6-1: Properties of Logarithms

6-1a: I can use the properties of exponents to simplify and evaluate logarithms.

6-1b: I can use the properties of logarithms to simplify and evaluate logarithms.

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EXPONENT RULES

Graphic Organizer

Name	Rule	Examples
ADDING & SUBTRACTING MONOMIALS	COMBINE LIKE TERMS!!! (DO NOT CHANGE common variables and exponents!)	1. $9x^2y - 10x^2y =$ 2. Subtract $6w$ from $8w$.
PRODUCT RULE	$x^a \cdot x^b = x^{a+b}$	1. $h^2 \cdot h^6 =$ 2. $(-2a^2b)\cdot(7a^3b) =$
POWER RULE	$(x^a)^b = x^{ab}$	1. $(x^2)^3 =$ 2. $(-2m^5)^2 \cdot m^3 =$
QUOTIENT RULE	$\frac{x^a}{x^b} = x^{a-b}$	1. $\frac{27x^5}{42x} =$ 2. $\frac{(y^2)^2}{y^4} =$
NEGATIVE EXPONENT RULE	$x^{-a} = \frac{1}{x^a}$	1. $-5x^{-2} =$ 2. $\frac{4k^2}{8k^5} =$
ZERO EXPONENT RULE	$x^0 = 1$	1. $7x^0 =$ 2. $\frac{(w^4)^2}{w^8} =$

$\boxed{\log_b a = x \; | \; b^x = a}$ $\ln = \log_e$ $e \approx 2.7$

$\log = \log_{10}$

$a^1 = a$

$\log_5$

5-2 Rules of Logarithms

Name	Property	Examples
Zero Rule	$\log_a 1 =$ 0	$\log_5 1 =$ 0 $\ln 1 =$ 0
Identity Rule	$\log_a a =$ 1	$\log_4 4 =$ 1 $\log 10 =$ 1
Inverse Properties ? $= \log_5 25$	$\log_a a^r =$ r $b^{\log_b M} =$ M	$\log_4 4^3 =$ 3 $4^? = 4^3$ $\ln e^{-0.5} =$ $5^{\log_5 25} =$ 25 $e^{\ln 24} =$ 24
Product Rule	$\log_b MN =$ $\log_b M + \log_b N$	$\log_2 5 \cdot 3 = \log_2 5 + \log_2 3$ $\log 5w =$ $\ln 6z =$
Quotient Rule	$\log_b \frac{M}{N} =$ $\log_b M - \log_b N$	$\log_7 \frac{9}{x} =$ $\ln \frac{p}{3} =$
Power Rule	$\log_b M^r = r \log_b M$	$\log_8 3^5 =$ $\log_b 5 =$

Find the value of each logarithm without using a calculator.

1. $\log_7 7$

2. $\log_{18} 18$

3. $\log_5 1$

4. $\log_9 1$

$$\log_a 1 = 0 \qquad \log_a a = 1$$

$\log_5 1$ $\qquad$ $\ln 1$

$\log_4 4$ $\qquad$ $\log 10$

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$\log_3 3^2$

$\log_5 5^8$

Without evaluating, predict what the following logs equal:

$\log_2 2^{10}$

$\log_{20} 20^7$

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[redacted]

$$\log_a a^r = r$$

$\log_4 4^3$ $\ln e^{-0.5}$

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Recall: $b^x = a \quad \Leftrightarrow \quad \log_b a = x$

$$5^{\log_5 20}$$

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[redacted]

$\log_{20} 20^7$

$$b^{\log_b M} = M$$

[redacted]

$5^{\log_5 20}$

$8^{\log_8 \sqrt{23}}$

$12^{\log_{12} \sqrt{2}}$

$10^{\log 0.2}$

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[redacted]

$$\log_b(MN) = \log_b M + \log_b N$$

[redacted]

[redacted]

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$\log_2(5 \cdot 3)$ $\ln(6z)$

Find 3 ways to expand $\log_3 24$

using this rule

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$$\log_b \frac{M}{N} =$$

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[redacted]

[redacted]

$$\log_b\left(\frac{M}{N}\right) = \log_b M - \log_b N$$

$\log_2\left(\frac{5}{3}\right)$ $\log\left(\frac{y}{5}\right)$

Find 3 ways to expand $\log_5 3$ using this rule

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q

$\log_3\left(\frac{4x}{y}\right) = \log_3 4 + \log_3 x - \log_3 y$

$\log_3\left(\frac{3m}{n}\right) = 1 + \log_3 m - \log_3 n$

$\log_3\left(\frac{q}{3p}\right) = \log_{:}$ b $+ \log_3 p$

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$$\log_2 (4)^3 = 3 \cdot \log_2 4$$

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M b $b \neq 0$

$$\log_b M^r = r \log_b M$$

$\log_8 3^5$ $\ln x^{\sqrt{3}}$

$\log_5 25$ $\log b^5$

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$\log_2(x^2 \cdot y^3)$

$\log_2 x^2 + \log_2 y^3$

$2\log_2 x + 3\log_2 y$

$\log_6 \frac{x^2}{y^3}$

$4\log_9 a + 4\log_9 b$

$\log_a 1 = 0$ $\log_a a = 1$

[redacted]

$\log_b M^r = r\log_b M$

[redacted]

$\log_a a^r = r$

[redacted]

$\log_b\left(\frac{M}{N}\right) = \log_b M - \log_b N$

[redacted]

$\log_{20} 20^7$

$b^{\log_b M} = M$

[redacted]

$\log_b(MN) = \log_b M + \log_b N$

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21) $\frac{2\log_3 x}{3}$

$\frac{\log_3 x^2}{3} = \frac{1}{3}\log_3 x^2 = \log_3 x^{\frac{2}{3}}$

$x^{\frac{2}{3}} = \sqrt[3]{x^2}$

$\log_3 \sqrt[3]{x^2}$

Day 2

$\log_5 \left(a^{-2}bc^3\right)^{-2}$

$\log_5 a^4 b^{-2} c^{-6}$

$\log_5 \frac{a^4}{b^2c^6}$

$\log\left(\frac{100x}{\sqrt{y}}\right)$

$\log_5 a^4 - \log_5 b^2 + \log_5 c^6$

$4\log_5 a - 2\log_5 b + 6\log_5 c$

$\log\left(a^2\sqrt{bc}\right)$

$\log a^2 + \log \sqrt{bc}$

$2\log a + \log (bc)^{\frac{1}{2}}$

$2\log a + \frac{1}{2}\log b + \frac{1}{2}\log c$

5) $\log_4 \left(z^4\sqrt[3]{xy}\right)$

$\log_4 z^4 \cdot x^{\frac{1}{3}} \cdot y^{\frac{1}{3}}$

$\log_4 z^4 + \log_4 x^{\frac{1}{3}} + \cancel{\log_4 y^{\frac{1}{3}}}$

5) $\log_4 \left(z^4 \sqrt[3]{xy} \right)$

Matt Blackburn

Tanner

Brett

$\log_6 3 + \log_6 12$

$\log(x-2) - \log x$

$\log_5 x - 3\log_5 2$

$\log(x-1) + \log(x+1) - 3\log x$