LESSON MAKER PRO

Log Power Moves

Use product, quotient, and power rules to rewrite logarithms.

HIGH SCHOOL · MA.912.NSO.1.7

MA.912.NSO.1.7 "Given an algebraic logarithmic expression, generate an equivalent algebraic expression using the properties of logarithms or exponents."

NAME _____ DATE _____

LOG RULES IN ACTION

For positive quantities, use the product rule to split a logarithm of multiplication and the quotient rule to split a logarithm of division. Use the power rule to move an exponent in front of a logarithm. You can also use these rules backward to combine logarithms into one expression.

WORKED EXAMPLE

Expand $\log_7(49m^3)$, where $m > 0$.

1. Use the product rule: $\log_7 49 + \log_7(m^3)$.
2. Use the power rule: $\log_7 49 + 3 \log_7 m$.
3. Since $49 = 7^2$, $\log_7 49 = 2$.

Answer: $2 + 3 \log_7 m$

PRACTICE 6 problems

1 Expand $\log(5x^4)$, where $x > 0$.

ANSWER _____

2 Write as a single logarithm: $4 \log a - \log b$, where $a > 0$ and $b > 0$.

ANSWER _____

3 Expand $\ln(8y/z^6)$, where $y > 0$ and $z > 0$.

ANSWER _____

4 Rewrite using the power rule: $\log_4(1/p^5)$, where $p > 0$.

ANSWER _____

5 Write as a single logarithm: $\log_6 m + 5 \log_6 n$, where $m > 0$ and $n > 0$.

ANSWER _____

6 Simplify $\log_5(625r) - \log_5 r$, where $r > 0$.

ANSWER _____

APPLY IT Show your work

1 An audio club compares a playlist's signal strength to a reference level with $\log_{10}(10000p)$, where $p > 0$ is the strength ratio. Write an equivalent expanded expression.

WORK SPACE

ANSWER _____

2 A photography student models an exposure setting with $\log_5(q^4/s^6)$, where $q > 0$ and $s > 0$. Write an equivalent expanded expression.

WORK SPACE

ANSWER _____

CHALLENGE One step up

Expand and simplify $\log_4(256x^8/y^4)$, where $x > 0$ and $y > 0$.

WORK SPACE AND ANSWER

ANSWER KEY

Log Power Moves

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PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Expand $\log(5x^4)$, where $x > 0$.	**$\log 5 + 4 \log x$**
2	Write as a single logarithm: $4 \log a - \log b$, where $a > 0$ and $b > 0$.	**$\log(a^4/b)$**
3	Expand $\ln(8y/z^6)$, where $y > 0$ and $z > 0$.	**$\ln 8 + \ln y - 6 \ln z$**
4	Rewrite using the power rule: $\log_4(1/p^5)$, where $p > 0$.	**$-5 \log_4 p$**
5	Write as a single logarithm: $\log_6 m + 5 \log_6 n$, where $m > 0$ and $n > 0$.	**$\log_6(mn^5)$**
6	Simplify $\log_5(625r) - \log_5 r$, where $r > 0$.	**4**

PART 2 · APPLY IT

1. **$4 + \log_{10} p$** Split the product into $\log_{10} 10000 + \log_{10} p$. Since $10000 = 10^4$, the first logarithm equals 4.
2. **$4 \log_5 q - 6 \log_5 s$** Use the quotient rule to separate the numerator and denominator. Then use the power rule on each variable.

CHALLENGE

$4 + 8 \log_4 x - 4 \log_4 y$

Accept equivalent forms with logarithm terms in a different order. Parentheses around products or quotients may vary as long as the expression remains equivalent.