

14.4 Properties of logs

expand

$$\log_3 \left(\frac{81 \sqrt{x}}{y^3} \right)$$

$$\log_3 81 + \log_3 x^{\frac{1}{2}} - \log_3 y^3$$

$$4 + \frac{1}{2} \log_3 x - 3 \log_3 y$$

write as a single log

$$\textcircled{3} \log_2 X + \textcircled{\frac{1}{3}} \log_2 y - 5 \log_2 (z-1)$$

$$\log_2 X^3 \textcircled{+} \log_2 \sqrt[3]{y} \textcircled{-} \log_2 (z-1)^5$$

$$\log_2 \frac{X^3 \sqrt[3]{y}}{(z-1)^5}$$

35. $\log_5 \sqrt[3]{\frac{x^2 y}{25}}$ expand

$$\log_5 \left(\frac{x^2 y}{25} \right)^{\frac{1}{3}}$$

$$\log_5 \frac{x^{\frac{2}{3}} y^{\frac{1}{3}}}{25^{\frac{1}{3}}}$$

$$\log_5 x^{\frac{2}{3}} + \log_5 y^{\frac{1}{3}} - \log_5 25^{\frac{1}{3}}$$

$$\frac{2}{3} \log_5 x + \frac{1}{3} \log_5 y - \frac{1}{3} \log_5 25 \quad \textcircled{2}$$

$$\boxed{\frac{2}{3} \log_5 x + \frac{1}{3} \log_5 y - \frac{2}{3}}$$

Write as a single log

59. $\frac{1}{2}(\log_5 x \oplus \log_5 y) - 2\log_5(x+1)$

$$\frac{1}{2}\log_5 x + \frac{1}{2}\log_5 y - 2\log_5(x+1)$$

$$\log_5 \sqrt{x} \oplus \log_5 \sqrt{y} - \log_5 (x+1)^2$$

$$\log_5 \sqrt{xy} \ominus \log_5 (x+1)^2$$

$$\log_5 \frac{\sqrt{xy}}{(x+1)^2}$$

Properties $a > 0, a \neq 1$

$$1) \log_a a = 1$$

$$2) \log_a 1 = 0$$

$$3) \log_a (a^x) = x$$

$$4) a^{\log_a x} = x$$

5) Change of Base Formula

$$\log_7 7 = 1$$

$$\log_{12} 12 = 1$$

$$\log_{\underline{5}} 5 = 1$$

$$\log_{\frac{5}{15}} 3 = 3$$

$$\log_{12} 1 = 0$$

$$2^{\log_2 7} = 7$$

$$\log_7 1 = 0$$

calculator

$$\begin{cases} \log_{10} x = \log x \\ \log_e x = \ln x \end{cases}$$

$$2 < \log \textcircled{7} < 3$$

$\textcircled{2}$

$$\frac{\log(7)}{\log(2)} \approx 2.807 \approx \frac{\ln(7)}{\ln(2)}$$

$$2 < \log_5 30 < 3$$

$$\frac{\log(30)}{\log 5} \approx 2.113$$

$$\log_{\pi} e \approx \frac{\log e}{\log \pi} \approx 0.874$$

$$= \frac{\cancel{\ln} e}{\ln \pi} = \frac{1}{\ln(\pi)}$$

$$\log_4 32 = x \quad \text{evaluate without a calculator}$$

$$4^x = 32$$

$$2^{2x} = 2^5$$

$$2x = 5$$

$$x = 5/2$$

$$\log_4 32 = \frac{\log_2 32}{\log_2 4} = \frac{5}{2}$$

$$\log_{25} \underline{125} = \frac{\log_5 125}{\log_5 25} = \left(\frac{3}{2} \right)$$

78. $\log_5 x = 5\log_5 2 - \log_5 4$ Solve

→ write as
a single
log

$$\log_5 x = \log_5 2^5 - \log_5 4$$

$$\log_5 x = \log_5 \left(\frac{32}{4} \right)$$

$$\log_5 x = \log_5 8$$

$$x = 8$$

Solve

$$77. \log_5 x = 4 \log_5 2 - \log_5 8$$

$$\log_5 x = \log_5 2^4 - \log_5 8$$

$$\log_5 x = \log_5 \left(\frac{16}{8} \right)$$

$$\log_5 x = \log_5 2$$

$$x = 2$$