4.3 Properties of Logarithms

GOALS:
1. Learn and understand Properties of Logarithms
2. Understand the relationship between the Properties of Exponents and the Properties of Logs
3. Use Properties of Logs to expand logarithmic expressions.
4. Use Properties of Logs to rewrite expanded logarithms as a single logarithm.

Study 4.3 CVC # 1-4 all
1 - 69

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4.3 Properties of Logarithms

Properties of Logarithms

1. $\log_b (1) = 0$
2. $\log_b (b) = 1$
3. $\log_b (MN) = \log_b(M) + \log_b(N)$
4. $\log_b \frac{M}{N} = \log_b(M) - \log_b(N)$
5. $\log_b M^n = n \log_b(M)$

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4.3 Properties of Logarithms

Properties of Exponents	Properties of Logarithms
1. $b^0 = 1$	1. $\log_b (1) = 0$
2. $b^1 = b$	2. $\log_b (b) = 1$
3. $b^m b^n = b^{m+n}$	3. $\log_b (MN) = \log_b(M) + \log_b(N)$
4. $\frac{b^m}{b^n} = b^{m-n}$	4. $\log_b \frac{M}{N} = \log_b(M) - \log_b(N)$
5. $(b^m)^n = b^{mn}$	5. $\log_b M^n = n \log_b(M)$

M, N and $b > 0$, $b \neq 1$

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4.3 Properties of Logarithms

Connection between exponents and logs

3. $b^m b^n = b^{m+n}$ 3. $\log_b (MN) = \log_b(M) + \log_b(N)$

The log is the exponent.

Also, $\log_b b^m = m$ and $\log_b b^n = n$

$\log_b (b^m b^n) = m + n$

$\log_b (b^m b^n) = \log_b b^m + \log_b b^n$

Let $M = b^m$ and $N = b^n$

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

M, N and $b > 0$, $b \neq 1$

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4.3 Properties of Logarithms

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

Expand: $\log_9 (9x)$

4.3 Properties of Logarithms

Expand: $\log_9 (9x)$

$= \log_9 9 + \log_9 x$

$= 1 + \log_9 x$

4.3 Properties of Logarithms

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

Expand: $\log (10000x)$

4.3 Properties of Logarithms

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

Expand: $\log (10000x)$

$= \log_{10} 10^4 + \log x$

$= 4 + \log x$

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4.3 Properties of Logarithms

4. $\log_b \frac{M}{N} = \log_b(M) - \log_b(N)$

Expand: $\log_9 (9 / x)$

4.3 Properties of Logarithms

4. $\log_b \frac{M}{N} = \log_b(M) - \log_b(N)$

Expand: $\log_9 (9 / x)$

$$\log_9\left(\frac{9}{x}\right) = \log_9 9 - \log_9 x$$

$$= 1 - \log_9 x$$

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4.3 Properties of Logarithms

4. $\log_b \frac{M}{N} = \log_b(M) - \log_b(N)$

Expand: $\log\left(\frac{16}{x}\right)$

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4.3 Properties of Logarithms

4. $\log_b \frac{M}{N} = \log_b(M) - \log_b(N)$

Expand: $\log\left(\frac{16}{x}\right)$

$= \log 16 - \log x$

$= \log 2^4 - \log x$

$= 4\log 2 - \log x$

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4.3 Properties of Logarithms

4. $\log_b \frac{M}{N} = \log_b(M) - \log_b(N)$

Expand: $\log\left(\frac{xy}{z}\right)$

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4.3 Properties of Logarithms

4. $\log_b \frac{M}{N} = \log_b(M) - \log_b(N)$

Expand: $\log\left(\frac{xy}{z}\right)$

$= \log(xy) - \log z$

$= \log x + \log y - \log z$

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4.3 Properties of Logarithms

4. $\log_b \frac{M}{N} = \log_b(M) - \log_b(N)$

Expand: $\log\left(\frac{x}{yz}\right)$

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4.3 Properties of Logarithms

4. $\log_b \frac{M}{N} = \log_b(M) - \log_b(N)$

Expand: $\log\left(\frac{x}{yz}\right)$

$= \log x - \log y - \log z$

$\log x - \log(yz)$

$\log x - [\log y + \log z]$

$\log x - \log y - \log z$

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4.3 Properties of Logarithms

$\log_b M^n = n \log_b(M)$

Expand: $\log_b (x^7)$

4.3 Properties of Logarithms

$\log_b M^n = n \log_b(M)$

Expand: $\log_b (x^7)$

$= 7 \log_b x$

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4.3 Properties of Logarithms

