Properties of Logarithms

Objective: To use properties of logarithms

Just like exponents we have properties of logs.

Product Property

Quotient Property

Power Property

for any positive number m, n, and where \( b \neq 1 \)

Product Property

Quotient Property

Power Property

Rewrite the following as a single logarithm

\[
\log_4 5x + \log_4 3x = \log_4 15x^2
\]

\[
\log_4 32 - \log_4 2 = \log_4 \frac{32}{2} = \log_4 16 = 2
\]

\[
2\log_4 6 - \log_4 9 = \log_4 \frac{6^2}{9} = \log_4 4 = 1
\]

\[
6\log_3 x + 5\log_3 y = \log_3 x^6 y^5
\]

How could you expand these logarithm?

\[
\log_{5a} 250 = \log_{5a} (5a)^2 - \log_{5a} 25
\]

\[
\log_{2a} 32 = \log_{2a} (2a)^5 - \log_{2a} 5
\]

\[
\log_{3a} 27 = \log_{3a} (3a)^3 - \log_{3a} 3
\]

\[
\log_{5a} 125 = \log_{5a} (5a)^3 - \log_{5a} 5
\]
Simplify
\[ \log_b(9)^2 \]
\[ \log_b(27)^9 \]
\[ \log_b(32)^{\frac{1}{5}} \]
\[ \frac{2 \log_b 3}{\log_b 9} \]
\[ 9 \log_b 3 \]
\[ \log_b 3^3 \]
\[ 2 \log_b 3 \]
\[ 3 \log_b 3 \]
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\[ 3 \log_b 3 \]
\[ \frac{1}{2} \log_b 2 \]
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Change of Base Formula
\[ \log_b m = \frac{\log_a m}{\log_a b} \]

Method 1:
1) \[ \log_2 27 = \frac{\log_2 27}{\log_2 8} = \frac{3 \log_2 3}{3} = \frac{3}{3} \]
\[ g^x = 27 \]
\[ g = 3 \]

Method 2: use a calculator
\[ \frac{3^x}{3} = 27 \]
\[ \log_3 27 = \frac{\log_3 27}{\log_3 8} = .75 \]
\[ x = \frac{3}{4} \]

Class work:
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Homework:
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