

(A) Lesson Context

BIG PICTURE of this UNIT:	<ul style="list-style-type: none"> • How do algebraically & graphically work with growth and decay applications? • What are logarithms and how do we invert or undo an exponential function? • How do we work with simple algebraic and graphic situations involving the use of logarithms (or inverting exponentials?) 		
CONTEXT of this LESSON:	<p>Where we've been</p> <p>We have seen algebra skills related to the parent exponential function $f(x) = AB^x$ in Lesson 1 and we've worked with Inverses in SEM 1</p>	<p>Where we are</p> <p>What are & How do work with the inverse of exponential functions?</p>	<p>Where we are heading</p> <p>How do work with the mathematically model $f(x) = AB^{k(x+c)} + d$?</p>

(B) Lesson Objectives:

- How can we summarize number patterns associated with logarithmic & exponential relationships?
- Convert between exponential & logarithmic forms of numerical expressions
- Solve simple logarithmic equations using fundamental knowledge of exponents

(C) FUNCTIONS Review: INVERSES

Exponential : $f(x) = 2^x$		Inverse of Exponential: $y = f^{-1}(x)$																																					
ToV	Graph	ToV	Graph																																				
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(D) VIDEO SUMMARY

Converting between FORMS: log form \leftrightarrow exp form

$$\log_5 25 = 2$$

$$\log_{\frac{1}{4}} 64 = -3$$

$$\log_{125} 5 = \frac{1}{3}$$

$$\log_2 \frac{1}{8} = -3$$

(E) Converting Forms \rightarrow between Exponential & Logarithmic

Given the following examples \rightarrow convert all log equations to equivalent exponential equations & vice versa (convert exponential equations into equivalent logarithmic equations)

1) $\log_{16} 256 = 2$	2) $\log_9 81 = 2$	21) $4^{\frac{1}{2}} = 2$	22) $3^5 = 243$
3) $\log_2 \frac{1}{8} = -3$	4) $\log_5 25 = 2$	23) $14^{-2} = \frac{1}{196}$	24) $18^2 = 324$
5) $\log_{20} 400 = 2$	6) $\log_{17} 289 = 2$	25) $3^3 = 27$	26) $\left(\frac{1}{6}\right)^3 = \frac{1}{216}$
7) $\log_{13} 169 = 2$	8) $\log_5 125 = 3$	27) $14^2 = 196$	28) $36^{-\frac{1}{2}} = \frac{1}{6}$
9) $\log_9 \frac{1}{81} = -2$	10) $\log_{169} 13 = \frac{1}{2}$	29) $6^3 = 216$	30) $17^2 = 289$
11) $\log_y x = \frac{2}{3}$	12) $\log_y 76 = x$		

(F) Application: Solving Logarithmic Equations

Evaluate & solve the following logarithmic expressions/equations

Evaluate the following logarithmic expressions

$$\log_5 125 =$$

$$\log_2 \frac{1}{16} =$$

$$\log_2 \frac{1}{128} =$$

$$4\log_9 3 =$$

$$\log_4 256 =$$

$$\log_3 \frac{1}{243} =$$

$$4\log_2 4 =$$

$$\log_2 64 =$$

$$\log_{\frac{1}{6}} 36 =$$

$$2\log_4 2 =$$

Solve the following logarithmic equations

$$\log_x 32 = 5$$

$$\log_3 x = 3$$

$$\log_3 81 = x$$

$$\log_5 x = -2$$

$$\log_6 x = 2$$

$$\log_9 x = \frac{1}{2}$$

$$\log_5 0.04 = x$$

$$\log_2 \frac{1}{x} = 4$$

$$\log_x 2 = \frac{1}{3}$$

$$\log_x 256 = -4$$

(G)Application: Number PATTERNS

Use your TI-84 to determine the value of the following logarithms:

$\log_2 0$	$\log_2 1$	$\log_2 2$	$\log_2 3$	$\log_2 4$	$\log_2 5$	$\log_2 6$
$\log_2 7$	$\log_2 8$	$\log_2 9$	$\log_2 10$	$\log_2 11$	$\log_2 12$	$\log_2 13$
$\log_2 14$	$\log_2 15$	$\log_2 16$	$\log_2 17$	$\log_2 18$	$\log_2 19$	$\log_2 20$

CHALLENGE: Look for patterns amongst the numbers & outputs → can you see some patterns that will lead to some GENERALIZATIONS that would then in turn allow us to make PREDICTIONS?

(a) PREDICTIONS: Predict a value for $\log_2 200$

(a) PREDICTIONS: Predict a value for $\log_2 85$

(a) PREDICTIONS: Predict a value for $\log_2 7.5$

(a) PREDICTIONS: Predict a value for $\log_2 \left(4\frac{1}{3}\right)$

(a) PREDICTIONS: Predict a value for $\log_2 243$

Name : _____

Score : _____

Logarithmic & Exponential Form**Express each equation in logarithmic form.**

1) $5^2 = 25$

2) $36^{\frac{1}{2}} = 6$

3) $3^{-3} = \frac{1}{27}$

4) $4^3 = 64$

5) $3^2 = 9$

6) $2^6 = 64$

7) $6^3 = 216$

8) $2^{-4} = \frac{1}{16}$

Express each equation in exponential form.