Expand: $\log_4 (x /64)$

4.3 Properties of Logarithms

Expand: $\log_4 (x /64)$

$= \log_4 x - \log_4 64$

$= \log_4 x - \log_4 4^3$

$= \log_4 x - 3$

$\frac{16}{4}$

$\frac{4}{64}$

$64 = 4^3$

4.3 Properties of Logarithms

$$\log_5\left(\frac{125}{y}\right)$$

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4.3 Properties of Logarithms

$$\log_5\left(\frac{125}{y}\right) = \log_5 125 - \log_5 y$$

$$= \log_5 5^3 - \log_5 y$$

$$= 3 - \log_5 y$$

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4.3 Properties of Logarithms

$$\ln \frac{e^4}{8}$$

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4.3 Properties of Logarithms

$$\ln \frac{e^4}{8} = \ln e^4 - \ln 8 = 4 - \ln 8$$

$$\ln e^4 = 4 \ln e = 4$$

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4.3 Properties of Logarithms

$\log_b M^n = n \log_b(M)$

$\ln \sqrt[7]{x}$

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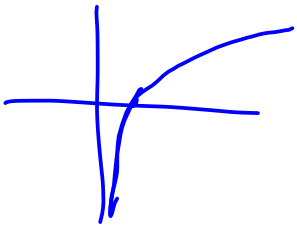
4.3 Properties of Logarithms

$\log_b M^n = n \log_b(M)$

$\ln \sqrt[7]{x} = \ln x^{\frac{1}{7}}$

$= \frac{1}{7} \ln x$



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4.3 Properties of Logarithms

$\log_8\left(\frac{64}{\sqrt{x+1}}\right)$

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4.3 Properties of Logarithms

$\log_8\left(\frac{64}{\sqrt{x+1}}\right) = \log_8 64 - \log_8 \sqrt{x+1}$

$= \log_8 64 - \log_8 (x+1)^{1/2}$

$= 2 - \frac{1}{2}\log_8 (x+1)$

$\sqrt{x+1} \neq \sqrt{x} + \sqrt{1}$

let $x = 3$, $\sqrt{4} \neq \sqrt{3} + 1$

$2 \qquad 1.73 + 1 = 2.73$

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4.3 Properties of Logarithms

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

$$\log_b \left(\frac{x^3 y}{z^2} \right)$$

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4.3 Properties of Logarithms

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

$$\log_b \left(\frac{x^3 y}{z^2} \right)$$

$$\log_b x^3 + \log_b y - \log_b z^2$$

$$3\log_b x + \log_b y - 2\log_b z$$

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4.3 Properties of Logarithms

Write as a single logarithm:

$\log x + \log y$

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

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4.3 Properties of Logarithms

Write as a single logarithm:

$\log x + \log y$

$= \log(xy)$

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

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4.3 Properties of Logarithms

Write as a single logarithm:

$$\frac{\log 250 + \log 4}{\log(3x+7) - \log x}$$

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4.3 Properties of Logarithms

Write as a single logarithm:

$$\log 250 + \log 4 = \log(250 \cdot 4) = \log(1000) = 3$$

$$\frac{3}{\log(3x+7) - \log x}$$

$$\log\left(\frac{3x+7}{x}\right)$$

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4.3 Properties of Logarithms

Write as a single logarithm:

$$2\ln x - \frac{1}{2}\ln y$$

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4.3 Properties of Logarithms

Write as a single logarithm:

$$2\ln x - \frac{1}{2}\ln y$$

$$\ln x^2 - \ln y^{1/2} = \ln \frac{x^2}{\sqrt{y}}$$

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4.3 Properties of Logarithms

Write as a single logarithm:

$4\ln x + 7\ln y - 3\ln z$

$\frac{1}{3}(\log_4 x - \log_4 y)$

4.3 Properties of Logarithms

$4\ln x + 7\ln y - 3\ln z$

$\ln x^4 + \ln y^7 - \ln z^3$

$\ln \frac{x^4 y^7}{z^3}$

$\frac{1}{3}(1\log_4 x - 1\log_4 y)$

$\frac{1}{3}\log_4\left(\frac{x}{y}\right) = \log_4\left(\frac{x}{y}\right)^{1/3} = \log_4 \sqrt[3]{\frac{x}{y}}$

Attachments

slope_intercept.mp4

InverseFunctionBase2.mp4