

 **5-Minute Check**

Over Lesson 7-5

You will need your calculator today!!!

Standardized Test Practice

- 3** A tournament begins with 64 teams. After each round, only  $\frac{1}{2}$  of the teams remain. Write an exponential function for the number of teams remaining after  $x$  rounds of play. How many teams remain after 3 rounds?


- A.  $y = 64\left(\frac{1}{2}\right)^x$ ; 8 teams
- B.  $y = 64\left(\frac{1}{2}\right)^x$ ; 6 teams
- C.  $y = \frac{1}{2}(8)^x$ ; 12 teams
- D.  $y = 64\left(\frac{1}{2^2}\right)^x$ ; 4 teams

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 **Key Concept** Equation for Exponential Growth

$a$  is the initial amount.

$t$  is time.

$$y = a(1 + r)^t$$

$y$  is the final amount.

$r$  is the rate of change  
expressed as a decimal,  $r > 0$ .

 Real-World Example 1 Exponential Growth

**A. POPULATION** In 2008, the town of Flat Creek had a population of about 280,000 and a growth rate of 0.85% per year. Write an equation to represent the population of Flat Creek since 2008.

The rate 0.85% can be written as 0.0085.

$y = a(1 + r)^t$	Equation for exponential growth
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$y = 280,000(1 + 0.0085)^t$	$a = 280,000$ and $r = 0.0085$
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$y = 280,000(1.0085)^t$	Simplify.
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**Answer:** An equation to represent the population of Flat Creek is  $y = 280,000(1.0085)^t$ , where  $y$  is the population and  $t$  is the number of years since 2008.

 Real-World Example 1 Exponential Growth

**B. POPULATION** In 2008, the town of Flat Creek had a population of about 280,000 and a growth rate of 0.85% per year. According to the equation, what will be the population of Flat Creek in the year 2018?

In 2018,  $t$  will equal  $2018 - 2008$  or 10.

$y = 280,000(1.0085)^t$       Equation for population of Flat Creek

$y = 280,000(1.0085)^{10}$        $t = 10$

$y \approx 304,731$       Use a calculator.

**Answer:** In 2018, there will be about 304,731 people in Flat Creek.

 Real-World Example 1 Check Your Progress

**A. POPULATION** In 2008, Scioto School District had a student population of about 4500 students, and a growth rate of about 0.15% per year. Write an equation to represent the student population of the Scioto School District since the year 2008.

- A.  $y = 4500(1.0015)$
- B.  $y = 4500(1.0015)^t$
- C.  $y = 4500(0.0015)^t$
- D.  $y = (1.0015)^t$

 Real-World Example 1 Check Your Progress

**A. POPULATION** In 2008, Scioto School District had a student population of about 4500 students, and a growth rate of about 0.15% per year. Write an equation to represent the student population of the Scioto School District since the year 2008.

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**B.**  $y = 4500(1.0015)^t$

C.  $y = 4500(0.0015)^t$

D.  $y = (1.0015)^t$

 **Key Concept** Equation for Compound Interest

$A$  is the current amount.

$$A = P \left( 1 + \frac{r}{n} \right)^{nt}$$

$n$  is the number of times the interest is compounded each year, and  $t$  is time in years.

$P$  is the principal or initial amount.

$r$  is the annual interest rate expressed as a decimal,  $r > 0$ .



 Real-World Example 2

**Compound Interest**

**COLLEGE** When Jing May was born, her grandparents invested \$1000 in a fixed rate savings account at a rate of 7% compounded annually. The money will go to Jing May when she turns 18 to help with her college expenses. What amount of money will Jing May receive from the investment?

$$A = P \left( 1 + \frac{r}{n} \right)^{nt}$$

Compound interest equation

$$= 1000 \left( 1 + \frac{0.07}{1} \right)^{1(18)}$$

$P = 1000$ ,  $r = 7\%$  or  $0.07$ ,  
 $n = 1$ , and  $t = 18$

 Real-World Example 2

**Compound Interest**

$$= 1000(1.07)^{18}$$

Simplify.

$$\approx 3379.93$$

Use a calculator.

**Answer:** She will receive about \$3380.

 **Key Concept** Equation for Exponential Decay

$a$  is the initial amount.

$t$  is time.

$$y = a(1 - r)^t$$

$y$  is the final amount.

$r$  is the rate of decay expressed as a decimal,  $0 < r < 1$ .

