LESSON MAKER PRO

Undo the Power

Use logarithms to find missing exponents.

HIGH SCHOOL · MT.PLUS.ALG.EXP.1

MT.PLUS.ALG.EXP.1 "Understand logarithmic functions as the inverse of exponential functions."

NAME _____ DATE _____

THE INVERSE RULE

A logarithm asks which exponent makes a power. If $b^x = a$, then $\log_b(a) = x$, where b is positive, b is not 1, and a is positive.

WORKED EXAMPLE

Evaluate $\log_7(2401)$.

1. $7^2 = 49$.
2. $7^4 = 49 \times 49 = 2401$.
3. The exponent that gives 2401 from base 7 is 4.

Answer: 4

PRACTICE 6 problems

1 Rewrite $2^6 = 64$ as a logarithmic equation.

ANSWER _____

2 Rewrite $\log_3(243) = 5$ as an exponential equation.

ANSWER _____

3 Evaluate $\log_5(125)$.

ANSWER _____

4 Evaluate $\log_{10}(1/100)$.

ANSWER _____

5 Solve $\log_8(x) = 2$.

ANSWER _____

6 Solve $6^x = 1/216$.

ANSWER _____

APPLY IT Show your work

1 A gaming channel has 20 subscribers. Its subscriber count triples each week. After how many weeks will it have 4,860 subscribers? Write an exponential equation and an equivalent logarithmic equation.

WORK SPACE

ANSWER _____

2 A phone has 256 MB of photos left to upload. Each hour, half of the remaining data uploads. After how many hours will 8 MB remain? Write an exponential equation and an equivalent logarithmic equation.

WORK SPACE

ANSWER _____

CHALLENGE One step up

Solve $\log_2(x + 6) = \log_3(9) + 1$. Explain how the inverse relationship gives your answer, and check that the logarithm is defined.

WORK SPACE AND ANSWER

Undo the Power

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Rewrite $2^6 = 64$ as a logarithmic equation.	**$\log_2(64) = 6$**
2	Rewrite $\log_3(243) = 5$ as an exponential equation.	**$3^5 = 243$**
3	Evaluate $\log_5(125)$.	**3**
4	Evaluate $\log_{10}(1/100)$.	**-2**
5	Solve $\log_8(x) = 2$.	**x = 64**
6	Solve $6^x = 1/216$.	**x = -3**

PART 2 · APPLY IT

1. **$20(3^x) = 4{,}860$; $\log_3(243) = x$; x = 5 weeks** Divide 4,860 by 20 to get $3^x = 243$. Since $3^5 = 243$, the channel reaches 4,860 subscribers after 5 weeks.
2. **$256(1/2)^x = 8$; $\log_{1/2}(1/32) = x$; x = 5 hours** Divide 8 by 256 to get $(1/2)^x = 1/32$. Since $(1/2)^5 = 1/32$, 8 MB remains after 5 hours.

CHALLENGE

$\log_3(9) = 2$, so $\log_2(x + 6) = 3$. By the inverse relationship, $x + 6 = 2^3 = 8$, giving x = 2. The logarithm is defined because $x + 6 = 8$ is positive.

Accept equivalent exponential and logarithmic equations in the word problems. For the challenge, the check must show that x + 6 is positive.