

## UNIT 4 • MODELING AND ANALYZING EXPONENTIAL FUNCTIONS

## Lesson 2: Domain and Range of Exponential Functions

## Assessment

## Progress Assessment

Circle the letter of the best answer.

1. The domain of  $f(x) = -2 \cdot 5^x + 1$  is all real numbers. What is the range of  $f(x)$ ?

a.  $x < 1$

c.  $x > 1$

b.  $x < -2$

d.  $x > -2$

2. The domain of  $f(x) = 7 \cdot 2^x - 6$  is all real numbers. What is the range of  $f(x)$ ?

a.  $x < -6$

c.  $x > -6$

b.  $x < 7$

d.  $x > 7$

3. The domain of  $f(x) = 4^x + 5$  is  $\{0, 1, 2, 3\}$ . What is the range of  $f(x)$ ?

a.  $\{0, 4, 8, 12\}$

c.  $\{1, 4, 16, 64\}$

b.  $\{5, 9, 13, 17\}$

d.  $\{6, 9, 21, 69\}$

4. The domain of  $f(x) = 2^x - 12$  is  $\{1, 2, 3, 4\}$ . What is the range of  $f(x)$ ?

a.  $\{2, 4, 6, 8\}$

c.  $\{2, 4, 8, 16\}$

b.  $\{-10, -8, -6, -4\}$

d.  $\{-10, -8, -4, 4\}$

**continued**

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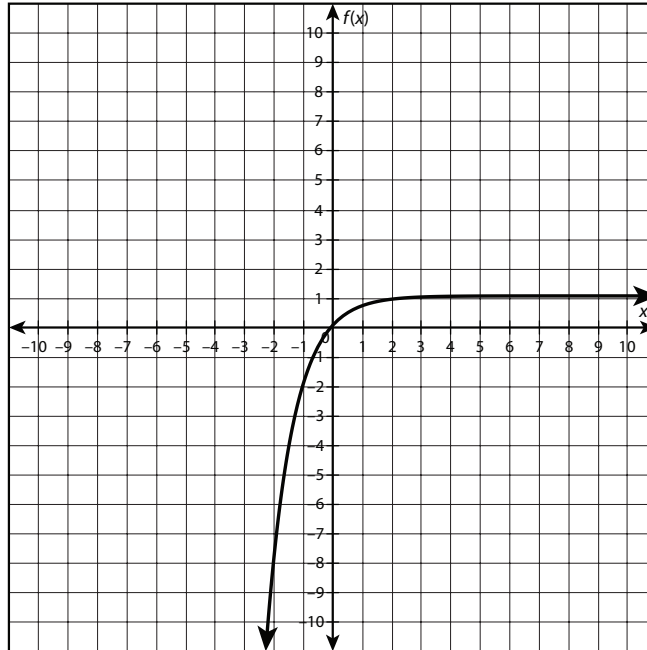
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5. What are the domain and range of the graphed function?

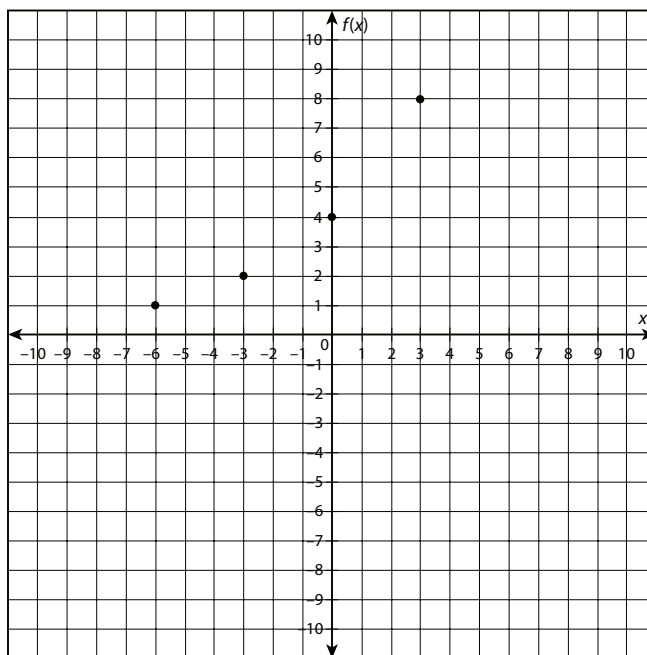


- a. Domain: {all real numbers}; range:  $\{f(x) > 1\}$
- b. Domain: {all real numbers}; range:  $\{f(x) < 1\}$
- c. Domain:  $\{x < 1\}$ ; range: {all real numbers}
- d. Domain:  $\{x > 1\}$ ; range: {all real numbers}

*continued*

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6. What are the domain and range of the graphed function?



