Name: Date:

Assessment

Modeling Logarithmic Functions

Progress Assessment

Circle the letter of the best answer.

1. What is the inverse function of the exponential function $f(x) = 1 - 3^x$?

   a. $\log_3 (x - 1) = f^{-1}(x)$

   b. $\log_3 x = f^{-1}(x)$

   c. $\log_3 f^{-1}(x) = x$

   d. $\log_3 (1 - x) = f^{-1}(x)$

2. What is the inverse function of the exponential function $g(x) = 4 \bullet 5^{6-x}$?

   a. $g^{-1}(x) = \frac{1}{4}(\log_5 x - 6)$

   b. $g^{-1}(x) = 4(6 - \log_5 x)$

   c. $g^{-1}(x) = 6 + \log_5 4 - \log_5 x$

   d. $g^{-1}(x) = \log_5 x - 6 - \log_5 4$

3. What is the exponential function for which the common logarithmic function $h(x) = -\log (3x + 4)$ is the inverse?

   a. $h^{-1}(x) = \frac{1}{10^x}$

   b. $h^{-1}(x) = \frac{1}{3 \bullet 10^x} - \frac{4}{3}$

   c. $h^{-1}(x) = \frac{1}{3}(10^x - 4)$

   d. $h^{-1}(x) = \frac{1}{3 \bullet 10^x} - 4$

4. What is the common logarithmic function that is equivalent to $a(x) = -7 \bullet \log_4 x$?

   a. $a(x) = -\frac{7 \bullet \log x}{\log 4}$

   b. $a(x) = -7 \bullet \log 4x$

   c. $a(x) = -\frac{7 \bullet \log 5}{\log x}$

   d. $a(x) = -\frac{\log x}{7 \bullet \log 4}$

5. What is the value of the natural logarithm function that is equivalent to the function $b(1) = 4 \bullet e^3$?

   a. $\ln b(1) = 4 - \ln 3$

   b. $\ln b(1) = 4 + \ln 3$

   c. $\ln b(1) = 3 + \ln 4$

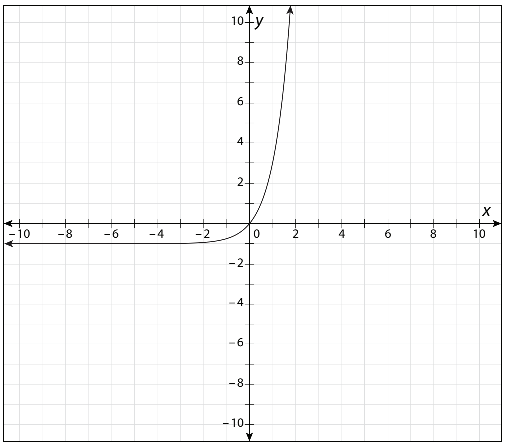
   d. $\ln b(1) = 3 - \ln 4$

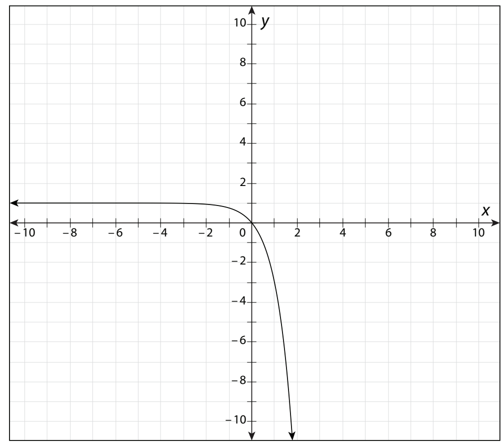
continued

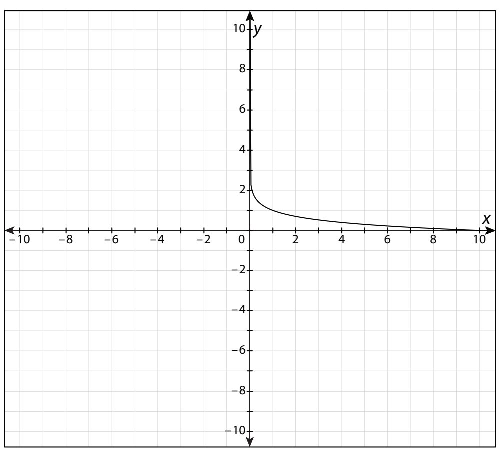
6. What is the domain of the natural logarithm function $c(x) = 10 \bullet \ln (x - e)$?

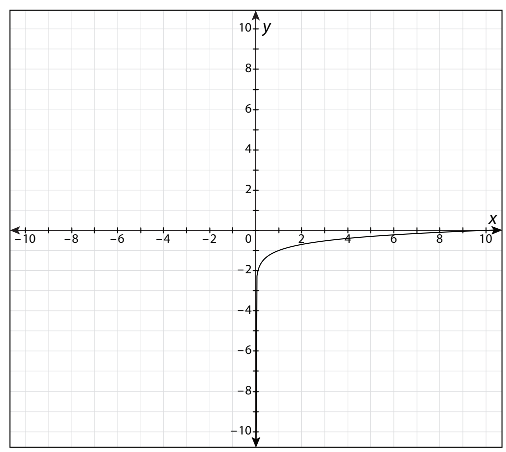
   a. $(-e,+\infty)$
   b. $(-e,-\infty)$
   c. $(e,+\infty)$
   d. $(0,+\infty)$

7. Which is the graph of $d(x) = 1 - \log_4 x$?

   a.


