Warm up

1. Evaluate without a calculator.

a. $y = \log_5 \frac{1}{5}$ $= \log_5 5^{-1} = -1$

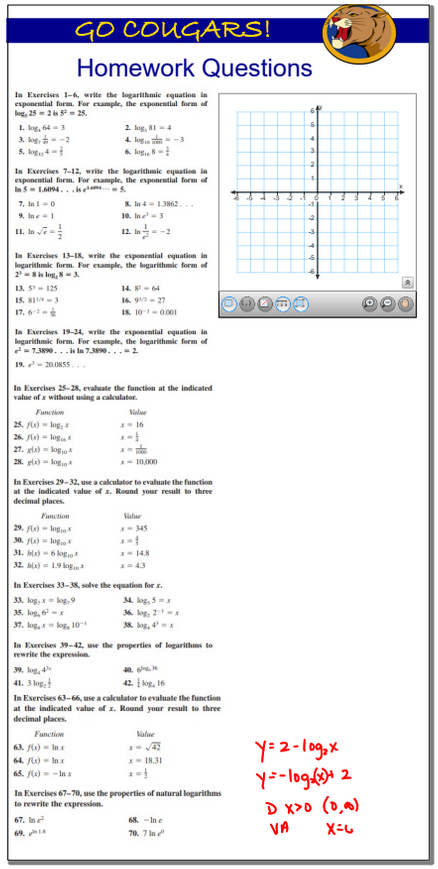
b. $y = \log_2 32$

c. $y = \log 10^2$

d. $y = \ln e$

e. $y = \log_{12} 1$

Nov 7-6:27 AM



GO COUGARS!

Homework Questions

In Exercises 1–6, write the logarithmic equation in exponential form. For example, the exponential form of $\log_2 25 = 2$ is $5^2 = 25$.

1. $\log_6 64 = 3$
2. $\log_3 81 = 4$
3. $\log_5 \frac{1}{25} = -2$
4. $\log_{10} \frac{1}{1000} = -3$
5. $\log_{13} 4 = \frac{2}{3}$
6. $\log_{16} 8 = \frac{3}{4}$

In Exercises 7–12, write the logarithmic equation in exponential form. For example, the exponential form of $\ln 5 = 1.6094 \ldots$ is $e^{1.6094 \ldots} = 5$.

7. $\ln 1 = 0$
8. $\ln 4 = 1.3862 \ldots$
9. $\ln e = 1$
10. $\ln e^3 = 3$
11. $\ln \sqrt{e} = \frac{1}{2}$
12. $\ln \frac{1}{e^2} = -2$

In Exercises 13–18, write the exponential equation in logarithmic form. For example, the logarithmic form of $2^3 = 8$ is $\log_2 8 = 3$.

13. $5^3 = 125$
14. $8^2 = 64$
15. $81^{1/4} = 3$
16. $9^{3/2} = 27$
17. $6^{-2} = \frac{1}{36}$
18. $10^{-3} = 0.001$

In Exercises 19–24, write the exponential equation in logarithmic form. For example, the logarithmic form of $e^2 = 7.3890 \ldots$ is $\ln 7.3890 \ldots = 2$.

19. $e^3 = 20.0855 \ldots$

In Exercises 25–28, evaluate the function at the indicated value of x without using a calculator.

Function	Value
25. $f(x) = \log_2 x$	$x = 16$
26. $f(x) = \log_{16} x$	$x = \frac{1}{4}$
27. $g(x) = \log_{10} x$	$x = \frac{1}{1000}$
28. $g(x) = \log_{10} x$	$x = 10{,}000$

In Exercises 29–32, use a calculator to evaluate the function at the indicated value of x. Round your result to three decimal places.

Function	Value
29. $f(x) = \log_{10} x$	$x = 345$
30. $f(x) = \log_{10} x$	$x = \frac{4}{5}$
31. $h(x) = 6 \log_{10} x$	$x = 14.8$
32. $h(x) = 1.9 \log_{10} x$	$x = 4.3$

In Exercises 33–38, solve the equation for x.

33. $\log_3 x = \log_3 9$
34. $\log_5 5 = x$
35. $\log_6 6^x = x$
36. $\log_2 2^{-1} = x$
37. $\log_8 x = \log_8 10^{-1}$
38. $\log_4 4^x = x$

In Exercises 39–42, use the properties of logarithms to rewrite the expression.

