

**Chapter 8 Test (Practice)**  
(EXPONENTIAL AND LOGARITHMIC FUNCTIONS)

Multiple Choice  
Show work.

1. Find the annual percent increase or decrease that  $y = 0.35(2.3)^x$  models.
- a. 230% increase
  - b. 130% increase
  - c. 30% decrease
  - d. 65% decrease

Write the equation in logarithmic form.

2.  $3^8 = 6,561$
- a.  $\log_3 6,561 = 8$
  - b.  $\log 6,561 = 8 \cdot 3$
  - c.  $\log_8 6,561 = 3$
  - d.  $\log 6,561 = 8$

3. Evaluate the logarithm.

$\log_3 \frac{1}{81}$

- a. 3
- b. 4
- c. -3
- d. -4

The pH of a liquid is a measure of how acidic or basic it is. The concentration of hydrogen ions in a liquid is labeled  $[H^+]$ . Use the formula  $pH = -\log [H^+]$  to answer questions about pH.

- 4.

Find the pH level, to the nearest tenth, of a liquid with  $[H^+]$  about  $5.1 \times 10^{-10}$ .

- a. -10.7
- b. 10.0
- c. 10.7
- d. 9.3

5. Write the equation  $\log_{12} 8 = \frac{3}{5}$  in exponential form.

- a.  $32^{\frac{3}{5}} = 8$
- b.  $8^{\frac{3}{5}} = 32$
- c.  $\left(\frac{3}{5}\right)^{32} = 8$
- d.  $8^{\frac{3}{5}} = 32$

Write the expression as a single logarithm.

6.  $4 \log x - 6 \log(x + 2)$
- a.  $24 \log \frac{x}{x+2}$
  - b.  $\log x^4(x+2)^6$
  - c.  $\log x(x+2)^{24}$
  - d. none of these

Expand the logarithmic expression.

7.  $\log_b \sqrt{\frac{57}{74}}$
- a.  $\frac{1}{2} \log_b 57 + \frac{1}{2} \log_b 74$
  - b.  $\frac{1}{2} \log_b 57 - \frac{1}{2} \log_b 74$
  - c.  $\sqrt{\log_b 57 - \log_b 74}$
  - d.  $\log_b \frac{1}{2} (57 - 74)$

8. Use the properties of logarithms to evaluate  $\log_3 9 + \log_3 36 - \log_3 4$ .

- a. 2
- b. 4
- c. 8
- d. 41

Write the expression as a single natural logarithm.

9.  $3 \ln a - \frac{1}{2} (\ln b + \ln c^2)$

- a.  $\ln \frac{3a}{0.5bc^2}$
- b.  $\frac{3}{2} \ln \frac{a}{bc^2}$
- c.  $\ln \frac{a^3}{bc}$
- d.  $\ln \frac{a^3}{c\sqrt{b}}$

10. Simplify  $\ln e^3$ .

a. 3

b.  $\frac{1}{3e}$

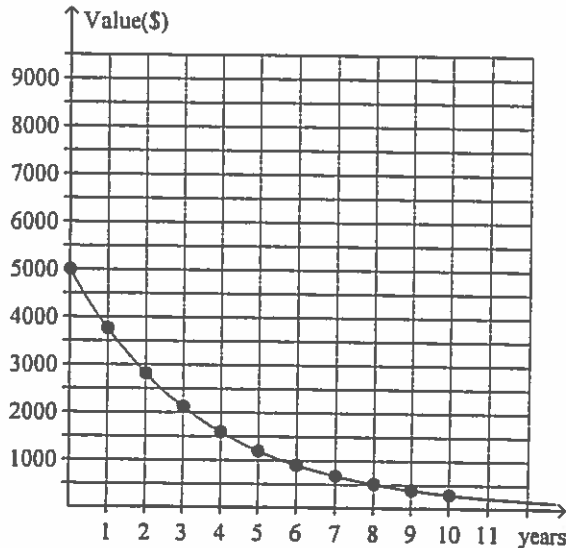
c.  $3e$

d.  $\frac{1}{3}$

11. Without graphing, determine whether the function  $y = 4(8.5)^x$  represents exponential growth or exponential decay.

12. Without graphing, determine whether the function  $y = 4\left(\frac{6}{13}\right)^x$  represents exponential growth or exponential decay.

13. The exponential decay graph shows the expected depreciation for a new boat, selling for \$5000, over 10 years.

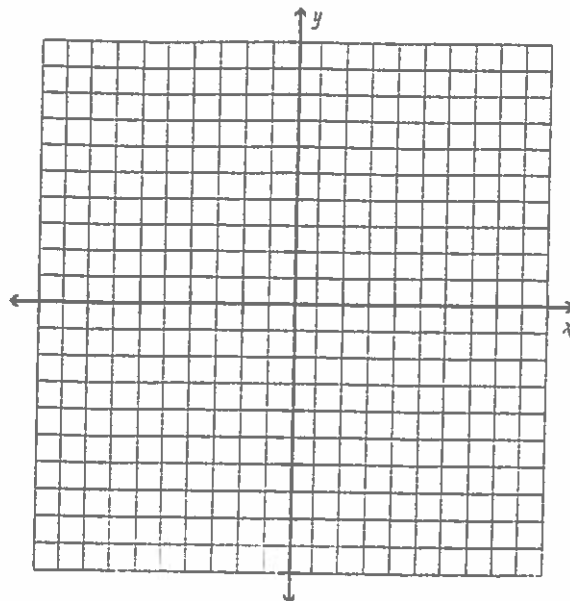


a. Write an exponential function for the graph.

b. Use the function in part a to find the value of the boat after 5.5 years.

