9.6

SM3 Properties of Logarithms 2019-2020

58 pt. total

Name Key Date Period

1. $\log_a 1 =$ 0 +1
2. $\log_a a =$ 1 +1
3. $a^{\log_a M} =$ M +1
4. $\log_a a^r =$ r +1
5. $\log_a(MN) =$ $\log_a M + \log_a N$ +1
6. $\log_a\left(\frac{M}{N}\right) =$ $\log_a M - \log_a N$ +1
7. $\log_a M^r =$ $r \log_a M$ +1
8. If $\log_a x = \log_a 6$, then $x =$ 6 +1.
9. If $\log_8 M = \frac{\log_5 7}{\log_5 8}$, then $M =$ 7 +1.
10. **True or False:** $\frac{\ln 8}{\ln 2} = 3$ +1 $\log_2 8 = 3$
11. **True or False:** $\ln(x+3) - \ln(2x) = \frac{\ln(x+3)}{\ln(2x)}$ +1 $\ln\left(\frac{x+3}{2x}\right)$
12. **True or False:** $\log_2(3x^4) = 4\log_2(3x)$ +1 $\rightarrow \log_2(3x)^4$ 4 is only on x not whole thing

Use properties of logarithms of find the exact value of each expression. Do not use a calculator.

13. $\log_2 2^{-13}$ +1 −13
14. $2^{\log_2 7}$ +1 7
15. $\log_4 4^1$ +1 1
16. $\ln \sqrt[4]{e}$ $\ln e^{1/4}$ +1 $\frac{1}{4}$
17. $e^{\ln 6}$ +1 6
18. $\log_6 1$ +1 0
19. $7^{\log_7 6}$ +1 6
20. $\log 10{,}000$ $\log_{10} 10^4$ +1 4
21. $10^{\log(0.5)}$ +1 .5
22. $\log_5 \sqrt[3]{25}$ $\log_5 5^{2/3}$ +1 $\frac{2}{3}$
23. $\log_6 \frac{1}{\sqrt[3]{36}}$ $\log_6 6^{-2/3}$ +1 $-\frac{2}{3}$
24. $\ln \frac{1}{e}$ $\ln e^{-1}$ +1 −1
25. $\log 10^{-4}$ +1 −4
26. $\log \sqrt[3]{10}$ $\log_{10} 10^{1/3}$ +1 $\frac{1}{3}$
27. $e^{\ln\left(\frac{1}{5}\right)}$ +1 $\frac{1}{5}$
28. $\ln e^3$ +1 3
29. $10^{\log 14}$ +1 14
30. $\ln e^1$ +1 1
31. $10^{\log(5)}$ +1 5
32. $\log_2 32$ $\log_2 2^5$ +1 5
33. $\ln 1$ +1 0
34. $\log_7 1$ +1 0
35. $\ln \frac{1}{\sqrt{e^7}}$ $\ln e^{-\frac{7}{2}}$ +1 $-\frac{7}{2}$

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Assuming x and y are positive, use properties of logarithms to write the expression as a sum and/or difference of logarithms or multiples of logarithms. Express exponents as factors using the power property. Simplify if possible.

36. $\ln 4x$ $\ln 4 + \ln x$ +1

37. $\log \frac{5}{y}$ $\log 5 - \log y$ +1

38. $\log y^4$ $4 \log y$ +1

39. $\log_6 x^2 y^3$ $\log_6 x^2 + \log_6 y^3$ $2\log_6 x + 3\log_6 y$ +1

40. $\ln \frac{x^3}{y^2}$ $\ln x^3 - \ln y^2$ $3\ln x - 2\ln y$ +1

41. $\log_3 x^{-2}$ $-2\log_3 x$ +1

42. $\ln(ex)$ $\ln e^1 + \ln x$ $1 + \ln x$ +1

43. $\ln\left(\frac{e}{x}\right)$ $\ln e^1 - \ln x$ $1 - \ln x$ +1

44. $\log_a(u^2 v^3)$ $\log_a u^2 + \log_a v^3$ $2\log_a u + 3\log_a v$ +1

Assuming *x*, *y* and *z* are positive, use properties of logarithms to write the expression as a single logarithm. Simplify if possible.

45. $\log y + \log 7$ $\log(7y)$ +1

46. $\ln y - \ln x$ $\ln \frac{y}{x}$ +1

47. $\frac{1}{2}\ln y$ $\ln y^{1/2}$ +1

48. $3\log(xy) - 2\log(yz)$ $\log(xy)^3 - \log(yz)^2 = \log\left(\frac{(xy)^3}{(yz)^2}\right)$ or $\log\left(\frac{x^3y}{z^2}\right)$ +1

49. $3\log_5 u + 4\log_5 v$ $\log_5 u^3 + \log_5 v^4$ $\log_5(u^3 v^4)$ +1

50. $2\log_3 u - \log_3 v$ $\log_3 u^2 - \log_3 v$ $\log_3 \frac{u^2}{v}$ +1

Use the Change-of-Base Formula and a calculator to evaluate each logarithm. Round your answer to three decimal places. <u>You must write the Change-of-Base expression</u>.

51. $\log_3 21$ $\frac{\log 21}{\log 3} \approx 2.771$ +1 +1

52. $\log_5 18$ $\frac{\log 18}{\log 5} \approx 1.796$ +1 +1

53. $\log_2 15$ $\frac{\log 15}{\log 2} \approx 3.907$ +1 +1

54. $\log_6 4$ $\frac{\log 4}{\log 6} \approx .774$ +1 +1