PRACTICE & PROBLEM SOLVING

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Practice Tutorial

Additional Exercises Available Online

UNDERSTAND

10. **Look for Relationships** How is an exponential growth function of the form $f(x) = a(1 + r)^x$ related to an exponential function of the form $f(x) = a \cdot b^x$?

11. **Generalize** What is the asymptote of the graph of an exponential growth or exponential decay function? Explain your reasoning.

12. **Error Analysis** Describe and correct the error a student made in writing an equation to find the annual value of an investment of \$1,000 at 4% annual interest compounded semiannually.

$$\begin{aligned} A &= 1{,}000(1+0.04)^{4t} \\ &= 1{,}000(1.04)^{4t} \end{aligned}$$

✗

13. **Use Appropriate Tools** Describe how you could use a graphing calculator to estimate the value of x when $f(x) = 8(1.25)^x$ equals 15.

14. **Higher Order Thinking** In Example 2, you used the formula $A = P\left(1 + \frac{r}{n}\right)^{nt}$ to solve problems involving compound interest.

   a. How is the growth factor of a function that models compound interest affected as n increases? Explain.

   b. Copy and complete the table.

n	$A = 3{,}000\left(1 + \frac{0.08}{n}\right)^{5n}$
12	■
365	■
1,000	■
10,000	■
100,000	■

   c. What is the relationship between the value of the function and the change in the growth factor as n increases? Explain.

PRACTICE

Write an exponential growth function to model each situation. SEE EXAMPLE 1

15. initial value: 20
growth factor: 1.25

16. initial value: 100
growth factor: 1.05

Compare each investment to an investment of the same principal at the same rate compounded annually. SEE EXAMPLE 2

17. principal: \$8,000
annual interest: 6%
interest periods: 4
number of years: 20

18. principal: \$10,000
annual interest: 3.5%
interest periods: 2
number of years: 5

Write an exponential decay function to model each situation. Then estimate the value of x for the given value of $f(x)$. SEE EXAMPLE 3

19. initial value: 100
decay factor: 0.95
$f(x) = 60$

20. initial value: 5,000
decay factor: 0.7
$f(x) = 100$

Write an exponential decay function to model each situation. Compare the average rates of change over the given intervals. SEE EXAMPLE 4

21. initial value: 50
decay factor: 0.9
$1 \le x \le 4$ and
$5 \le x \le 8$

22. initial value: 25
decay factor: 0.8
$2 \le x \le 4$ and
$6 \le x \le 8$

Write an exponential function to model the data in each table. Identify the growth or decay factor.
SEE EXAMPLES 1–4

23.

x	$f(x)$
0	4
1	2
2	1
3	$\frac{1}{2}$
4	$\frac{1}{4}$

24.

x	$f(x)$
0	100
1	110
2	121
3	133.1
4	146.41

Model each pair of situations with exponential functions f and g. Find the approximate value of x that makes $f(x) = g(x)$. SEE EXAMPLE 5

25. f: initial value of 100 decreasing at a rate of 5%
g: initial value of 20 increasing at a rate of 5%

26. f: initial value of 40 increasing at a rate of 25%
g: initial value of 10,000 decreasing at a rate of 16%

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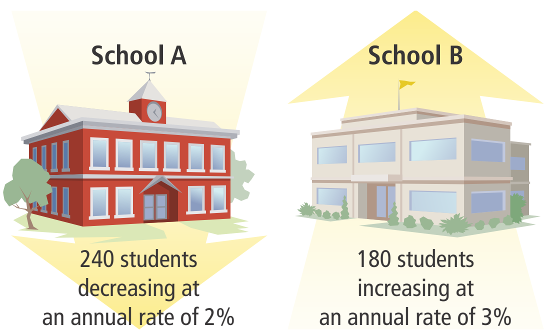
Mixed Review Available Online

APPLY

27. Model With Mathematics A plant will become invasive when the number of plants reaches 10,000. Model the situation with an exponential growth function. How many years will it take for the plant to become invasive? Explain how you found the solution.

28. Look for Relationships Joshua invests \$500 at the interest rate shown. Felix invests \$1,000 in an account with the same compounding, but at 6% interest rate. Model each investment with an exponential growth function. Whose money will double first? Explain.

29. Make Sense and Persevere Write and graph exponential functions to model the number of students at School A and at School B as a function of number of years. In about how many years will the number of students at both schools be approximately the same? Explain how you can use a graph to determine the answer.



ASSESSMENT PRACTICE

30. Classify each function as an exponential growth function or an exponential decay function.

$f(x) = 2(1.02)^x$

$f(x) = 5000(3)^x$

$f(x) = 7500(0.91)^x$

$f(x) = 189(1 - 0.25)^x$

$f(x) = 2485(1 + 0.25)^x$

31. SAT/ACT Which function models the value in x years of an investment at 3% annual interest compounded quarterly?

Ⓐ $150(1 - 0.03)^{4x}$

Ⓑ $150(1 + 0.03)^{4x}$

Ⓒ $150(1 - 0.03)^{x}$

Ⓓ $150(1 + 0.0075)^{4x}$

Ⓔ $150(1 - 0.0075)^{x}$

32. Performance Task Isabel has \$10,000 to invest. She is choosing between the three investment opportunities shown.

Investment	Annual Interest	Number of Interest Periods
A	4%	1
B	4%	4
C	4.2%	1

Part A Write a function for each investment to model its value in x years.

Part B Suppose Isabel only wants to invest her money for five years. Which investment will have the greatest value in five years?

Part C Which investment will make Isabel a millionaire first?