

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, $b > 0$, $b \neq 1$, 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 $16^{(x - 1)} = 4^8$.

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

CHALLENGE

Solve $4^{(x+1)} = 16^{(x-2)}$. Explain how rewriting both sides with the same base helps you find x .

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 $16^{(x - 1)} = 4^8$.	$x = 5$
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

$x = 5$, because $4^{(x + 1)} = 2^{(2x + 2)}$ and $16^{(x - 2)} = 2^{(4x - 8)}$. Therefore $2x + 2 = 4x - 8$, so $x = 5$.

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