Section 7-4
Properties of Logarithms

Students will be able to use the properties of logs.

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Logarithms and exponents have corresponding properties.

Product property: $\log_b mn = \log_b m + \log_b n$

Quotient Property: $\log_b \frac{m}{n} = \log_b m - \log_b n$

Power Property: $\log_b m^n = n \log_b m$

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Write as a single log:

$\log_4 5x + \log_4 3x$ $\quad \log_4 (5x)(3x) = \log_4 15x^2$

$2\log_4 15x$

$2\log_4 6 - \log_4 9$

$\log_4 36 - \log_4 9 = \log_4 \frac{36}{9} = \log_4 4 = 1$

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You can use the product property and quotient property to expand a single logarithm to involve the sum or difference of two or more logs.

Expand:

$\log_3 \frac{2x}{y} = \log_3 2x - \log_3 y = \boxed{\log_3 2 + \log_3 x - \log_3 y}$

$\log_3 \frac{250}{37}$ $\quad \boxed{\log_3 250 - \log_3 37}$

$\log_3 9x^5$ $\quad \log_3 9 + 5\log_3 x$

$\boxed{2 + 5\log_3 x}$

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When you see the log button on a calculator it is used to evaluate a common log. To evaluate a log in any base, use the change of base formula.

$\log_b m = \frac{\log m}{\log b}$

Ex: $\log_8 32 = \frac{\log 32}{\log 8} \approx 1.\overline{6}$

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From pg 466 - 467

#43. Evaluate:

$\log_4 48 - \frac{1}{2}\log_4 9$ $\quad \log_4 3$

$\frac{\log 48}{\log 4} - \frac{\log 3}{\log 4} = 2$ $\quad$ | $\quad \log_4 \frac{48}{3}$

$\log_4 16 = 2$

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True or False? Justify your answer.

#51. $\log_3\frac{3}{2} = \frac{1}{2}\log_3 3$

$\log_3 1.5 \neq \log_3 \sqrt{3}$ False

#55. $\log_4 7 - \log_4 3 = \log_4 4$

$\log_4 \frac{7}{3} \neq \log_4 4$

$\log_4 \frac{7}{3} \neq 1$ False

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Write as a single log:

#57. $\frac{1}{2}(\log_x 4 + \log_x y) - 3\log_x z$

$(\log_x 4 + \log_x y)^{1/2} - \log_x z^3$

$(\log_x 4y)^{1/2} - \log_x z^3$

$\log_x \frac{\sqrt{4y}}{z^3} = \log_x \frac{2\sqrt{y}}{z^3}$

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Expand:

#67. $\log \frac{\sqrt{x^2 - 4}}{(x+3)^2}$

$\log \sqrt{x^2-4} - \log (x+3)^2$

$\log (x^2-4)^{1/2} - 2\log(x+3)$

$\log ((x+2)(x-2))^{1/2} - 2\log(x+3)$

$(x+2)^{1/2}(x-2)^{1/2}$

$\log(x+2)^{1/2} + \log(x-2)^{1/2} - 2\log(x+3)$

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Hwk: pg. 466 - 467
#10 - 34 (4th), 40 - 44 evens, 49,
50 - 68 evens, 74, 78

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