LESSON MAKER PRO

Unlock the Exponent

Solve exponential models with common and natural logarithms.

HIGH SCHOOL · F.LE.A.4.a

F.LE.A.4.a "Use properties of logarithms, including both common and natural logarithms, to rewrite and solve exponential models."

NAME _____ DATE _____

MOVE THE EXPONENT

To solve an equation with x in an exponent, take a common logarithm (log) or a natural logarithm (ln) of both sides. The power rule, $\ln(b^x) = x \ln b$ or $\log(b^x) = x \log b$, moves x out of the exponent. If a log quotient does not simplify, it is an exact answer.

WORKED EXAMPLE

Use natural logarithms to solve $7^x = 343$.

1. Take the natural logarithm: $\ln(7^x) = \ln 343$.
2. Use the power rule: $x \ln 7 = \ln 343$.
3. Divide: $x = \ln 343 / \ln 7 = \ln(7^3)/\ln 7 = 3$.

Answer: x = 3

PRACTICE 6 problems

1 Use common logarithms to solve $2^x = 32$.

ANSWER _____

2 Use natural logarithms to solve $3^x = 81$.

ANSWER _____

3 Use common logarithms to solve $4^x = 8$.

ANSWER _____

4 Use natural logarithms to solve $5^{x+1} = 125$.

ANSWER _____

5 Use common logarithms to solve $10^{2x-1} = 1000$.

ANSWER _____

6 Use natural logarithms to solve $6^x = 15$. Leave your answer in exact form.

ANSWER _____

APPLY IT Show your work

1 A new game clip has 75 views when you begin tracking it. Its views double each day, so $V = 75(2^x)$ after x days. After how many days will the model reach 600 views? Use common logarithms.

WORK SPACE

ANSWER _____

2 A used phone is worth $360 now. Its modeled resale value drops to half its previous value each year, so $V = 360(1/2)^x$ after x years. When will it be worth $90? Use natural logarithms.

WORK SPACE

ANSWER _____

CHALLENGE One step up

Solve $3(2^x) + 2^{x+1} = 160$. Show how you combine terms before taking a logarithm.

WORK SPACE AND ANSWER

ANSWER KEY

Unlock the Exponent

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Use common logarithms to solve $2^x = 32$.	**x = 5**
2	Use natural logarithms to solve $3^x = 81$.	**x = 4**
3	Use common logarithms to solve $4^x = 8$.	**x = 3/2**
4	Use natural logarithms to solve $5^{x+1} = 125$.	**x = 2**
5	Use common logarithms to solve $10^{2x-1} = 1000$.	**x = 2**
6	Use natural logarithms to solve $6^x = 15$. Leave your answer in exact form.	**x = ln 15/ln 6**

PART 2 · APPLY IT

1. **3 days** Divide by 75, then take common logarithms: x = log(600/75)/log 2 = log 8/log 2 = 3.
2. **2 years** Divide by 360, then take natural logarithms: x = ln(90/360)/ln(1/2) = ln(1/4)/ln(1/2) = 2.

CHALLENGE

x = 5; $3(2^x) + 2(2^x) = 5(2^x)$, so x = ln(160/5)/ln 2 = ln 32/ln 2 = 5.

Accept equivalent exact log quotients when students use the requested log type. Context answers should include units.