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

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

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

Example 2

- Write each logarithmic equation in exponential form:

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

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

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

1

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

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

Example 3

- Evaluate each log:

  a) $\log 10$ 1

  b) $\log_2 16$ 4

  c) $\log 0.001$ -3

  d) $\ln e^4$ 4

  e) $\log_{64} 4$ $\frac{1}{3}$

  f) $\ln 1$ 0

Panel 1

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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.

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

ANSWER

Answer: $\dfrac{5}{7}$

Logarithmic Functions and their Graphs

Correct Answer!

OK

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Panel 2

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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: $\dfrac{1}{4}$

Logarithmic Functions and their Graphs

Correct Answer!

OK

Level ▶	Problem #	Part	# Parts	# Correct	% Correct			
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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.

$$log_2(log_{36}6\,)$$

ANSWER

Answer: -1

Logarithmic Functions and their Graphs

Correct Answer!

OK

Level ▶	Problem #	Part	# Parts	# Correct	% Correct			
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Panel 4

Example 4

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

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

$$16^{3/4} = x$$

$$x = 8$$

Example 5

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

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

$\log_4 0 = \log_3 x$

No solution

Example 6

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

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

$10^{2.1} = 3x$

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

$x \approx 41.96$