LESSON MAKER PRO

Find the Exponent

Use logarithms to solve exponential equations.

HIGH SCHOOL · A2S.AF.C.9

A2S.AF.C.9 "For exponential models, express as a logarithm the solution to $ab^{ct} = d$, where a, c, and d are real numbers and the base b is 2 or 10; evaluate the logarithm using technology to solve an exponential equation."

NAME _____ DATE _____

DIVIDE, THEN LOG

To solve $a*b^{cx} = d$, first divide by a to isolate the power. Then write $cx = \log_b(d/a)$ and divide by c. This works when a and c are not zero and d/a is positive.

WORKED EXAMPLE

Solve $7*10^{4x} = 7000$. Write the solution as a logarithm first.

1. Divide by 7: $10^{4x} = 1000$.
2. Write a logarithm: $4x = \log_{10}(1000)$.
3. Since $10^3 = 1000$, $x = 3/4$.

Answer: $x = \log_{10}(1000)/4 = 3/4$

PRACTICE 6 problems

1 Write x as a logarithm, then solve: $5*2^x = 80$.

ANSWER _____

2 Write x as a logarithm, then solve: $9*10^{2x} = 9000$.

ANSWER _____

3 Write x as a logarithm, then solve: $6*2^{-x} = 3/4$.

ANSWER _____

4 Write x as a logarithm, then solve: $12*10^{x/2} = 1200$.

ANSWER _____

5 Write x as a logarithm, then solve: $11*2^{3x} = 88$.

ANSWER _____

6 Write x as a logarithm, then solve: $8*10^{-x} = 1/125$.

ANSWER _____

APPLY IT Show your work

1 A phone battery is at 64%. Its charge halves every 6 hours. The model $64*2^{-x/6}$ gives its charge percentage after x hours. When will it reach 8%? Write a logarithmic expression, then solve.

WORK SPACE

ANSWER _____

2 A new music clip has 30 shares. During its first few hours online, the number of shares is modeled by $30*10^{x/2}$, where x is hours. When will it reach 3000 shares? Write a logarithmic expression, then solve.

WORK SPACE

ANSWER _____

CHALLENGE One step up

Solve $24*2^{-x/3} = 3/4$. Write x as a logarithm, then check your answer by substitution.

WORK SPACE AND ANSWER

ANSWER KEY # Find the Exponent

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Write x as a logarithm, then solve: $5*2^x = 80$.	**$x = \log_2(16) = 4$**
2	Write x as a logarithm, then solve: $9*10^{2x} = 9000$.	**$x = \log_{10}(1000)/2 = 3/2$**
3	Write x as a logarithm, then solve: $6*2^{-x} = 3/4$.	**$x = -\log_2(1/8) = 3$**
4	Write x as a logarithm, then solve: $12*10^{x/2} = 1200$.	**$x = 2*\log_{10}(100) = 4$**
5	Write x as a logarithm, then solve: $11*2^{3x} = 88$.	**$x = \log_2(8)/3 = 1$**
6	Write x as a logarithm, then solve: $8*10^{-x} = 1/125$.	**$x = -\log_{10}(1/1000) = 3$**

PART 2 · APPLY IT

1. **$x = -6*\log_2(1/8) = 18$ hours** Divide 8 by 64 to get 1/8. Since $\log_2(1/8) = -3$, $x = -6*(-3) = 18$.
2. **$x = 2*\log_{10}(100) = 4$ hours** Divide 3000 by 30 to get 100. Since $\log_{10}(100) = 2$, $x = 2*2 = 4$.

CHALLENGE

$x = -3*\log_2(1/32) = 15$. Check: $24*2^{-15/3} = 24*(1/32) = 3/4$.

Accept equivalent logarithmic expressions and exact solutions. The logarithms can be evaluated by identifying powers of 2 or 10, so no calculator is needed.