8-5 Properties of Logarithms Homework

Name Master E

Date _____ Block _____

Evaluate each expression without using a calculator.

1. $\log_2 \frac{1}{32}$ (-5)

2. $\log \frac{1}{1000}$ (-3)

3. $\log_8 4$ $8^x = 4$, $2^{3x} = 2^2$, $3x = 2$, $x = \frac{2}{3}$

4. $\log_{16} 8$ $16^x = 8$, $2^{4x} = 2^3$, $4x = 3$, $x = \frac{3}{4}$

5. $\log_{27} \frac{1}{9}$ $27^x = \frac{1}{9}$, $3^{3x} = 3^{-2}$, $3x = -2$, $x = -\frac{2}{3}$

6. $\log_{100} \frac{1}{1000}$ $100^x = \frac{1}{1000}$, $10^{2x} = 10^{-3}$, $2x = -3$, $x = -\frac{3}{2}$

7. $\log_3 243$ (5)

8. $\log_2 2$ (1)

9. $6^{\log_6 4x}$ (4x)

10. $\log_{\frac{1}{3}} 9$ $\left(\frac{1}{3}\right)^x = 9$, $3^{-x} = 3^2$, $x = -2$

11. $\log_{\frac{1}{2}} \frac{1}{32}$ (5)

12. $\log_3 3^{-2.16}$ (-2.16)

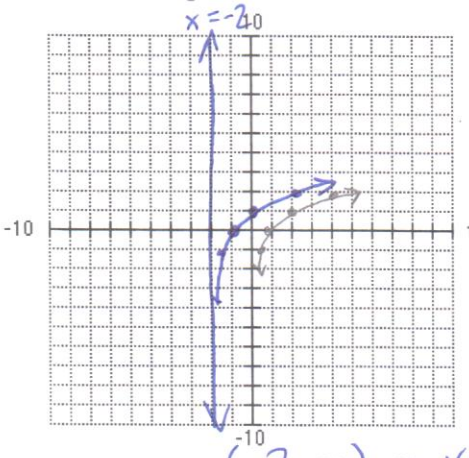
13. $\log_{\frac{1}{3}} \left(\frac{1}{3}\right)^{16}$ (16)

14. $3^{\log_2 8} \rightarrow \log_2 8 = 3$! $3^3 =$ (27)

15. $\log_{13} 169^{3x}$ $\log_{13} 13^{2(3x)}$ (6x)

Graph each function. State the domain and range and write the equation of the asymptote.

16. $f(x) = \log_2 (x + 2)$



$\log_2 x$, $\leftarrow 2$

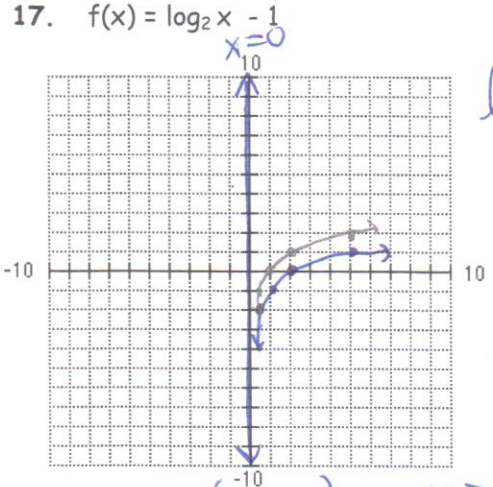
(1,0)
(2,1)
(4,2)
($\frac{1}{2}$,-1)

domain: $(-2, \infty)$ or $x > -2$

range: $(-\infty, \infty)$ or $\mathbb{R}$

asymptote: $x = -2$

17. $f(x) = \log_2 x - 1$



$\log_2 x$, $\downarrow 1$

domain: $(0, \infty)$ or $x > 0$

range: $(-\infty, \infty)$ or $\mathbb{R}$

asymptote: $x = 0$

Identify the equation of the asymptote of each function.

