

8.3 Properties of Logarithms

SOLUTIONS

PRACTICE

DIRECTIONS: Expand each logarithm.

1) $\log_2 3x$

$\log_2 3 + \log_2 x$

2) $\log_5 \frac{4}{c}$

$\log_5 4 - \log_5 c$

3) $\log_9 3h^3$

$$\begin{aligned} &\log_9 3 + \log_9 h^3 \\ &\boxed{\log_9 3 + 3 \log_9 h} \end{aligned}$$

4) $\log_6 \frac{5h}{4}$

$\log_6 5 + \log_6 h - \log_6 4$

5) $\log(5t)^{x+2}$

$$\begin{aligned} &\log 5^{x+2} + \log t^{x+2} \\ &\boxed{(x+2)\log 5 + (x+2)\log t} \end{aligned}$$

6) $\ln \sqrt{2h}^h$

$$\begin{aligned} \ln(\sqrt{2h})^h &= \ln 2^{\frac{1}{2}h} + \ln h^h \\ &= \frac{1}{2} \ln 2 + \frac{1}{2} h \ln h \end{aligned}$$

DIRECTIONS: Condense each logarithm.

7) $\log_4 6 + \log_4 2$

$= \log_4 6(2)$

$\boxed{= \log_4 12}$

8) $\log_7 8 - \log_7 x$

$\log_7 \frac{8}{x}$

9) $\frac{1}{2} \log_2 x$

$\log_2 x^{\frac{1}{2}} = \boxed{\log_2 \sqrt{x}}$

10) $4 \ln x + \ln 5$

$\ln x^4 + \ln 5$

$\boxed{\ln 5x^4}$

11) $\log_3 6 + \log_3 y - \log_3 2$

$\log_3 \frac{6y}{2}$

12) $3 \log x - 2 \log y - \log z$

$\log x^3 - \log y^2 - \log z$

$\boxed{\log \frac{x^3}{y^2 z}}$

DIRECTIONS: Simplify.

13) $\log_4 40 + \log_4 25.6$

$$\begin{aligned} &\log_4 (4)(10)(6.4) \\ &x = \log_4 1024 \quad \boxed{4^x = 4} \\ &4^x = 1024 \quad \boxed{x = 5} \end{aligned}$$

14) $\log_3 81^2 + \log_6 6^{2x}$

$$\begin{aligned} &2 \log_3 81 + 2x \log_6 6 \\ &2(\log_3 3^4) + 2x(1) \\ &2(4) + 2x \\ &\boxed{8+2x} \end{aligned}$$

15) $\log_2 60 + \log_2 12.8 - \log_2 6$

$$\begin{aligned} &\log_2 \frac{60(12.8)}{6} = \log_2 \frac{768}{6} \\ &x = \log_2 128 \\ &2^x = 128 \\ &\boxed{2^7 = 128 \rightarrow x = 7} \end{aligned}$$

14) $\log_{x-3} (x-3)^3$

 $\textcircled{3}$

15) $\log_{x+2} (x^2 + 4x + 4)^4 + \log_5 5$

$$\begin{aligned} &= \log_{x+2} ((x+2)^4)^4 + 1 \\ &= \log_{x+2} (x+2)^8 + 1 \\ &= 8+1 \\ &= \textcircled{9} \end{aligned}$$

16) $\log_3 27 + \log_3 54 - \log_3 2$

$$\begin{aligned} &\log_3 \frac{27(54)}{2} = \log_3 \frac{1458}{2} \\ &x = \log_3 729 \\ &3^x = 729 \\ &3^x = 3^6 \quad \boxed{x = 6} \end{aligned}$$

Solve. Express your radical solutions in the simplest form.

17) $(3y)^2 + 10 = -18$

$$\begin{aligned} &-10 \quad 10 \\ &\hline \sqrt{(3y)^2} = \sqrt{-28} \\ &3y = \pm \sqrt{-4\sqrt{7}} \\ &\frac{3y}{3} = \pm \frac{2\sqrt{7}}{3} \\ &\boxed{y = \pm \frac{2\sqrt{7}}{3}} \end{aligned}$$

18) $(2t+3)^2 + 39 = 3$

$$\begin{aligned} &-39 \quad -39 \\ &\hline \sqrt{(2t+3)^2} = \sqrt{36} \\ &2t+3 = \pm 6 \\ &2t = \frac{\pm 6 - 3}{2} \\ &t = \frac{\pm 6 - 3}{2} = \boxed{\frac{\pm 3i - 3}{2}} \end{aligned}$$