

Logarithm Practice

1. Expand using properties of logarithms:

$$\text{a) } \log_3 rt = \boxed{\log_3 r + \log_3 t}$$

$$\text{d) } \ln \frac{u}{7} = \boxed{\ln u - \ln 7}$$

$$\text{b) } \log_f k^3 = \boxed{3 \log_f k}$$

$$\begin{aligned} \text{e) } \log_4 \frac{3y}{gh} &= \log_4 3y - (\log_4 gh) \\ &= \log_4 3 + \log_4 y - (\log_4 g + \log_4 h) \\ &= \boxed{\log_4 3 + \log_4 y - \log_4 g - \log_4 h} \end{aligned}$$

$$\begin{aligned} \text{c) } \log_5 2f^3h^4 &= \log_5 2 + \log_5 f^3 + \log_5 h^4 \\ &= \boxed{\log_5 2 + 3 \log_5 f + 4 \log_5 h} \end{aligned}$$

$$\begin{aligned} \text{f) } \log_9 \frac{2d}{5w^3} &= \log_9 2d - \log_9 5w^3 \\ &= \log_9 2 + \log_9 d - (\log_9 5 + \log_9 w^3) \\ &= \log_9 2 + \log_9 d - \log_9 5 - \log_9 w^3 \\ &= \boxed{\log_9 2 + \log_9 d - \log_9 5 - 3 \log_9 w} \end{aligned}$$

2. Write as a single logarithm using properties of logarithms: (go from left to right)

$$\begin{aligned} \text{a) } \log_2 t + \log_2 6 + \log_2 k \\ &= \log_2 t \cdot 6 \cdot k \\ &= \boxed{\log_2 6kt} \end{aligned}$$

$$\begin{aligned} \text{d) } \log_3 y - \log_3 6 - 2 \log_3 t \\ &= \log_3 y - \log_3 6 - \log_3 t^2 \\ &= \log_3 \frac{y}{6} - \log_3 t^2 \\ &= \log_3 \frac{y}{6t^2} = \log_3 \frac{y}{6} \cdot \frac{1}{t^2} = \boxed{\log_3 \frac{y}{6t^2}} \end{aligned}$$

$$\begin{aligned} \text{b) } 2 \log_4 m + 5 \log_4 n + \log_4 k \\ &= \log_4 m^2 + \log_4 n^5 + \log_4 k \\ &= \log_4 m^2 \cdot n^5 \cdot k \\ &= \boxed{\log_4 n^5 m^2 k} \end{aligned}$$

$$\begin{aligned} \text{e) } 2 \log_6 t + 3 \log_6 t + 5 \log_6 t \\ &= \log_6 t^2 + \log_6 t^3 + \log_6 t^5 \\ &= \log_6 t^2 \cdot t^3 \cdot t^5 \\ &= \boxed{\log_6 t^{10}} \end{aligned}$$

Argument the same
Add like terms
= 10 log₆ t
= log₆ t¹⁰ ✓

$$\begin{aligned} \text{c) } \frac{1}{2} \log_8 a + \frac{1}{3} \log_8 b \\ &= \log_8 a^{\frac{1}{2}} + \log_8 b^{\frac{1}{3}} \\ &= \log_8 a^{\frac{1}{2}} \cdot b^{\frac{1}{3}} \\ &= \boxed{\log_8 a^{\frac{1}{2}} b^{\frac{1}{3}}} \text{ or } \boxed{\log_8 \sqrt{a} \cdot \sqrt[3]{b}} \end{aligned}$$

$$\begin{aligned} \text{f) } \ln x - 3 \ln x + 2 \ln x \\ &= \ln x - \ln x^3 + \ln x^2 \\ &= \ln \frac{x}{x^3} + \ln x^2 \\ &= \ln \frac{x}{x^3} \cdot x^2 = \ln \frac{x^3}{x^3} = \ln 1 = \boxed{0} \end{aligned}$$

Argument the same
Add like terms
= 0 · ln x = 0 ✓