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

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

2 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.

3 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) \( g(x) = \log_3 x - 5 \)

4 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) \((3,0)\)

5 Which sketch shows the inverse of \( y = a^x \), where \( a > 1 \)?

1)

2)

3)

4)
6 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)  
2)  
3)  
4) 

7 Which graph represents the function \( \log_2 x = y \)?

1)  
2)  
3)  
4)
8 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)
9 Which sketch best represents the graph of \( x = 3^y \)?

1)  

2)  

3)  

4)  

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

1)  
2)  
3)  
4)  

12 Sketch below the graph of \( y = 4^x \). On the same set of axes, sketch the graph of \( y = \log_4 x \).
13 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 $c$?

14 Graph $f(x) = \log_2(x + 6)$ on the set of axes below.
15 On the grid below, graph the function \( y = \log_2(x - 3) + 1 \)

16 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.
17 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.
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Answer Section

1 ANS: 4  REF: 018535siii

2 ANS: 1

3 ANS: 1  REF: 011902aaii

4 ANS: 4

\[ \log_2 (x - 1) - 1 = 0 \]

\[ \log_2 (x - 1) = 1 \]

\[ x - 1 = 2^1 \]

\[ x = 3 \]

REF: 061819aaii

5 ANS: 3  REF: 011422a2

6 ANS: 3  REF: 010420b

7 ANS: 1  REF: 061211a2

8 ANS: c, a, d

REF: 088539siii

9 ANS: 2  REF: 081816aaii
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.

ANS:

\[ f^{-1}(x) = \log_4 x \]

ANS:

\[ y = 10^x \]
As $x \to -3, y \to -\infty$. As $x \to \infty, y \to \infty$. 
ANS:

\[ 3\log(x^2 + 10x) = 12 \]
\[ \log(x^3 + 10x) = 4 \]
\[ x^2 + 10x = 10^4 \]
\[ x^2 + 10x - 10000 = 0 \]

\[
x = \frac{-10 \pm \sqrt{10^2 - 4(1)(-10000)}}{2}
\]

\[
x = \frac{-10 + \sqrt{40100}}{2}
\approx 95.1
\]

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

REF: 080530b