14. An initial population of 400 quail increases at an annual rate of 26%. Write an exponential function to model the quail population.

15. Graph  $y = 3\left(\frac{1}{6}\right)^{x-2} - 4$ .



16. The half-life of a certain radioactive material is 78 days. An initial amount of the material has a mass of 60 kg. Write an exponential function that models the decay of this material. Find how much radioactive material remains after 20 days. Round your answer to the nearest thousandth.

17. How much money invested at 5% compounded continuously for 3 years will yield \$820?

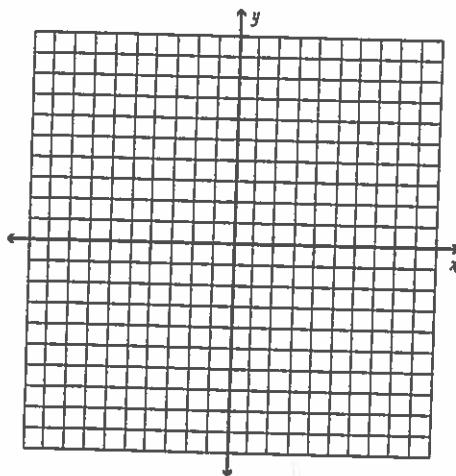
18. The table shows some notable earthquakes that occurred in recent years. How many times more energy was released by the earthquake in Peru than by the earthquake in Afghanistan?

Earthquake Location	Date	Richter Scale Measure
Italy	October 31, 2002	5.9
El Salvador	February 13, 2001	6.6
Afghanistan	May 30, 1998	6.9
Mexico	January 22, 2003	7.6
Arequipa, Peru	June 23, 2001	8.1

[Source: *World Almanac 2004*, p. 190]

19. Solve  $\frac{1}{16} = 64^{4x-3}$ .

20. Use a graphing calculator. Solve  $2^{5x} = 2265$  by graphing. Round to the nearest hundredth.



21. Solve  $2 \log 4 - \log 3 + 2 \log x - 4 = 0$ . Round to the nearest ten-thousandth.

22. The generation time  $G$  for a particular bacteria is the time it takes for the population to double. The bacteria increase in population is shown by the formula  $G = \frac{t}{3.3 \log_a P}$ , where  $t$  is the time period of the population increase,  $a$  is the number of bacteria at the beginning of the time period, and  $P$  is the number of bacteria at the end of the time period. If the generation time for the bacteria is 6 hours, how long will it take 8 of these bacteria to multiply into a colony of 7681 bacteria? Round to the nearest hour.

23. Solve  $\ln(2x - 1) = 8$ .

Round to the nearest thousandth.

Round to the nearest thousandth.

24.  $2e^{4x} - 9 = 21$

25. The amount of money in an account with continuously compounded interest is given by the formula  $A = Pe^{rt}$ , where  $P$  is the principal,  $r$  is the annual interest rate, and  $t$  is the time in years. Calculate to the nearest hundredth of a year how long it takes for an amount of money to double if interest is compounded continuously at 2.8%. Round to the nearest tenth.

26. Write an exponential function  $y = ab^x$  for a graph that includes (2, 24) and (3, 48).

27. Suppose you invest \$580 at 10% compounded continuously.
- Write an exponential function to model the amount in your investment account.

b. Explain what each value in the function model represents.

c. In how many years will the total reach \$3600? Show your work.

28. The formula  $P = 14.7e^{-0.21x}$  gives the average atmospheric pressure  $P$  in pounds per square inch, at an altitude  $x$  in miles above sea level.
- Find the elevation at which the average atmospheric pressure is  $8.4 \text{ lb/in.}^2$ . Show the steps you used to solve this problem.
  - What is the average atmospheric pressure at sea level? Explain.
29. The half-life of a radioactive substance is the time it takes for half of the substance to decay. The half-life of carbon-14 is 5700 years.
- Write an exponential function to model the decay of a 240-mg sample.
  - Explain what each value in the function model represents.
  - To the nearest hundredth, find the amount of carbon-14 remaining after 2353 years. Explain how you found this amount.
30. The time required to grow a certain bacteria in a culture beginning with 100 bacteria is  $t = \frac{\ln B - \ln 100}{1.532}$ , where  $B$  is the number of bacteria and  $t$  is the time in hours.
- How much time is required to grow a culture of 200 bacteria? Show the steps you used to find the number of hours. Round your answer to the nearest tenth.
  - How many bacteria will be in the culture in about 5 hours? Show the steps you used to find the number of bacteria. Round your answer to the nearest 100.
31. The number of bacteria present in a culture after  $t$  minutes is given as  $B = 1000e^{kt}$ . There are 4182 bacteria present after 5 minutes. Find  $k$ . Explain how you solve this problem and justify your steps.

