equations mean the same thing, square root, but they have different forms, they look different. In this section we are going to find out how to change an equation from logarithmic form to exponential form.

### Definition of Logarithms

To learn how to change an equation from logarithmic form to exponential form, we need to start with the definition of a logarithm.

#### Definition of a Logarithm

For  $x > 0$  and  $b > 0, b \neq 1$ ,  $y = \log_b x$  is equivalent to  $b^y = x$ .

The definition of a logarithm shows an equation written in logarithmic form,  $y = \log_b x$ , and the same equation written in exponential form,  $b^y = x$ . Let's compare the two equations and look at what is the same and what is different. In both equations the  $y$  stays on the left side and the  $x$  stays on the right side, the only thing that moved was the  $b$  called the “base”. Identifying and moving the base is the key to changing from logarithmic form into exponential form.

### Changing from Logarithmic Form to Exponential Form

Identifying the base of the logarithmic equation and moving the base to the other side of the equal sign is how to change a logarithmic equation into an exponential equation. Let's look at another example.

$$5 = \log_2 x \Rightarrow 2^5 = x$$

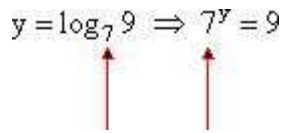
Logarithmic Form      Exponential Form

In this example, the base of the logarithmic equation is 2 and as the base moved from the left side of the equation to the right side of the equation the number 5 moved up and became the exponent, creating an exponential equation. The 5 and the  $x$  did not change sides and the word “log” was dropped.

To change from logarithmic form to exponential form, identify the base of the logarithmic equation and move the base to the other side of the equal sign. Moving the base will make the current number or variable into the exponent. Do not move anything but the base, the other numbers or variables will not change sides and the word “log” will be dropped.

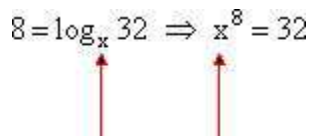
**Examples** – Now let's look at some more examples of how to change from logarithmic form to exponential form.

**Example 1:** Write the logarithmic equation  $y = \log_7 9$  in exponential form.

$$y = \log_7 9 \Rightarrow 7^y = 9$$


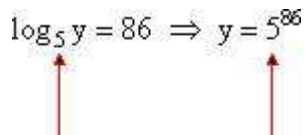
In this example, the base 7 moved from the right side of the equal sign to the left side of the equal sign turning  $y$  into the exponent.

**Example 2:** Write the logarithmic equation  $8 = \log_x 32$  in exponential form.

$$8 = \log_x 32 \Rightarrow x^8 = 32$$


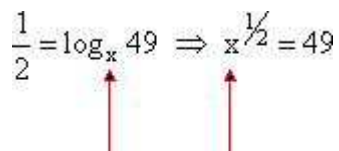
In this example, the base  $x$  moved from the right side of the equal sign to the left side of the equal sign turning 8 into the exponent.

**Example 3:** Write the logarithmic equation  $\log_5 y = 86$  in exponential form.

$$\log_5 y = 86 \Rightarrow y = 5^{86}$$


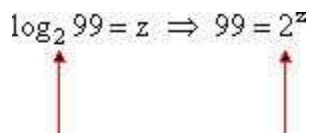
In this example, the base 5 moved from the left side of the equal sign to the right side of the equal sign turning 86 into the exponent.

**Example 4:** Write the logarithmic equation  $\frac{1}{2} = \log_x 49$  in exponential form.

$$\frac{1}{2} = \log_x 49 \Rightarrow x^{1/2} = 49$$


In this example, the base  $x$  moved from the right side of the equal sign to the left side of the equal sign turning  $1/2$  into the exponent.

**Example 5:** Write the logarithmic equation  $\log_2 99 = z$  in exponential form.

$$\log_2 99 = z \Rightarrow 99 = 2^z$$


In this example, the base 2 moved from the left side of the equal sign to the right side of the equal sign turning  $z$  into the exponent.

## Addition Examples

If you would like to see more examples of changing from logarithmic form to exponential form, just click on the link below.

[Additional Examples](#)

## Practice Problems

Now it is your turn to try a few practice problems on your own. Work on each of the problems below and then click on the link at the end to check your answers.

**Problem 1:** Write the logarithmic equation  $\log_8 73 = x$  in exponential form.

**Problem 2:** Write the logarithmic equation  $\log_x 54 = 9$  in exponential form.

**Problem 3:** Write the logarithmic equation  $x = \log_4 91$  in exponential form.

**Problem 4:** Write the logarithmic equation  $\log_3 x = 73$  in exponential form.

**Problem 5:** Write the logarithmic equation  $4 = \log_z 66$  in exponential form.

**Problem 6:** Write the logarithmic equation  $6 = \log_7 x$  in exponential form.

[Solutions to Practice Problems](#)