4.4 WS

KEY

Use the properties of logarithms to expand the following logarithmic expressions. Assume all variable expressions represent positive real numbers. When possible, evaluate logarithmic expressions.

1. $\log_2 \frac{\sqrt{x}}{y^3}$

$\frac{1}{2}\log_2 x - 3\log_2 y$

2. $\log_b\left(x\sqrt[3]{y}\right)$

$\log_b x + \frac{1}{3}\log_b y$

3. $\log_7 \frac{\sqrt{xz}}{y^2}$

$\frac{1}{2}\log_7 x + \frac{1}{2}\log_7 z - 2\log_7 y$

4. $\ln\sqrt{\frac{x}{x+5}}$

$\frac{1}{2}\ln x - \frac{1}{2}\ln(x+5)$

5. $\ln\left(\frac{m^2 n}{\sqrt{x+4}}\right)$

$2\ln m + \ln n - \frac{1}{2}\ln(x+4)$

6. $\ln\left(\sqrt[3]{x^2\sqrt{y}}\right)$

$\frac{2}{3}\ln x + \frac{1}{6}\ln y$

Use the properties of logarithms to rewrite each expression as a single logarithm with a coefficient of 1. Assume all variable expressions represent positive real numbers.

7. $2\log x + \log y - \frac{1}{2}\log y$

$\log\left(\frac{x^2 y}{\sqrt{y}}\right)$

$\log\left(x^2\sqrt{y}\right)$

8. $\ln(xy) + 3\ln\left(\frac{y}{z}\right) - 2\ln(xyz)$

$\ln\left(\frac{xy\left(\frac{y}{z}\right)^3}{(xyz)^2}\right)$

$\ln\left(\frac{xy^4 z^{-3}}{x^2 y^2 z^2}\right)$

$\ln\left(\frac{y^2}{xz^5}\right)$

9. $\log(3x) - (2\log x - \log y)$

$\log(3x) - \log\left(\frac{x^2}{y}\right)$

$\log\left(\frac{3x}{\frac{x^2}{y}}\right) = \log\left(3x\left(\frac{y}{x^2}\right)\right)$

$\log\left(\frac{3y}{x}\right)$

Evaluate the logarithm. Round to the nearest ten-thousandth.

10. $\log_8\left(\frac{3}{5}\right)$ -.2457

11. $\log_9\sqrt{17}$ 0.6447

12. $\log_{\sqrt{2}} 17$ 8.1749

13. $\log_\pi e$ 0.8736

Find the domain of each of the following logarithmic functions.

14. $f(x)=\log(x-9)$

$x-9>0$

$x>9$

D_x of $f(x)$: $\{x \mid x>9\}$ or $(9,\infty)$

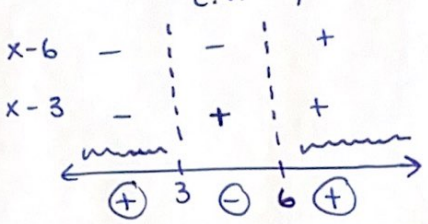
15. $f(x)=\log_7\left(x^2-9x+18\right)$

$x^2-9x+18>0$

$-6\ \ -3$

$(x-6)(x-3)>0$

C.V. 6, 3

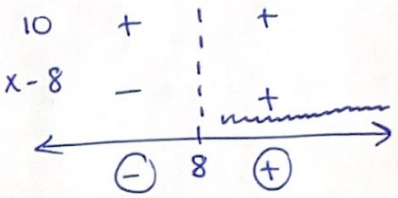


D_x of $f(x)$: $(-\infty,3)\cup(6,\infty)$

16. $f(x)=\log_2\left(\frac{10}{x-8}\right)$

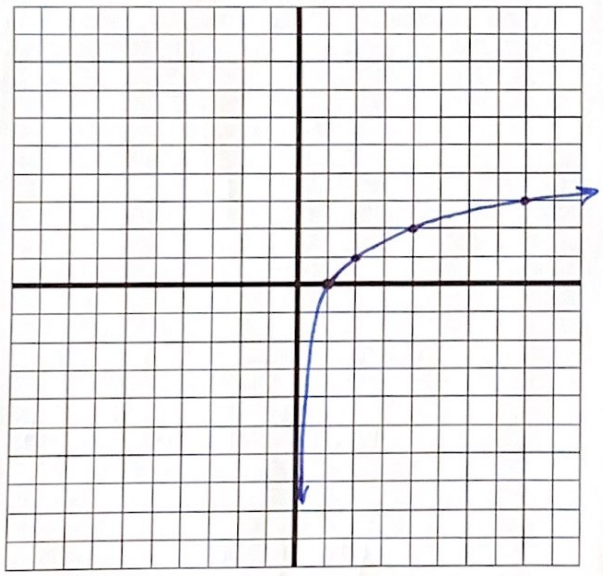
$\frac{10}{x-8}>0$

C.V. 8



D_x of $f(x)$: $(8,\infty)$ or $\{x \mid x>8\}$

17. Graph: $f(x)=\log_2 x$



18. Graph: $f(x)=\log_{1/6} x$