- a. Domain:  $\{-6, -3, 0, 3\}$ ; range:  $\{1, 2, 4, 8\}$   
 b. Domain:  $\{1, 2, 4, 8\}$ ; range:  $\{-6, -3, 0, 3\}$   
 c. Domain:  $\{1, 2, 3, 4\}$ ; range:  $\{1, 2, 4, 8\}$   
 d. Domain:  $\{1, 2, 4, 8\}$ ; range:  $\{1, 2, 3, 4\}$
7. Scientists performed a 12-week study on a population of rabbits. The population began with 10 rabbits. The scientists measured the population once every 4 weeks and found it had doubled each time. The function that models the population growth is  $f(x) = 10 \cdot 2^{\frac{x}{4}}$ . What are the domain and range of the function in this situation?
- a. Domain:  $\{1, 2, 3, 4\}$ ; range:  $\{10, 20, 40, 80\}$   
 b. Domain:  $\{10, 20, 40, 80\}$ ; range:  $\{1, 2, 3, 4\}$   
 c. Domain:  $\{0, 4, 8, 12\}$ ; range:  $\{10, 20, 40, 80\}$   
 d. Domain:  $\{10, 20, 40, 80\}$ ; range:  $\{0, 4, 8, 12\}$

**continued**

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8. An investment promises a return of 10% per year. Pamela wants to know how much money she will have if she invests \$1,400 for 5, 10, or 15 years. The investment's growth can be modeled using the exponential function  $f(x) = 1400 \cdot 1.10^x$ , where  $x$  represents the number of years and  $f(x)$  represents the return on the investment. What are the domain and range of the function in this situation? (*Note:* Range values should be rounded to 2 decimal points, because  $f(x)$  represents money.)
- Domain: {5, 10, 15}; range: {2254.71, 3631.24, 5848.15}
  - Domain: {5, 10, 15}; range: {7700, 15,400, 23,100}
  - Domain: {2254.71, 3631.24, 5848.15}; range: {5, 10, 15}
  - Domain: {7700, 15,400, 23,100}; range: {5, 10, 15}
9. There are 64 teams in a tennis tournament. After each round, half the teams are eliminated, until only 1 remains. This situation can be represented by the function  $f(x) = 64\left(\frac{1}{2}\right)^x$ . What are the domain and range of the function in this situation?
- Domain: {1, 2, 4, 8, 16, 32, 64}; range: {7, 6, 5, 4, 3, 2, 1}
  - Domain: {0, 1, 2, 3, 4, 5, 6}; range: {64, 32, 16, 8, 4, 2, 1}
  - Domain: {1, 2, 3, 4, 5, 6, 7}; range: {64, 32, 16, 8, 4, 2, 1}
  - Domain: {1, 2, 4, 8, 16, 32, 64}; range: {7, 6, 5, 4, 3, 2, 1}
10. The half-life of polonium-210 is 138 days. A scientist at a high-security nuclear research facility obtained 1,200 grams of polonium-210 for a demonstration. When she actually did the demonstration 12 days after receiving the element, only 1,130 grams remained. The amount of polonium-210 she had before the demonstration is modeled by the function  $f(x) = 1200\left(\frac{1}{2}\right)^{\frac{x}{138}}$ . What are the domain and range of the function over the 12-day period?
- Domain:  $\{0 \leq x \leq 138\}$ ; range:  $\{f(x) < 1200\}$
  - Domain:  $\{0 \leq x \leq 12\}$ ; range:  $\{1130 \leq f(x) \leq 1200\}$
  - Domain:  $\{0 \leq x \leq 138\}$ ; range:  $\{f(x) > 1130\}$
  - Domain:  $\{0 \leq x \leq 12\}$ ; range:  $\{0 < f(x) \leq 1200\}$

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Use the given information to solve problem 11.

11. Nathaniel is studying a population of field mice. There were 8 mice when he started the study, but the population triples every month. The mouse population is modeled by the function  $f(x) = 8 \cdot 3^x$ , where  $x$  represents the number of months Nathaniel has been studying the mice and  $f(x)$  represents the field mouse population. The study will end after 6 months.
- What are the domain and range of the function?
  - Evaluate the function for  $x = 1, 2,$  and  $4$ .
  - Interpret your answer for part b in the context of the problem.
  - Write a statement using function notation that shows the population of field mice at the end of the study. Then use words to describe the symbolic statement.