7.5 : apply properties of logarithms

PART 1

Properties of Logarithms

- Product Property: $\log_x mn = \log_x m + \log_x n$

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

- Power Property: $\log_x m^n = n \log_x m$

EX: use $\boxed{\log_4 3 \approx 0.792}$ and $\boxed{\log_4 7 \approx 1.404}$ to evaluate

a) $\log_4 \left(\frac{3}{7}\right) = \log_4 3 - \log_4 7 = 0.792 - 1.404 = \boxed{-0.612}$

quotient

b) $\log_4 21 = \log_4 (7 \cdot 3) = \log_4 7 + \log_4 3 = 1.404 + 0.792$

$4^? = 21$ product $= \boxed{2.196}$

c) $\log_4 49 = \log_4 (7^2) = 2\log_4 7 = 2(1.404) = \boxed{2.808}$

Try: use $\log_6 5 \approx 0.898$ & $\log_6 8 \approx 1.161$ to evaluate.

a) $\log_6 \left(\frac{5}{8}\right) = \log_6 5 - \log_6 8$

$0.898 - 1.161$

$\boxed{-0.263}$

b) $\log_6 40 =$

$\log_6 (5 \cdot 8) = \log_6 5 + \log_6 8$

$0.898 + 1.161$

$\boxed{2.059}$

c) $\log_6 64 = \log_6 (8)^2$

$2\log_6 8$

$2(1.161) =$

$\boxed{2.322}$

d) $\log_6 125 = \log_6 (5^3)$

$3\log_6 5$

$3(.898)$

$\boxed{2.694}$

Expand $\log_6\left(\dfrac{5x^3}{y}\right)$

$\log_6 5x^3 - \log_6 y$ (quotient)

$\log_6 5 + \log_6 x^3 - \log_6 y$ (product)

$\boxed{\log_6 5 + 3\log_6 x - \log_6 y}$ (power)

Which of the following is equivalent to $\log 9 + 3\log 2 - \log 3$?

ⓐ $\log 8$ ⓑ $\log 14$ ⓒ $\log 18$ ⓓ $\log 24$

$\log 9 + \log 2^3 - \log 3$

$\log 9 + \log 8 - \log 3$

$\log(9 \cdot 8) - \log 3$

$\log 72 - \log 3$

$\log \dfrac{72}{3} = \log 24$

PART 2:

CHANGE OF BASE FORMULA

Logs with any base other than __10__ or __e__ can be written using the following formula:

$$\log_c a = \frac{\log a}{\log c} \qquad \text{or} \qquad \log_c a = \frac{\ln a}{\ln c}$$

Practice! Evaluate:

① $\log_5 8 = \dfrac{\log 8}{\log 5} = 1.292$

$8^? = 14$

② $\log_8 14 \quad \dfrac{\log 14}{\log 8} \approx 1.269$

$26^? = 9$

③ $\log_{26} 9 \quad \dfrac{\log 9}{\log 26} \approx 0.674$

$\dfrac{\ln 8}{\ln 5} = 1.292$