Name _____ Date _____

LESSON 4.5

Practice A

For use with the lesson "Apply Properties of Logarithms"

Match the expression with the logarithm that has the same value.

1. $\log 4 + \log 3$ **2.** $\log 3 - \log 4$ **3.** $3 \log 4$ **4.** $4 \log 3$

A. $\log \frac{3}{4}$ **B.** $\log 81$ **C.** $\log 64$ **D.** $\log 12$

Use $\log 3 \approx 0.477$ and $\log 5 \approx 0.699$ to evaluate the logarithm.

5. $\log 5$ **6.** $\log 15$ **7.** $\log 9$

8. $\log 25$ **9.** $\log \frac{5}{3}$ **10.** $\log 45$

Expand the expression.

11. $\log_4 5x$ **12.** $\log 7x$ **13.** $\log_8 x^2$

14. $\log_2 \frac{x}{3}$ **15.** $\ln x^{-2}$ **16.** $\log 12x^3$

17. $\ln \frac{4}{x^2}$ **18.** $\log_6 \frac{5x^3}{6}$ **19.** $\log_2 \frac{\sqrt{2}x}{2}$

Condense the expression.

20. $\log_7 4 + \log_7 3$ **21.** $\log 7 + \log x$ **22.** $\log y + \log 3$

23. $\log x - \log 2$ **24.** $\ln x - \ln 3$ **25.** $\log_3(x + 2) - \log_3 5$

26. $2 \log x + \log 5$ **27.** $\ln(x - 1) - \ln x$ **28.** $2 \log x - \log(x + 4)$

Use the change-of-base formula to evaluate the logarithm. Round your result to three decimal places.

29. $\log_7 5$ **30.** $\log_3 14$ **31.** $\log_5 7$

32. $\log_6 27$ **33.** $\log_8 \frac{1}{2}$ **34.** $\log_2 220$

In Exercises 35–37, use the following information.

Investment You want to invest \$1500 in a stock whose value has been increasing by approximately 5% each year. The time required for an initial investment I_0 to grow to I can be modeled by $t = \frac{\ln\left(\frac{I}{I_0}\right)}{0.049}$ where I_0 and I are measured in dollars and t is measured in years.

35. Expand the expression.

36. How long until your investment doubles?

37. How long until your investment triples?

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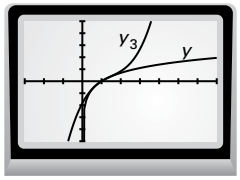
Lesson 4.4 Evaluate Logarithms and Graph Logarithmic Functions, continued

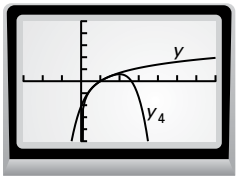
c. 

The graphs are nearly identical for $0.25 < x < 2$.

10. The pattern is

$$y = (x - 1) - \frac{1}{2}(x - 1)^2 + \frac{1}{3}(x - 1)^3 + \cdots + \frac{(-1)^{k+1}}{k}(x - 1)^k.$$

$$y_4 = (x - 1) - \frac{1}{2}(x - 1)^2 + \frac{1}{3}(x - 1)^3 - \frac{1}{4}(x - 1)^4$$



The graphs are nearly identical for $0.2 < x < 2$.

The interval of accuracy increases when additional terms are added to the polynomial.

11. The pattern implies that

$$\ln x = (x - 1) - \frac{1}{2}(x - 1)^2 + \frac{1}{3}(x - 1)^3 - \frac{1}{4}(x - 1)^4 + \cdots = \sum_{k=1}^{\infty} \frac{(-1)^{k+1}}{k}(x - 1)^k$$

Lesson 4.5 Apply Properties of Logarithms

Teaching Guide

1. 30^7; 30; 7

2. 30^3; 30^4; $\frac{30^7}{30^3}$; quotient of powers property

Practice Level A

1. D **2.** A **3.** C **4.** B **5.** 0.699 **6.** 1.176
7. 0.954 **8.** 1.398 **9.** 0.222 **10.** 1.653
11. $\log_4 5 + \log_4 x$ **12.** $\log 7 + \log x$
13. $2 \log_8 x$ **14.** $\log_2 x - \log_2 3$ **15.** $-2 \ln x$
16. $\log 12 + 3 \log x$ **17.** $\ln 4 - 2 \ln x$
18. $\log_6 5 + 3 \log_6 x - 1$ **19.** $\log_2 x - \frac{1}{2}$
20. $\log_7 12$ **21.** $\log 7x$ **22.** $\log 3y$ **23.** $\log \frac{x}{2}$
24. $\ln \frac{x}{3}$ **25.** $\log_3 \frac{x+2}{5}$ **26.** $\log 5x^2$
27. $\ln \frac{x-1}{x}$ **28.** $\log \frac{x^2}{x+4}$ **29.** 0.827
30. 2.402 **31.** 1.209 **32.** 1.839 **33.** −0.333
34. 7.781 **35.** $t = \frac{\ln I - \ln I_0}{0.049}$ **36.** 14.1 yr
37. 22.4 yr

Practice Level B

1. C **2.** A **3.** D **4.** B **5.** 1.447 **6.** 0.243
7. 1.204 **8.** 1.690 **9.** −0.602 **10.** −0.116
11. $1 + \log_3 x$ **12.** $\log 2 + \log x - \log 5$
13. $2 \log_7 x + \log_7 y$ **14.** $2 \log_2 x - 2$
15. $\frac{1}{2} \ln x + \frac{1}{2} \ln y$ **16.** $\log 5 + \frac{1}{3} \log x$
17. $-\ln 2 - 2 \ln x$ **18.** $\log_9 2 + 3 \log_9 x - \frac{1}{2}$
19. $\log_6 x + 2 \log_6 y - \frac{1}{2} \log_6 z$ **20.** $\log_3 16$
21. $\log 4x^3y$ **22.** $\log \frac{3\sqrt{x}}{5}$ **23.** $\ln 2x^2$
24. $\log \frac{2x^2}{3}$ **25.** $\ln \frac{2(x+1)^3}{y}$ **26.** 1.277
27. 3.404 **28.** 0.139 **29.** 3.920 **30.** 2.018
31. 6.919 **32.** $\text{pH} = 6.1 + \log B - \log C$
33. 7.38 **34.** just below normal

Practice Level C

1. 3.332 **2.** 0.560 **3.** 2.772 **4.** 3.738
5. 1.659 **6.** 0.980 **7.** $\log_4 x + \frac{3}{2}$
8. $2 \log x + \log y + \log z$
9. $\log_7 y + \log_7 z - \log_7 3$
10. $3 \log_2 x - \log_2 y - 2 \log_2 z$
11. $\frac{3}{2} \ln x + \frac{1}{2} \ln y$ **12.** $\log 2 + \frac{1}{2} \log x - 2 \log y$
13. $\ln 7 + \ln y - 2 \ln x$
14. $5[\log_9 2 + 2 \log_9 x + \log_9 y + \log_9 z]$
15. $2 \log_6(x + 3) - \log_6 3 - 3 \log_6 y$
16. $\log_3 \frac{5}{3}$ **17.** $\log \frac{25y}{x^2}$ **18.** $\log_2 \frac{9}{x^3y}$
19. $\ln \frac{(x-3)^2}{6(x+2)^3}$ **20.** $\log \frac{\sqrt{(x+4)^3}}{6x^3}$
21. $\ln \sqrt{\frac{3x^4}{(x-1)^2}}$ **22.** 1.869 **23.** −1.032

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