5.3 Properties of Logarithms Pt. 1

Note Title 2012-10-19

PRODUCT LAW

$$\log xy = \log x + \log y$$

QUOTIENT LAW

$$\log \frac{x}{y} = \log x - \log y$$

$$\log w + \log x - (\log y + \log z)$$

Note: $\log \frac{wx}{yz} = \log w + \log x - \log y - \log z$

(1) Evaluate

a) $\log_5 100 + \log_5 \frac{1}{4}$

$\log_5 \left(100 \cdot \frac{1}{4}\right)$

$\log_5 25$

$\boxed{2}$

b) $\log_6 9 + \log_6 8 - \log_6 12$

$\log_6 \left(\frac{9 \cdot 8}{12}\right)$

$\log_6 6$

$\boxed{1}$

POWER LAW

$$\log x^n = n \log x$$

ROOT LAW

$$\log \sqrt[n]{x} = \log x^{\frac{1}{n}} = \frac{1}{n} \log x \text{ or } \frac{\log x}{n}$$

(2) Evaluate

a) $\log 100^5$

$5 \log_{10} 100$

$5(2)$

$\boxed{10}$

b) $\log_2 \sqrt[3]{16}$

$\log_2 16^{\frac{1}{3}}$

$\frac{1}{3} \log_2 16$

$\frac{1}{3}(4) = \boxed{\frac{4}{3}}$

c) $\log_2 2^8 + \log_2\left(\frac{1}{8}\right)^2$

$8\log_2 2 + 2\log_2\left(\frac{1}{8}\right)$

$8(1) + 2(-3)$

$8 - 6$

$\boxed{2}$

(3) Simplify / Re-write as a single logarithm.

a) $\log A - 3\log B + 5\log \sqrt[5]{C}$

$\log A - \log B^3 + \log C^{\frac{5}{5}}$

$$\log\left(\frac{AC}{B^3}\right)$$

b) $2\log B^3 - 3\log A - 4\log\sqrt{C}$

$\log B^6 - \log A^3 - \log C^{\frac{4}{2}}$

$$\log\left(\frac{B^6}{A^3C^2}\right)$$

c) $3\log_4 A^2 + \log_2 B^5 - 2\log_2 A^2$

$\log_4 (A^6)^{\frac{1}{2}} + \log_2 B^5 - \log_2 A^4$

$\log_2 A^3 + \log_2 B^5 - \log_2 A^4$

$$\log_2\left(\frac{A^3B^5}{A^4}\right)$$

$$\log_2\left(\frac{B^5}{A}\right)$$

(4) Expand

$$\log \frac{x^3}{1000y^2}$$

$$= \log x^3 - \log 1000 - \log y^2$$

$$= 3\log x - 3 - 2\log y$$

OR

$$\boxed{3\log x - 2\log y - 3}$$

(5) Express in terms of $\log 2$ and $\log 3$.

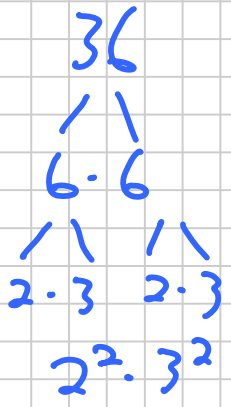
a) $\log \frac{36}{8} = \log 36 - \log 8$

$\log 2^2 \cdot 3^2 - \log 2^3$

$\log 2^2 + \log 3^2 - \log 2^3$

$2\log 2 + 2\log 3 - 3\log 2$

$\boxed{2\log 3 - \log 2}$



$$\log \frac{36}{8} = \log \frac{9}{2}$$

$$= \log 9 - \log 2$$

$$= \log 3^2 - \log 2$$

$$= 2\log 3 - \log 2$$

ОТВ

b) $\log 0.12$

$= \log \frac{12}{100}$

$= \log 12 - \log 100$

$= \log 4 \cdot 3 - 2$

$= \log 2^2 + \log 3 - 2$

$= \boxed{2\log 2 + \log 3 - 2}$

c) $\log 3.6$

$= \log \frac{36}{10}$

$= \log 36 - \log 10$

$= \log 3^2 \cdot 2^2 - \log 10$

$= \boxed{2\log 3 + 2\log 2 - 1}$

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#1-4 (a, c, e)