F.I.F.C.7: Graphing Logarithmic Functions

1. For which value of \( x \) is \( y = \log x \) undefined?
   1) 0
   2) \( \frac{1}{10} \)
   3) \( \pi \)
   4) 1.483

2. The graph of \( y = \log x \) lies in Quadrant(s)
   1) I and II
   2) II and III
   3) III and IV
   4) I and IV

3. Which statement about the graph of \( c(x) = \log_6 x \) is false?
   1) The asymptote has equation \( y = 0 \).
   2) The graph has no \( y \)-intercept.
   3) The domain is the set of positive reals.
   4) The range is the set of all real numbers.

4. Which statement below about the graph of \( f(x) = -\log(x + 4) + 2 \) is true?
   1) \( f(x) \) has a \( y \)-intercept at (0,2).
   2) \(-f(x)\) has a \( y \)-intercept at (0,2).
   3) As \( x \to \infty, f(x) \to \infty \).
   4) \( x \to -4, f(x) \to \infty \).

5. If \( f(x) = \log_3 x \) and \( g(x) \) is the image of \( f(x) \) after a translation five units to the left, which equation represents \( g(x) \)?
   1) \( g(x) = \log_3(x + 5) \)
   2) \( g(x) = \log_3 x + 5 \)
   3) \( g(x) = \log_3(x - 5) \)
   4) \( g(x) = \log_3 x - 5 \)

6. The graph of \( y = \log_2 x \) is translated to the right 1 unit and down 1 unit. The coordinates of the \( x \)-intercept of the translated graph are
   1) (0,0)
   2) (1,0)
   3) (2,0)
   4) (3,0)

7. Which equation best represents the graph below?

   ![Graph](image)

   1) \( h(x) = \log(x + a) + c \)
   2) \( h(x) = \log(x - a) + c \)
   3) \( h(x) = \log(x + a) - c \)
   4) \( h(x) = \log(x - a) - c \)
8. Which sketch shows the inverse of $y = a^x$, where $a > 1$?

1) ![Graph 1](image1)
2) ![Graph 2](image2)
3) ![Graph 3](image3)
4) ![Graph 4](image4)

9. The cells of a particular organism increase logarithmically. If $g$ represents cell growth and $h$ represents time, in hours, which graph best represents the growth pattern of the cells of this organism?

1) ![Graph 5](image5)
2) ![Graph 6](image6)
3) ![Graph 7](image7)
4) ![Graph 8](image8)
10 Which graph represents the function \( \log_2 x = y \)?

1) 

2) 

3) 

4) 

11 Which sketch best represents the graph of \( x = 3^y \)?

1) 

2) 

3) 

4)
12 If a function is defined by the equation \( f(x) = 4^x \), which graph represents the inverse of this function?

1) 

2) 

3) 

4) 

13 Which sketch could represent the function \( m(x) = -\log_{100}(x - 2) \)?
14 Sketch and label the graph of \( y = 2^x \).

The graph of \( y = 2^x \) is subject to each of these transformations:

1. reflection in the \( y \)-axis
2. reflection in the line \( y = x \)
3. translation: \( (x,y) \rightarrow (x,y + 1) \)

Next to the appropriate numeral below, write the letter of the equation, chosen from the list below, that best described the image of \( y = 2^x \) under each of the numbered transformations.

**Equations**
- (a) \( y = \log_2 x \)
- (b) \( y = -2^x \)
- (c) \( y = 2^{-x} \)
- (d) \( y = 2^x + 1 \)

(1)
(2)
(3)
15 Sketch the graph of the functions \( f(x) = 3^x \) and \( g(x) = \log_3 x \). Considering the graphs, describe the relationship between \( f(x) \) and \( g(x) \). Specify the domain and the range of \( g \).

