LESSON MAKER PRO

Unlock the Exponent

Write exponential solutions as logarithms, then evaluate.

HIGH SCHOOL · HSF-LE.A.4

CCSS.Math.Content.HSF-LE.A.4 "For exponential models, express as a logarithm the solution to ab ct = d where a, c, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology."

NAME _____ DATE _____

SOLVE WITH A LOGARITHM

For an equation of the form $a(b)^{cx} = d$, first divide by a. Then write $cx = \log_b(d/a)$, or use ln when the base is e, and divide by c to find x.

WORKED EXAMPLE

Solve $7(10)^{11x} = 700000000000$. Express the solution as a logarithm and evaluate it.

1. Divide by 7: $10^{11x} = 100000000000$.
2. Rewrite in logarithmic form: $11x = \log_{10}(100000000000) = 11$.
3. Divide by 11: $x = 1$.

Answer: $x = \log_{10}(100000000000)/11 = 1$

PRACTICE 6 problems

1 Solve $5(2)^{2x} = 80$. Express the solution as a logarithm and evaluate it.

ANSWER _____

2 Solve $4e^{5x} = 4e^{20}$. Express the solution as a logarithm and evaluate it.

ANSWER _____

3 Solve $6(2)^{4x} = 1536$. Express the solution as a logarithm and evaluate it.

ANSWER _____

4 Solve $8e^{2x} = 8e^{8}$. Express the solution as a logarithm and evaluate it.

ANSWER _____

5 Solve $9(2)^{6x} = 576$. Express the solution as a logarithm and evaluate it.

ANSWER _____

6 Solve $2e^{4x} = 2e^{12}$. Express the solution as a logarithm and evaluate it.

ANSWER _____

APPLY IT Show your work

1 A student posts a short video. Its views are modeled by $12(2)^{x/4} = 96$, where x is the number of hours after posting. How many hours will it take for the video to reach 96 views? Express x as a logarithm and evaluate it.

WORK SPACE

ANSWER _____

2 The number of active players in an online game is modeled by $40e^{x/3}$. The game reaches $40e^{9}$ active players. What is x, the number of hours since tracking began? Express x as a logarithm and evaluate it.

WORK SPACE

ANSWER _____

CHALLENGE One step up

Solve $5(2)^{4x} = 250$. Write x as a logarithm. Then explain why $5/4 < x < 3/2$ without using a calculator.

WORK SPACE AND ANSWER

ANSWER KEY

Unlock the Exponent

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Solve $5(2)^{2x} = 80$. Express the solution as a logarithm and evaluate it.	**$x = \log_2(16)/2 = 2$**
2	Solve $4e^{5x} = 4e^{20}$. Express the solution as a logarithm and evaluate it.	**$x = \ln(e^{20})/5 = 4$**
3	Solve $6(2)^{4x} = 1536$. Express the solution as a logarithm and evaluate it.	**$x = \log_2(256)/4 = 2$**
4	Solve $8e^{2x} = 8e^{8}$. Express the solution as a logarithm and evaluate it.	**$x = \ln(e^{8})/2 = 4$**
5	Solve $9(2)^{6x} = 576$. Express the solution as a logarithm and evaluate it.	**$x = \log_2(64)/6 = 1$**
6	Solve $2e^{4x} = 2e^{12}$. Express the solution as a logarithm and evaluate it.	**$x = \ln(e^{12})/4 = 3$**

PART 2 · APPLY IT

1. **$x = 4\log_2(8) = 12$ hours** Divide by 12 to get $2^{x/4} = 8$. Since $x/4 = \log_2(8) = 3$, $x = 12$.
2. **$x = 3\ln(e^9) = 27$ hours** Divide by 40 to get $e^{x/3} = e^9$. Then $x/3 = \ln(e^9) = 9$, so $x = 27$.

CHALLENGE

$x = \log_2(50)/4$. Since $2^5 = 32$ and $2^6 = 64$, $5 < \log_2(50) < 6$. Dividing by 4 gives $5/4 < x < 3/2$.

Accept equivalent logarithmic forms, including $\ln(16)/\ln(2)$ in place of $\log_2(16)$. Students may simplify a logarithm before or after dividing by the exponent coefficient.