 Real-World Example 3 Exponential Decay

**A. CHARITY** During an economic recession, a charitable organization found that its donations dropped by 1.1% per year. Before the recession, its donations were \$390,000. Write an equation to represent the charity's donations since the beginning of the recession.

$$y = a(1 - r)^t$$

Equation for exponential decay

$$y = 390,000(1 - 0.011)^t$$

$a = 390,000$  and  $r = 1.1\%$   
or  $0.011$

$$y = 390,000(0.989)^t$$

Simplify.

**Answer:**  $y = 390,000(0.989)^t$

## Check Your Understanding

 = Step-by-Step Solutions begin on page R13.



### Example 1

1. **SALARY** Ms. Acosta received a job as a teacher with a starting salary of \$34,000. According to her contract, she will receive a 1.5% increase in her salary every year. How much will Ms. Acosta earn in 7 years? **about \$37,734.73**

### Example 2

2. **MONEY** Paul invested \$400 into an account with a 5.5% interest rate compounded monthly. How much will Paul's investment be worth in 8 years? **about \$620.46**

### Example 3

3. **ENROLLMENT** In 2000, 2200 students attended Polaris High School. The enrollment has been declining 2% annually.

- a. Write an equation for the enrollment of Polaris High School  $t$  years after 2000.  
b. If this trend continues, how many students will be enrolled in 2015? **about 1624**

$$y = 2200(0.98)^t$$

①  $A = P(1+r)^t$   
 $A = 34,000(1+0.015)^7$   
 $A = 34,000(1.015)^7$

②  $A = P(1-r)^t$   
 $= 2200(1-0.02)^t$   
 $= 2200(.98)^t$

③  $A = 2200(.98)^{15}$

## Check Your Understanding

Step-by-Step Solutions begin on page R13.



### Example 1

1. **SALARY** Ms. Acosta received a job as a teacher with a starting salary of \$34,000. According to her contract, she will receive a 1.5% increase in her salary every year. How much will Ms. Acosta earn in 7 years? **about \$37,734.73**

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### Example 2

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### Example 3

3. **ENROLLMENT** In 2000, 2200 students attended Polaris High School. The enrollment has been declining 2% annually.

$$y = 2200(0.98)^t$$

- a. Write an equation for the enrollment of Polaris High School  $t$  years after 2000.  
b. If this trend continues, how many students will be enrolled in 2015? **about 1624**

②

$$A = P \left( 1 + \frac{r}{n} \right)^{nt}$$

$r = .055$   
 $t = 8$   
 $n = 12$

$$A = 400 \left( 1 + \frac{.055}{12} \right)^{12(8)}$$
$$= 400 (1.0046)^{96}$$

⑤

## Example 1

4. **MEMBERSHIPS** The Work-Out Gym sold 550 memberships in 2001. Since then the number of memberships sold has increased 3% annually.
  - a. Write an equation for the number of memberships sold at Work-Out Gym  $t$  years after 2001.  $y = 550(1.03)^t$
  - b. If this trend continues, predict how many memberships the gym will sell in 2020. **about 964**
5. **COMPUTERS** The number of people who own computers has increased 23.2% annually since 1990. If half a million people owned a computer in 1990, predict how many people will own a computer in 2015. **about 92,095,349**
6. **COINS** Camilo purchased a rare coin from a dealer for \$300. The value of the coin increases 5% each year. Determine the value of the coin in 5 years. **about \$382.88**

## Example 2

9. **Sample answer:**  
No; she will have about \$199.94 in the account in 4 years.

7. **INVESTMENTS** Theo invested \$6600 at an interest rate of 4.5% compounded monthly. Determine the value of his investment in 4 years. **about \$7898.97**
8. **COMPOUND INTEREST** Paige invested \$1200 at an interest rate of 5.75% compounded quarterly. Determine the value of her investment  $t$  years. **about \$1789.54**
9. **CCSS PRECISION** Brooke is saving money for a trip to the Bahamas that costs \$295.99. She puts \$150 into a savings account that pays 7.25% interest compounded quarterly. Will she have enough money in the account after 4 years? Explain.
10. **INVESTMENTS** Jin's investment of \$4500 has been losing its value at a rate of 2.5% each year. What will his investment be worth in 5 years? **about \$3964.93**

## Example 3

11. **POPULATION** In the years from 2010 to 2015, the population of the District of Columbia is expected decrease about 0.9% annually. In 2010, the population was about 530,000. What is the population of the District of Columbia expected to be in 2015? **about 506,575**
12. **CARS** Leonardo purchases a car for \$18,995. The car depreciates at a rate of 18% annually. After 6 years, Manuel offers to buy the car for \$4500. Should Leonardo sell the car? Explain. **Sample answer: No; the car is worth about \$5774.61.**