16 Sketch below the graph of \( y = 4^x \). On the same set of axes, sketch the graph of \( y = \log_4 x \).
17 Sketch and label the graph of the equation \( y = \log x \) for all values of \( x \) in the interval \( 0.1 \leq x \leq 10 \). On the same set of axes, reflect the graph drawn in the line \( y = x \), and label it \( c \). What is the equation of \( c \)?

![Graph of \( y = \log x \) and \( y = x \)](image1)

18 Graph \( f(x) = \log_2 (x + 6) \) on the set of axes below.

![Graph of \( f(x) = \log_2 (x + 6) \)](image2)
19. On the grid below, graph the function $y = \log_2(x - 3) + 1$.

20. Sketch $p(x) = -\log_2(x + 3) + 2$ on the axes below.

Describe the end behavior of $p(x)$ as $x \to -3$. Describe the end behavior of $p(x)$ as $x \to \infty$. 
21 Graph \( y = \log_2(x + 3) - 5 \) on the set of axes below. Use an appropriate scale to include both intercepts.

Describe the behavior of the given function as \( x \) approaches \(-3\) and as \( x \) approaches positive infinity.

22 Graph the following function on the axes below.

\[
f(x) = \log_3(2 - x)
\]

State the domain of \( f \). State the equation of the asymptote.
23 A hotel finds that its total annual revenue and the number of rooms occupied daily by guests can best be modeled by the function \( R = 3 \log(n^2 + 10n), n > 0 \), where \( R \) is the total annual revenue, in millions of dollars, and \( n \) is the number of rooms occupied daily by guests. The hotel needs an annual revenue of $12 million to be profitable. Graph the function on the accompanying grid over the interval \( 0 < n \leq 100 \). Calculate the minimum number of rooms that must be occupied daily to be profitable.
F.I.F.C.7: Graphing Logarithmic Functions

Answer Section

1 ANS: 1 REF: 060301b
2 ANS: 4 REF: 018535siii
3 ANS: 1

\[
\log_2(x - 1) - 1 = 0
\]
\[
\log_2(x - 1) = 1
\]
\[
x - 1 = 2^1
\]
\[
x = 3
\]

4 ANS: 4 REF: 062215aii
5 ANS: 1 REF: 011902aii
6 ANS: 4

\[
\log_2(x - 1) - 1 = 0
\]
\[
\log_2(x - 1) = 1
\]
\[
x - 1 = 2^1
\]
\[
x = 3
\]

7 ANS: 1 REF: 062308aii
8 ANS: 3 REF: 011422a2
9 ANS: 3 REF: 010420b
10 ANS: 1 REF: 061211a2
11 ANS: 2 REF: 081816aii
12 ANS: 2

\[f^{-1}(x) = \log_4x\]

REF: fall0916a2

13 ANS: 4 Translate the parent log function 2 to the right and reflect over the x-axis.

REF: 082207aii

14 ANS:
c, a, d

REF: 088539siii
f(x) and g(x) are inverses of each other. The domain of g is the positive reals and the range of g is the reals.

REF: fall9927b

16 ANS:

REF: 069039siii

17 ANS:

REF: 019442siii
18 ANS:

REF: 061927aii

19 ANS:

REF: 011932aii

20 ANS:

As $x \to -3, \ y \to \infty$. As $x \to \infty, \ y \to -\infty$.

REF: 082333aii

21 ANS:

As $x \to -3, \ y \to -\infty$. As $x \to \infty, \ y \to \infty$.

REF: 061735aii
Domain: $x < 2$, Asymptote $x = 2$

REF: 012034aii

23 ANS:

$$3 \log (n^2 + 10n) = 12$$
$$\log (n^2 + 10n) = 4$$
$$n^2 + 10n = 10^4$$
$$n^2 + 10n - 10000 = 0$$

$$x = \frac{-10 \pm \sqrt{10^2 - 4(-10000)}}{2}$$
$$x = \frac{-10 + \sqrt{40100}}{2} \approx 95.1$$

96 rooms must be occupied. The other root is negative.

REF: 080530b