Converting from Logarithmic to Exponential Form
A logarithm is an exponent. That is, ...

\[ \log_a y = \text{exponent} \] to which the base \( a \) must be raised to obtain \( y \)

In other words, \( \log_a y = x \) is equivalent to \( a^x = y \)

**Example 1** Write the logarithmic equation \( \log_3 (9) = 2 \) in equivalent exponential form.

\[(\underline{\phantom{2}})^{\underline{\phantom{2}}} = \underline{\phantom{2}}\]
Converting from Logarithmic to Exponential Form

\[ \log_a y = x \quad \text{is equivalent to} \quad a^x = y \]

**Example 2** Write the logarithmic equation \( C = \log_H (A) \) in equivalent exponential form.

\[ = ( \quad ) \]
Example 3  Write the logarithmic equation \( \log (10,000) = 4 \) in equivalent exponential form.

\[
\text{ } = \left( \text{ } \right)^\text{ }
\]
Converting from Logarithmic to Exponential Form

Natural Logarithm: \( \log_e y = \ln y \)
\((Note: \ e \approx 2.718)\)

**Example 4** Write the logarithmic equation \( A = \ln (19) \) in equivalent exponential form.

\( (\text{[ ]})^{\text{[ ]}} = \text{[ ]} \)
Converting from Exponential to Logarithmic Form
Converting from Exponential to Logarithmic Form

\[ \log_a y = x \quad \text{is equivalent to} \quad a^x = y \]

**Example 1** Write the exponential equation \( 8 = 2^3 \) in equivalent logarithmic form.

\[ \log_{\underline{\phantom{1}}} (\underline{\phantom{1}}) = \underline{\phantom{1}} \]
Converting from Exponential to Logarithmic Form

\[ \log_a y = x \quad \text{is equivalent to} \quad a^x = y \]

**Example 2** Write the exponential equation \( M^K = D \) in equivalent logarithmic form.

\[ \log_{\square} (\square) = \square \]
Evaluating Logarithms
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\[ \log_a y = \text{exponent to which the base } a \text{ must be raised to obtain } y \]

*Note:* \( \log_a y = x \) is equivalent to \( a^x = y \)

**Example 1** Determine the value of the logarithmic expression.

(a) \( \log_2 16 = \)

(b) \( \log 100 = \)

(c) \( \ln e = \)
Evaluating Logarithms

Properties of Exponents:
\[ a^0 = 1, \ a \neq 0 \quad a^{-m} = \frac{1}{a^m} \quad \left(\frac{1}{a}\right)^{-m} = a^m \]

Example 2  Determine the value of the logarithmic expression.

(a) \( \ln 1 = \)

(b) \( \log_3 \left(\frac{1}{81}\right) = \)

(c) \( \log_{1/2} 2 = \)
Evaluating Logarithms

Properties of Exponents:

\[ a^0 = 1, \ a \neq 0 \quad a^{-m} = \frac{1}{a^m} \quad \left(\frac{1}{a}\right)^{-m} = a^m \quad a^{1/2} = \sqrt{a} \]

**Example 3** Determine the value of the logarithmic expression.

(a) \( \log_6 6 = \)

(b) \( \log 0.01 = \)

(c) \( \log_{16} 4 = \)
Simplifying Logarithmic and Exponential Expressions
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\[ \log_a y = \text{exponent} \text{ to which the base } a \text{ must be raised to obtain } y \]

*Note:* \( \log_a y = x \) is equivalent to \( a^x = y \)

**Example 1** Simplify the following expression.

\[ \log_3 (3^4) + \log_3 (3) = \]
Example 2  Simplify the following expressions.

(a) \( e^{\ln(e^5)} = \)

(b) \( 2^{\log_2 8} = \)