

Expanding and Condensing Logarithms

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Expand each logarithm. Justify each step by stating logarithm property used.**Level 2:**

1) $\log_7 \sqrt[3]{10}$

2) $\log_9 11^5$

3) $\log_8 \frac{u}{v}$

4) $\log_3 \sqrt[3]{x}$

5) $\ln x^3$

6) $\log_8 (x \cdot y)$

Level 3:

7) $\log_3 \left(\frac{x}{y}\right)^4$

8) $\log_4 \frac{8^4}{7}$

9) $\log_4 \left(\frac{7}{12}\right)^5$

10) $\log_6 (a \cdot b \cdot c)$

11) $\log_5 \frac{x^5}{y}$

12) $\log_6 \sqrt[3]{u^2}$

Level 4:

13) $\log_9 \left(\frac{x^5}{y}\right)^6$

14) $\log_8 (x \cdot y \cdot z^6)$

15) $\ln (x \cdot y \cdot z^6)$

16) $\log_8 (w^3 \sqrt[3]{u})$

17) $\log_7 \left(\frac{a^5}{b}\right)^4$

18) $\log_2 (u^3 v^4)$

Condense each expression to a single logarithm. Justify each step by stating the logarithm property used.**Level 2:**

19) $\frac{\ln x}{3}$

20) $\log_4 x - \log_4 y$

21) $2 \ln a$

22) $\log_5 u - \log_5 v$

23) $6 \log_6 7$

24) $\log_5 x + \log_5 y$

Level 3:

25) $3 \log_2 x - 3 \log_2 y$

26) $5 \log u - \log v$

27) $3 \log_7 a - 3 \log_7 b$

28) $\log_7 12 - 5 \log_7 5$

29) $5 \log_9 6 - 5 \log_9 11$

30) $\log_8 x - 5 \log_8 y$

Level 4:

31) $30 \log a + 6 \log b$

32) $\log_3 c + \frac{\log_3 a}{2} + \frac{\log_3 b}{2}$

33) $\log_5 z + \frac{\log_5 x}{2} + \frac{\log_5 y}{2}$

34) $6 \ln x - 36 \ln y$

35) $5 \log_3 x - 2 \log_3 y$

36) $3 \log_6 u - 18 \log_6 v$

Alg 2 task 7-2 EVENS

$$\textcircled{2} \log_9 11^5 = \boxed{5 \log_9 11} \quad \text{Power Rule}$$

$$\textcircled{4} \log_3 \sqrt[3]{x} = \log_3 x^{1/3} = \boxed{\frac{1}{3} \log_3 x} \quad \text{Power Rule}$$

Exponent
Laws

$$\textcircled{6} \log_8(xy) = \log_8 x + \log_8 y \quad \text{Product Rule}$$

$$\textcircled{8} \log_4 \left(\frac{8^4}{7} \right) = \log_4 8^4 - \log_4 7 \quad \text{Quotient}$$
$$= \boxed{4 \log_4 8 - \log_4 7} \quad \text{Power}$$

but

$$4^x = 8$$

$$(2^2)^x = 2^3$$

$$2^{2x} = 2^3$$

$$2x = 3$$

$$\boxed{x = 3/2}$$

$$= 4 \log_4 (4 \cdot 2) - \log_4 7 \quad \text{Alg}$$
$$= 4 [\log_4 4 + \log_4 2] - \log_4 7 \quad \text{Product}$$

$$= 4 \left[1 + \frac{1}{2} \right] - \log_4 7$$

$$= 4 \left(\frac{3}{2} \right) - \log_4 7$$

$$= \frac{6}{2} - \log_4 7$$

$$= \boxed{6 - \log_4 7}$$

Best
Answer

$$\textcircled{10} \log_6 (a \cdot b \cdot c) = \boxed{\log_6 a + \log_6 b + \log_6 c}$$

Product Rule

$$\textcircled{12} \log_6 \sqrt[3]{4^2} = \log_6 4^{2/3} = \boxed{\frac{2}{3} \log_6 4}$$

exp law Power Rule

$$\textcircled{14} \log_8 (x \cdot y \cdot z^6) = \log_8 xy + \log_8 z^6$$

Product Rule

$$= \log_8 x + \log_8 y + \log_8 z^6$$

Product Rule

$$= \boxed{\log_8 x + \log_8 y + 6 \log_8 z}$$

$$\textcircled{16} \log_8 w^3 \sqrt[3]{4} = \log_8 w^3 4^{1/3} \quad \text{Exponent Rule}$$

$$\log_8 w^3 + \log_8 4^{1/3} \quad \text{Product Rule}$$

$$\boxed{3 \log_8 w + \frac{1}{3} \log_8 4}$$

$$\text{Power Rule}$$

$$(18) \log_2(u^3 v^4) = \log_2 u^3 + \log_2 v^4$$

Product Rule

$$= \boxed{3 \log_2 u + 4 \log_2 v}$$

Power Rule

$$(20) \log_4 x - \log_4 y = \boxed{\log_4 \left(\frac{x}{y} \right)}$$

Quotient Rule

$$(22) \log_5 u - \log_5 v = \boxed{\log_5 \left(\frac{u}{v} \right)}$$

Quotient Rule

$$(24) \log_5 x + \log_5 y = \boxed{\log_5 xy}$$

Product Rule

$$(26) 5 \log_4 u - \log_4 v = \log_4 u^5 - \log_4 v$$

Power Rule

$$= \boxed{\log_4 \left(\frac{u^5}{v} \right)}$$

Quotient Rule

$$(28) \log_7 12 - 5 \log_7 5 = \log_7 12 - \log_7 5^5$$

$$= \boxed{\log_7 \left(\frac{12}{5^5} \right)}$$

$$= \log_7 \left(\frac{12}{3125} \right)$$

Power Rule
Quotient Rule

$$\begin{aligned} \textcircled{30} \log_8 X - 5 \log_8 y &= \log_8 X - \log_8 y^5 && \text{Power Rule} \\ &= \boxed{\log_8 \left(\frac{X}{y^5} \right)} && \text{Quotient Rule} \end{aligned}$$

$$\begin{aligned} \textcircled{32} \log_3 C + \frac{\log_3 9}{2} + \frac{\log_3 b}{2} \\ \log_3 C + \frac{1}{2} \log_3 9 + \frac{1}{2} \log_3 b & \text{ (a/b) } \\ \log_3 C + \log_3 a^{1/2} + \log_3 b^{1/2} & \text{ Power Rule} \\ \boxed{\log_3 C \cdot a^{1/2} b^{1/2}} & \text{ Product Rule} \\ \boxed{\log_3 C \sqrt{ab}} & \end{aligned}$$

$$\begin{aligned} \textcircled{34} 6 \ln X - 36 \ln y &= \ln X^6 - \ln y^{36} && \text{Power Rule} \\ &= \boxed{\ln \left(\frac{X^6}{y^{36}} \right)} && \text{Quotient Law} \end{aligned}$$

$$\begin{aligned} \textcircled{36} 3 \log_6 u - 18 \log_6 v &= \log_6 u^3 - \log_6 v^{18} && \text{Power Law} \\ &= \boxed{\log_6 \frac{u^3}{v^{18}}} && \text{Quotient Law} \end{aligned}$$