39. $\log_4 4^{2x}$
40. $6^{\log_6 36}$
41. $3 \log_2 \frac{1}{2}$
42. $\frac{1}{2} \log_4 16$

In Exercises 63–66, use a calculator to evaluate the function at the indicated value of x. Round your result to three decimal places.

Function	Value
63. $f(x) = \ln x$	$x = \sqrt{42}$
64. $f(x) = \ln x$	$x = 18.31$
65. $f(x) = -\ln x$	$x = \frac{1}{7}$

In Exercises 67–70, use the properties of natural logarithms to rewrite the expression.

67. $\ln e^2$
68. $-\ln e$
69. $e^{\ln 1.8}$
70. $7 \ln e^0$

$y = 2 - \log_2 x$

$y = -\log_2(x) + 2$

D $x > 0$ $(0, \infty)$

VA $x = 0$

Feb 2-9:51 PM

3.3 Properties of Logs

Change of base

More Properties of logs

Expand Logs

Condense Logs

Oct 23-10:48 AM

Change of Base

If asked to evaluate $\log_3 4$ → $\frac{\log 4}{\log 3}$

Change of base says $\frac{\log_b x}{\log_b a} = \frac{\log_{10} x}{\log_{10} a} = \frac{\ln x}{\ln a}$

base b base 10 base e

$\log_5 62 = \frac{\log 62}{\log 5}$ or $\frac{\ln 62}{\ln 5} = 2.56$

$5^0 = 1$
$5^1 = 5$
$5^2 = 25$ — 62 between 2 & 3
$5^3 = 125$

Oct 23-10:49 AM

Properties of Logs

$x^2 \cdot x^3 = x^5$

$\log_a mn = \log_a m + \log_a n$ ⟶ Each m or n must be a single # or variable

$\frac{x^3}{x^2} = x^1$

$\log_a \frac{m}{n} = \log_a m - \log_a n$

$\log_a m^n = n \log_a m$

$= \log_a(m \cdot m \cdot m \cdot m \cdots)$ n times

$\log_a m + \log_a m + \log_a m \cdots$ n times

$n \log_a m$

$\log_a \frac{1}{m} = \log_a m^{-1} = -1 \log_a m$

Oct 23-10:57 AM

Expand

$\log_a 3x^3y^4 = \log_a 3 + \log_a x^3 + \log_a y^4$

$\log_a 3 + 3\log_a x + 4\log_a y$

$\sqrt{y} = y^{\frac{1}{2}}$

$\ln \frac{x^3\sqrt{y}}{z^4w} = (\ln x^3 + \ln \sqrt{y}) - (\ln z^4 + \ln w)$

$3\ln x + \frac{1}{2}\ln y - 4\ln z - \ln w$

$(x-1)(x+1)$

$\ln\left(\frac{(x^2-1)}{x}\right) = \ln(x-1) + \ln(x+1) - \ln x$

ln & log cannot be distruted over a polynomial

Oct 23-11:01 AM

Condense Logs

⇒ single log

base needs to be the same

$\log_2 7 + 4\log_2 x$

$\log_2 7 + \log_2 x^4 = \log_2(7x^4)$

$2\log_4(x-2) - \log_4 x$

$\log_4 (x-2)^2 - \log_4 x = \log_4\left(\frac{(x-2)^2}{x}\right)$

$-\log_4 x + \log_4 (x-2)^2 =$

$-6\log x + 4\log y - \log z$

$\log\left(\frac{y^4}{x^6 z}\right)$

Oct 25-12:00 PM

Evaluate

$\log_2 4 + \log_3 27 - \log 100$

$\log_2 2^2 \quad \log_3 3^3 \quad \log_{10} 10^2$

$2 + 3 - 2$

3

$\log_3 18 - \log_3 2$

$\log_3\left(\frac{18}{2}\right) = \log_3 9 = \log_3 3^2 = 2$

Oct 25-12:01 PM

HOMEWORK

p 211 5-13 odd, 39, 43, 47, 49, 55,

61, 67, 71-75 odd, 81-91 odd

Aug 29-6:38 AM