

Section 7.3

Logarithmic
Functions
and
Their
Graphs

Definition

- For $x > 0$ and $b > 0$ and b not equal to 1, then $b^y = x$ is equivalent to $y = \log_b x$
- Logarithmic Form: $y = \log_b x$
- Exponential Form: $b^y = x$
- Thus a logarithm is an exponent!

Example 1

- Write the following exponential equations in logarithmic form:

a) $2^3 = 8$ $\log_2 8 = 3$

b) $4^{-2} = \frac{1}{16}$ $\log_4 \frac{1}{16} = -2$

c) $\sqrt{9} = 3$ $\log_9 3 = \frac{1}{2}$

Example 2

- Write each logarithmic equation in exponential form:

a) $\log_b 25 = 2$ $b^2 = 25$

b) $\log_4 64 = y$ $4^y = 64$

c) $\log_3 x = 9$ $3^9 = x$

Definition

- **Common Log** - is the log base 10. The ten is usually dropped.
 - Example: $\log 100 = 2$
- **Natural Log** - is the log base e. It is written as "ln" instead of "log".
 - Example: $\ln x = 5$

Basic Properties of Logs

<u>General</u>	<u>Common</u>	<u>Natural</u>
$\log_b b = 1$	$\log 10 = 1$	$\ln e = 1$
$\log_b 1 = 0$	$\log 1 = 0$	$\ln 1 = 0$
$\log_b b^x = x$	$\log 10^x = x$	$\ln e^x = x$
$b^{\log_b x} = x$	$10^{\log x} = x$	$e^{\ln x} = x$

Example 3

- Evaluate each log:
 - $\log 10 = 1$
 - $\log_2 16 = 4$
 - $\log 0.001 = -3$
 - $\ln e^4 = 4$
 - $\log_{64} 4 = \frac{1}{3}$
 - $\ln 1 = 0$

The screenshot shows a software interface for "Logarithmic Functions and their Graphs". The main window displays a problem: "Evaluate the following logarithmic expression without the use of a calculator. Enter your answer as a fraction reduced to lowest terms." The expression is $\log_3 9$. Below the problem, there is an "ANSWER" field where the user has entered "2". A pop-up message box with a green information icon says "Correct Answer!". The interface includes a sidebar with buttons for "Report", "Keypad", "Instruct", "Practice", "Certify", and "End Practice". At the bottom, there is a status bar with fields for "Level", "Problem #", "Part", "# Parts", "# Correct", and "% Correct".

Logarithmic Functions and their Graphs

PROBLEM

Evaluate the following logarithmic expression without the use of a calculator. Enter your answer as a fraction reduced to lowest terms.

$$\ln \sqrt[7]{e^5}$$

ANSWER

Answer:

Logarithmic Functions and their Graphs

Correct Answer!

OK

Level	Problem #	Part	# Parts	# Correct	% Correct
Pre-certify	3 of 12	1 of 1	2	2	100%

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Logarithmic Functions and their Graphs

PROBLEM

Evaluate the following logarithmic expression without the use of a calculator. Enter your answer as a fraction reduced to lowest terms.

$$\log_5 \sqrt[8]{25}$$

ANSWER

Answer:

Logarithmic Functions and their Graphs

Correct Answer!

OK

Level	Problem #	Part	# Parts	# Correct	% Correct
Pre-certify	2 of 12	1 of 1	1	1	100%

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Logarithmic Functions and their Graphs

PROBLEM

Evaluate the following logarithmic expression without the use of a calculator. Enter your answer as a fraction reduced to lowest terms.

$$\log_4(\log_{16} 6)$$

ANSWER

Answer:

Logarithmic Functions and their Graphs

Correct Answer!

OK

Level	Problem #	Part	# Parts	# Correct	% Correct
Pre-certify	4 of 11	1 of 1	3	3	100%

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Example 4

Solve: $\log_{16} x = \frac{3}{4}$

Solution: $\log_{16} x = \frac{3}{4}$

$$16^{\frac{3}{4}} = x$$

$$x = 8$$

Example 5

Solve: $4^{\log_3 x} = 0$

Solution: $4^{\log_3 x} = 0$

$\log_4 0 = \log_3 x$

No solution

Logarithmic Functions and their Graphs - Practice mode

Report Keypad CKW, DEMO

Logarithmic Functions and their Graphs

PROBLEM

Use the elementary properties of logarithms to solve the following equation. Enter your answer as a fraction reduced to lowest terms.

$6^{\log_3 x} = 36$

ANSWER

Answer: $x =$

Logarithmic Functions and their Graphs

Correct Answer!

OK

Level	Problem #	Part	# Parts	# Correct	% Correct
Pre-certify	6 of 10	1 of 1	5	4	80%

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Example 6

Solve: $\log(3x) = 2.1$

Solution: $\log(3x) = 2.1$

$10^{2.1} = 3x$

$\frac{10^{2.1}}{3} = x$

$x \approx 41.96$

Logarithmic Functions and their Graphs - Practice mode

Report Keypad CKW, DEMO

Logarithmic Functions and their Graphs

PROBLEM

Use the elementary properties of logarithms to solve the following equation. Enter your answer as a fraction reduced to lowest terms.

$\log_2 8^{5x} = 5$

ANSWER

Answer: $x =$

Logarithmic Functions and their Graphs

Correct Answer!

OK

Level	Problem #	Part	# Parts	# Correct	% Correct
Pre-certify	1 of 6	1 of 1	0	0	0%

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