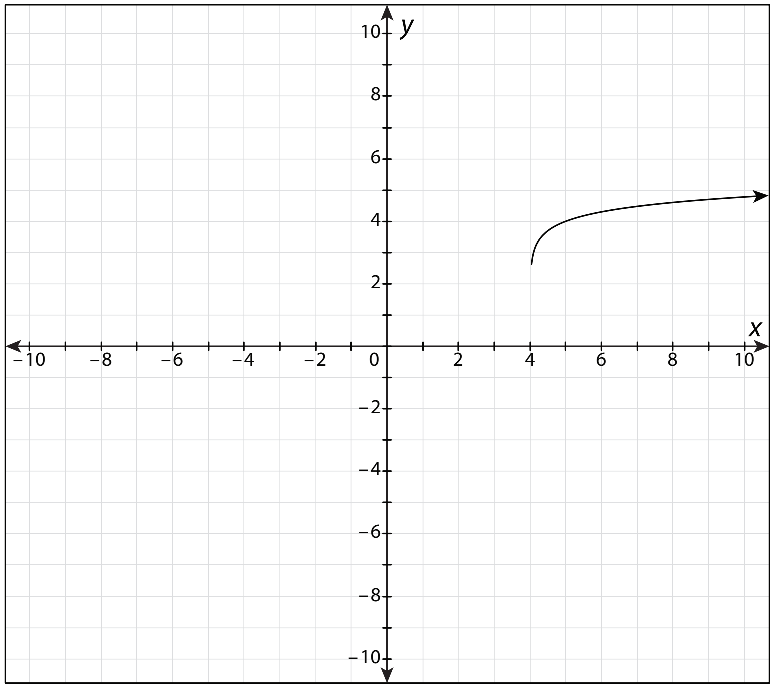
   c.


   b.


   d.


continued

8. What function could be represented by the graph shown?



a. $f(x) = 4 + \log(x + 4)$

b. $f(x) = 4 - \log(x - 4)$

c. $f(x) = 4 + \log(x - 4)$

d. $f(x) = 4 - \log(x + 4)$

Use the information that follows to complete problems 9 and 10.

The natural logarithm function $\Delta G = RT \bullet \ln \dfrac{C_{\text{inside}}}{C_{\text{outside}}}$ is used to describe the change in energy ΔG in a biological system (such as a cell) in which R and T are constants, C_{inside} is the ion concentration of a specific chemical inside the system, and C_{outside} is the ion concentration of that chemical outside the system.

9. What is the relationship of C_{inside} to C_{outside} for any energy change in the system?

a. $C_{\text{inside}} > C_{\text{outside}}$

b. $C_{\text{inside}} + C_{\text{outside}} = 0$

c. $\dfrac{C_{\text{inside}}}{C_{\text{outside}}} > 0$

d. $C_{\text{inside}} = C_{\text{outside}}$

continued

10. What is the relationship of C_{inside} to C_{outside} if $\Delta G < 0$?

    a. $C_{\text{inside}} < C_{\text{outside}}$

    b. $C_{\text{inside}} > C_{\text{outside}}$

    c. $C_{\text{inside}} = C_{\text{outside}}$

    d. $C_{\text{inside}} \bullet C_{\text{outside}} = 0$

Use the given information to complete all parts of problem 11.

11. A math instructor tells his students that the acceleration of the head of a copperhead snake as it strikes can be modeled by the natural logarithm function $\ln A(t) = t + \ln 15$, in which $A(t)$ is the acceleration of its head in meters per second squared and t is the strike time in milliseconds. The instructor says that the model is based on an exponential function and is accurate over the domain (0, 5 milliseconds). A team of students used an accelerometer probe to collect data on a copperhead in the reptile house of the city zoo, and analyzed the data using software. The students found that the acceleration of the snake's head starts from being at rest. Just before the head strikes the target, the acceleration of the head is almost 15 meters per second squared. In writing the logarithmic inverse function, the students made an error in one or more of the steps.

    For each step a through d:

    - Determine whether the step shown is correct.
    - If it is correct, state the correct operation or rule applied.
    - If it is incorrect, state the incorrect operation or rule applied.

    a. $\ln\left[\dfrac{A(t)}{15}\right] = \ln A(t) - \ln 15$

    b. $\ln\left[1 - \dfrac{A(t)}{15}\right] = \ln 1 - \ln A(t) + \ln(15)$

    c. $1 - \dfrac{A(t)}{15} = e^{-t} \rightarrow -t = \ln\left[1 - \dfrac{A(t)}{15}\right]$

    d. $15 - A(t) = 15e^{-t} \rightarrow 1 - \dfrac{A(t)}{15} = e^{-t}$