PRACTICE & PROBLEM SOLVING

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Practice Tutorial

Additional Exercises Available Online

UNDERSTAND

13. Make Sense and Persevere If the LN button on your calculator were broken, how could you still use your calculator to find the value of the expression ln 65?

14. Error Analysis Describe and correct the error a student made in solving an exponential equation.

$$16e^t = 98$$
$$e^t = 6.125$$
$$6.125t = \ln e$$
$$t = \frac{\ln e}{6.125}$$

✗

15. Higher Order Thinking Use the graph of $y = 3^x$ to estimate the value of $\log_3 50$. Explain your reasoning.

16. Generalize For what values of x is the expression $\log_4 x < 0$ true?

17. Use Structure A student says that $\log_3 (\frac{1}{27})$ simplifies to -3. Is the student correct? Explain.

18. Use Structure Explain why the expression ln 1,000 is not equal to 3.

PRACTICE

Write the inverse of each exponential function.
SEE EXAMPLE 1

19. $y = 4^x$

20. $y = 10^x$

21. $y = 7^x$

22. $y = a^x$

Write each equation in logarithmic form.
SEE EXAMPLE 2

23. $3^8 = 6{,}561$

24. $e^{-3} \approx 0.0498$

25. $5^0 = 1$

26. $7^3 = 343$

Write each equation in exponential form.
SEE EXAMPLE 2

27. $\log \frac{1}{100} = -2$

28. $\log_8 64 = 2$

29. $\ln 148.41 \approx 5$

30. $\log_2 \frac{1}{32} = -5$

Evaluate each logarithmic expression. SEE EXAMPLE 3

31. $\log_5 \frac{1}{125}$

32. $\log_6 (-216)$

33. $\log_3 3^4$

34. $\log_2 32$

35. $\log_9 729$

36. $\log_8 \frac{1}{64}$

37. $\log_7 0$

38. $\log_7 7^a$

Use a calculator to evaluate each expression. Round to the nearest ten-thousandth. SEE EXAMPLE 4

39. log 78.5

40. log 0.24

41. ln (−37)

42. ln 41.5

43. log 12

44. ln 3

Solve each equation. Round answers to the nearest ten-thousandth. SEE EXAMPLES 5 AND 6

45. $\log (7x + 6) = 3$

46. $2.75e^t = 38.6$

47. $\ln (3x - 1) = 2$

48. $10^{t+1} = 50$

49. $1.5e^t = 27$

50. $\log (x - 3) = -1$

51. How long does it take for \$250 to grow to \$600 at 4% annual percentage rate compounded continuously? Round to the nearest year.

APPLY

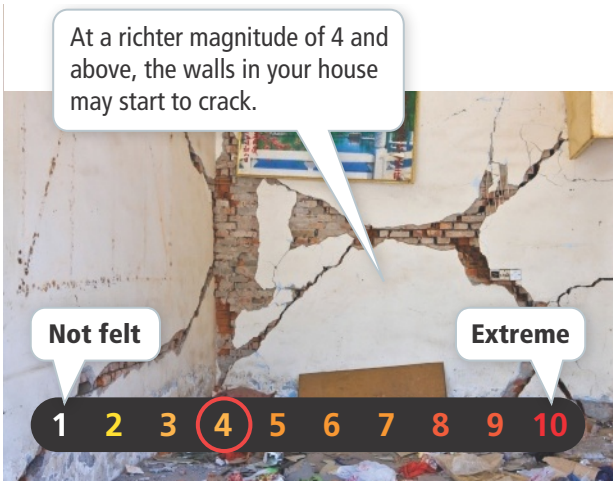
52. Model with Mathematics Michael invests $1,000 in an account that earns a 4.75% annual percentage rate compounded continuously. Peter invests $1,200 in an account that earns a 4.25% annual percentage rate compounded continuously. Which person's account will grow to $1,800 first?

53. Reason The Richter magnitude of an earthquake is $R = 0.67\log(0.37E) + 1.46$, where E is the energy (in kilowatt-hours) released by the earthquake.

a. What is the magnitude of an earthquake that releases 11,800,000,000 kilowatt-hours of energy? Round to the nearest tenth.

b. How many kilowatt-hours of energy would an earthquake have to release in order to be an 8.2 on the Richter scale? Round to the nearest whole number.

c. What number of kilowatt-hours of energy would an earthquake have to release in order for walls to crack? Round to the nearest whole number.



54. Reason The function $c(t) = 108e^{-0.08t} + 75$ calculates the temperature, in degrees Fahrenheit, of a cup of coffee that was handed out a drive-thru window t minutes ago.

a. What is the temperature of the coffee in the instant that it is handed out the window?

b. After how many minutes is the coffee in the cup 98 degrees Fahrenheit? Round to the nearest whole minute.

ASSESSMENT PRACTICE

55. Given that $\log_b x < 0$, which of the following are true? Select all that apply.

Ⓐ $b < 0$
Ⓑ $x < 0$
Ⓒ $b > 0$
Ⓓ $x > 0$
Ⓔ $x < 1$

56. SAT/ACT In the equation $\log_3 a = b$, if b is a whole number, which of the following CANNOT be a value for a?

Ⓐ 1 Ⓑ 3 Ⓒ 6 Ⓓ 9 Ⓔ 81

57. Performance Task Money is deposited into two separate accounts. The money in one account is compounded continuously. The money in the other account is not compounded continuously. Neither account has any money withdrawn in the first 6 years.

Year	Account 1 Balance ($)	Account 2 Balance ($)
0	400	500
1	433.31	575
2	469.40	650
3	508.50	725
4	550.85	800
5	596.72	875

Part A Write a function to calculate the amount of money in each account given t, the number of years since the account was opened. Describe the growth in each account.

Part B Will the amount of money in Account 1 ever exceed the amount of money in Account 2? Explain. If so, when will that occur?