

4.3 Logarithmic Functions

Goals: ① Convert from logarithmic to exponential form and vice versa.

② Evaluate logarithms using common base, natural base and other bases.

③ Application Problems

$b > 0; b \neq 1; \log_b(x) = y$ is equivalent to $b^y = x$

$$\log_b(x) = y \iff b^y = x$$

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E.g. 1 Write the given logarithmic equation in exponential form.

① $\log_6(\sqrt{6}) = \frac{1}{2}$ ② $\log_3(9) = 2$

③ $\log_{10}(1,000,000) = 6$ ④ $\log_5(25) = 2$

Sol: $\log_6(\sqrt{6}) = \frac{1}{2} \iff (\sqrt{6})^2 = 6$

$\log_3(9) = 2 \iff 3^2 = 9$

$\log_{10}(1,000,000) = 6 \iff 10^6 = 1,000,000$

$\log_5(25) = 2 \iff 5^2 = 25$

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E.g. 2 Convert from exponential form to logarithmic form.

$2^{-1} = \frac{1}{2} \iff \log_2\left(\frac{1}{2}\right) = -1$

Evaluate Logarithms.

E.g. Solve $\log_4(64) = y$ $\log_7(\sqrt[3]{7})$
 $y = 3$ $= \frac{3}{2}$
 $\log_3\left(\frac{1}{27}\right) = -3$ $\log_7(\sqrt{7})$
 $\log_2\left(\frac{1}{32}\right) = -5$ $= \frac{1}{2}$

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$y = \log_b(x)$

If $b = 10$; common logarithm.

$\log_{10}(x)$ is denoted by $\log(x)$

$\log(1000) = 3$; $\log(10^{2016}) = 2016$

$\log(0.01) = -2$; $\log(0.1) = -1$

If $b = e$, $\log_e(x)$ is denoted by $\ln(x)$
 $e \approx 2.718282...$

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$\ln(1) = 0$

$\log_b(1) = 0$

$\ln(e) = 1$; $\ln(e^3) = 3$

$\ln(\sqrt{e}) = \frac{1}{2}$; $2^0 = 1$

$\ln(-3) = \text{DNE}$ $\log_b(\text{negative}) = \text{DNE}$

$\log_2(-3) = \text{DNE}$ $2^y = -3$
 DNE $\log_2(0) = \text{DNE}$

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Applications.

Did Problems 64 and 66.

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