9) $\log_2 32 = 5$

10) $\log_4 256 = 4$

11) $\log_5 125 = 3$

12) $\log_8 2 = \frac{1}{3}$

13) $\log_3 27 = 3$

14) $\log_4 \left(\frac{1}{64}\right) = -3$

15) $\log_2 \left(\frac{1}{8}\right) = -3$

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

Name : _____

Score : _____

Logarithmic & Exponential Form**Express each equation in logarithmic form.**

1) $6^m = 36$

2) $x^{\frac{1}{2}} = 5$

3) $9^5 = w$

4) $4^{-k} = \frac{1}{16}$

5) $5^b = 125$

6) $u^3 = 64$

7) $8^{\frac{1}{3}} = s$

8) $5^2 = r$

Express each equation in exponential form.

9) $\log_3 27 = n$

10) $\log_a \left(\frac{1}{32}\right) = -2$

11) $\log_6 z = 3$

12) $\log_{25} m = \frac{1}{2}$

13) $\log_5 \left(\frac{1}{25}\right) = -y$

14) $\log_x 100 = 2$

15) $\log_{12} 144 = s$

16) $\log_{36} p = \frac{1}{2}$

Name : _____

Score : _____

Evaluating Expressions

Example :

Evaluate the expression : $\log_2 64$

$$\begin{aligned}\log_2 64 &= \log_2 2^6 \\ &= 6 \log_2 2 \\ &= 6(1) \\ &= \mathbf{6}\end{aligned}$$

$$\log_a b^c = c \log_a b$$

$$\log_a a = 1$$

Evaluate each expression.

1) $\log_3 81$

Answer

2) $\log_6 \left(\frac{1}{216}\right)$

Answer

3) $\log_{11} 121$

Answer

4) $3 \log_2 4$

Answer

5) $-2 \log_5 25$

Answer

6) $\log_2 \left(\frac{1}{2}\right)$

Answer

7) $5 \log_3 3$

Answer

8) $\log_2 128$

Answer

9) $3 \log_8 2$

Answer

10) $-3 \log_3 9$

Answer

Evaluating Expressions

Example :

Evaluate the expression : $\log_{16} 4^4 + \log_{\frac{1}{27}} 3^{-1}$

$$\begin{aligned} \log_{16} 4^4 + \log_{\frac{1}{27}} 3^{-1} &= \log_{16} 16^2 + \frac{1}{3} \log_{\frac{1}{27}} \left(\frac{1}{27}\right) \\ &= 2(1) + \frac{1}{3}(1) \\ &= \frac{7}{3} \end{aligned}$$

$$\log_a b^c = c \log_a b$$

$$\log_a a = 1$$

Evaluate each expression.

1) $\left(\frac{1}{2}\right) \log_{\frac{1}{32}} 4 - \log_{25} 5^{-2}$

Answer

2) $\log_{\frac{1}{64}} \left(\frac{1}{4}\right) \cdot \log_{81} 9$

Answer

3) $\frac{5 \log_{27} 3}{\log_{\frac{1}{25}} 5}$

Answer

4) $\log_{\frac{1}{36}} \left(\frac{1}{6}\right) + 6 \log_8 2$

Answer

5) $\log_{\frac{1}{2}} 64 + 7 \log_{125} 5$

Answer

6) $\log_{\frac{1}{9}} 3 - 4 \log_{64} 8$

Answer

7) $3 \log_{\frac{1}{4}} 16 \cdot \log_{36} 6$

Answer

8) $\frac{\log_{32} 2}{\log_{\frac{1}{6}} 6}$

Answer

9) $\log_{81} 3^6 + 2 \log_{\frac{1}{12}} 144$

Answer

10) $\log_{128} 2 - \log_{\frac{1}{49}} 7^3$

Answer

Logarithm - Solve

Solve for x.

Example 1:

$$\begin{aligned}\log_{81} 9 &= x \\ 81^x &= 9 \\ 9^{2x} &= 9 \\ x &= \frac{1}{2}\end{aligned}$$

Example 2:

$$\begin{aligned}\log_x 2^{-2} &= -1 \\ x^{-1} &= 2^{-2} \\ x &= 4\end{aligned}$$

Solve for x.

1) $\log_2 x^{\frac{1}{5}} = 2$

x =

2) $\log_x 5 = \frac{1}{3}$

x =

3) $\log_{128} \left(\frac{1}{4}\right) = x$

x =

4) $\log_4 \left(\frac{1}{2}\right) = x$

x =

5) $\log_{\frac{1}{8}} \left(\frac{1}{4}\right) = x$

x =

6) $\log_{32} 8 = x$

x =

7) $\log_x 6 = \frac{1}{3}$

x =

8) $\log_x 16^{\frac{1}{4}} = 1$

x =

9) $\log_5 x = 3$

x =

10) $\log_{27} 3^{-2} = x$

x =