

7.3 Logarithmic Functions (This is in your packet!)

Exponential Form

$$10^3 = 1000$$

Logarithmic Form

$$\log_{10} 1000 = 3$$

Equivalent Exponential and Logarithmic Forms

For any positive base b , where $b \neq 1$:

$$b^x = y \quad \text{if and only if} \quad x = \log_b y$$

Write in exponential/logarithmic form

Ex. 1 $5^2 = 25$

$$2 = \log_5 25$$

Ex. 2 $2^3 = 8$

$$\text{or } \log_2 8 = 3$$
$$3 = \log_2 8$$

Ex. 3 $\log_4 16 = 2$

$$4^2 = 16$$

Ex. 4 $\log_5 125 = 3$

$$5^3 = 125$$

Ex. 5 $16^{\frac{1}{2}} = 4$

$$\frac{1}{2} = \log_{16} 4$$

or $\log_{16} 4 = \frac{1}{2}$

Ex. 6 $\log_3 \frac{1}{9} = -2$

$$3^{-2} = \frac{1}{9}$$

Ex. 7 $\log_w z = k$

$$w^k = z$$

Ex. 8 $r = x^y$

$$\log_x r = y \quad \text{or } y = \log_x r$$

Use your calculator to find:

Ex. 1 $\log 100 = 2$

Ex. 2 $\log 1000 = 3$

if no base, it's common base = 10 which is what our calc does

Without your calculator, simplify:

Ex. 3 $\log_2 8 = x$ Ex. 4 $\log_6 36 = x$ Ex. 5 $\log_5 625 = x$

write in exp. form

$$\begin{aligned} 2^x &= 8 \\ 2^x &= 2^3 \\ x &= 3 \end{aligned}$$

$\boxed{3}$

$$\begin{aligned} 6^x &= 36 \\ 6^x &= 6^2 \\ x &= 2 \end{aligned}$$

$\boxed{2}$

$$\begin{aligned} 5^x &= 625 \\ 5^x &= 5^4 \\ x &= 4 \end{aligned}$$

$\boxed{4}$

Ex. 6 $\log_{16} 4 = x$ Ex. 7 $\log_5 \frac{1}{25} = x$ Ex. 8 $\log_3 (-27) = x$

get same BASE

$$\begin{aligned} 16^x &= 4 \\ (4^2)^x &= 4 \\ 4^{2x} &= 4^1 \\ 2x &= 1 \\ x &= \frac{1}{2} \end{aligned}$$

$\boxed{\frac{1}{2}}$

BASE IS SAME SO exponents must be equal

$$\begin{aligned} 5^x &= \frac{1}{25} \\ 5^x &= \frac{1}{5^2} \\ 5^x &= 5^{-2} \\ x &= -2 \end{aligned}$$

$\boxed{-2}$

$$3^x = -27$$

not possible