LESSON MAKER PRO

Undo the Power

Use logarithms and exponents as inverse operations.

HIGH SCHOOL · HSF-BF.B.5

CCSS.Math.Content.HSF-BF.B.5 "(+) Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents."

NAME _____ DATE _____

INVERSE PARTNERS

For $\log_b(A)$ to be defined, b > 0, b != 1, and A > 0. The statement $\log_b(A) = x$ means exactly the same thing as $b^x = A$. Change a logarithmic equation into an exponential equation when that form is easier to solve.

WORKED EXAMPLE

Solve $\log_{15}(3375) = x$.

1. Rewrite the logarithm as an exponential equation: $15^x = 3375$.
2. Recognize that $15^3 = 3375$.
3. Therefore, x = 3.

Answer: x = 3

PRACTICE 6 problems

1 Rewrite $\log_4(256) = x$ as an exponential equation, then solve for x.

ANSWER _____

2 Solve $8^x = 1/64$.

ANSWER _____

3 Solve $\log_{16}(x) = 1/2$.

ANSWER _____

4 Solve $\log_7(x - 8) = 2$.

ANSWER _____

5 Solve 16^(x - 1) = 4^8. Here ^ means raised to the entire exponent in parentheses.

ANSWER _____

6 Solve $\log_{(1/2)}(x) = -4$.

ANSWER _____

APPLY IT Show your work

1 A student posts a short video, and its shares double each hour. The number of shares is modeled by $S = 12(2^h)$, where h is the number of hours. How many hours will it take for the video to have 384 shares?

WORK SPACE

ANSWER _____

2 In a game, a temporary power-up begins at 96 points and halves after each completed level. Its strength is modeled by $P = 96(1/2)^n$, where n is the number of levels. After how many levels will the power-up have 6 points?

WORK SPACE

ANSWER _____

CHALLENGE One step up

Solve 4^(x + 1) = 16^(x - 2). Here ^ means raised to the entire exponent in parentheses. Explain how rewriting both sides with the same base helps you find x.

WORK SPACE AND ANSWER

ANSWER KEY # Undo the Power

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Rewrite $\log_4(256) = x$ as an exponential equation, then solve for x.	**$4^x = 256$; x = 4**
2	Solve $8^x = 1/64$.	**x = -2**
3	Solve $\log_{16}(x) = 1/2$.	**x=4**
4	Solve $\log_7(x - 8) = 2$.	**x = 57**
5	Solve 16^(x - 1) = 4^8. Here ^ means raised to the entire exponent in parentheses.	**x=5**
6	Solve $\log_{(1/2)}(x) = -4$.	**x = 16**

PART 2 · APPLY IT

1. **5 hours** Set $12(2^h) = 384$, then divide by 12 to get $2^h = 32$. Since $2^5 = 32$, h = 5.
2. **4 levels** Set $96(1/2)^n = 6$, then divide by 96 to get $(1/2)^n = 1/16$. Since $(1/2)^4 = 1/16$, n = 4.

CHALLENGE

x = 5. Rewriting both bases as powers of 2 gives 2^(2x + 2) = 2^(4x - 8). Equal powers of base 2 have equal exponents, so 2x + 2 = 4x - 8 and x = 5.

Accept equivalent exponential forms, such as $256 = 4^x$. For the challenge, students may use exponent rules or logarithms if their work leads to x = 5.