18. $f(x) = \log_3 x$ $x=0$

19. $f(x) = \log_2 (x - 4)$ $x=4$

20. $f(x) = \log_4 (x + 2) - 3$ $x=-2$

Expand each expression.

21. $\log (8x)$ $\log 8+\log x$

22. $\log_3 xyz$ $\log_3 x+\log_3 y+\log_3 z$

23. $\log_4 \frac{2xy}{z}$ $\log_4 2+\log_4 x+\log_4 y-\log_4 z$

24. $\ln \frac{x}{yz}$ $\ln x-\ln y-\ln z$

25. $\log \sqrt{3xy}$ $(3xy)^{\frac{1}{2}}$ $\frac{1}{2}(\log 3+\log x+\log y)$ $\frac{1}{2}\log 3+\frac{1}{2}\log x+\frac{1}{2}\log y$

26. $\log_5 \frac{\sqrt{x}}{y} \to x^{\frac{1}{2}}$ $\frac{1}{2}\log_5 x-\log_5 y$

27. $\ln \frac{3y}{\sqrt[4]{x}} \to x^{\frac{1}{4}}$ $\ln 3+\ln y-\frac{1}{4}\ln x$

28. $\log (3xyz^2)^3$ $3(\log 3+\log x+\log y+2\log z)$ $3\log 3+3\log x+3\log y+6\log z$

29. $\log_2 \frac{(xy)^4}{z^2}$ $\frac{x^4y^4}{z^2}$ $4\log_2 x+4\log_2 y-2\log_2 z$

Condense each expression.

30. $\log_2 x + \log_2 7$ $\log_2 7x$

31. $\log_3 (x + 5) + \log_3 4$ $\log_3 4(x+5)$ $\log_3 4x+20$

32. $3 \log_5 y + 2 \log_5 z$ $\log_5 y^3+\log_5 z^2$ $\log_5 y^3z^2$

33. $\log 3 - \log 4 - \log 7$ $\log \frac{3}{4\cdot 7} = \log \frac{3}{28}$

34. $\ln x - \ln y + \ln z + \ln 3$ $\ln \frac{x}{y}+\ln 3z$ $\ln \frac{3xz}{y}$

35. $3 \ln x - 2\ln y - 4 \ln z$ $\ln x^3-\ln y^2-\ln z^4$ $\ln \frac{x^3}{y^2z^4}$

36. $\log_2 (x - 4) + 2 \log_2 (x + 1) - \log_2 (x + 3)$ $\log_2 \frac{(x-4)(x+1)^2}{(x+3)}$

37. $3(\log_7 x + \log_7 y^2 - \log_7 z)$ $3(\log_7 \frac{xy^2}{z}) \Rightarrow \log_7 \left(\frac{xy^2}{z}\right)^3$ $\log_7 \frac{x^3y^6}{z^3}$

Use $\log_5 3 \approx 0.6826$, $\log_5 4 \approx 0.8614$ to approximate the value of each expression.

38. $\log_5 12$ $\log_5 3\cdot 4$ $\log_5 3+\log_5 4$ $.6826+.8614$ 1.544

39. $\log_5 100$ $\log_5 25\cdot 4$ $\log_5 25+\log_5 4$ $2+.8614$ 2.8614

40. $\log_5 0.75$ $\log_5 \frac{3}{4}$ $\log_5 3-\log_5 4$ $.6826-.8614$ $-.1788$

41. $\log_5 \frac{81}{5}$ $\log_5 \frac{3^4}{5}$ $4\log_5 3-\log_5 5$ $4(.6826)-1$ 1.7304

*Use the change-of-base formula to rewrite the function in terms of common logarithms. *(See 8-6)*

42. $y = \log_3 x$ $y=\frac{\log x}{\log 3}$

43. $y = \log_6 (x + 3)$ $y=\frac{\log x+3}{\log 6}$

44. $y = \log_3 (x - 1) + 4$ $y=\frac{\log x-1}{\log 3}+4$