MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Solve the problem.

1) The growth in the population of a certain rodent at a dump site fits the exponential function \( A(t) = 648e^{0.016t} \), where \( t \) is the number of years since 1987. Estimate the population in the year 2000.
   - A) 399
   - B) 813
   - C) 811
   - D) 658
   - E) 798

2) How long must $4400 be in a bank at 7% compounded annually to become $7560.02? (Round to the nearest year.)
   - A) 8 yr
   - B) 10 yr
   - C) 7 yr
   - D) 9 yr

3) In September 1998 the population of the country of West Goma in millions was modeled by \( f(x) = 17.9e^{0.0015x} \). At the same time the population of East Goma in millions was modeled by \( g(x) = 13.5e^{0.0128x} \). In both formulas \( x \) is the year, where \( x = 0 \) corresponds to September 1998. Assuming these trends continue, estimate what the population will be when the populations are equal.
   - A) 1 million
   - B) 19 million
   - C) 17 million
   - D) 18 million
   - E) 15 million

4) At what interest rate must $4000 be compounded annually to equal $7403.72 after 8 yr? (Round to the nearest percent.)
   - A) 9%
   - B) 7%
   - C) 8%
   - D) 10%

Solve the equation.

5) \( 4^{-x} = \frac{1}{64} \)
   - A) 3
   - B) \( \frac{1}{3} \)
   - C) \( \frac{1}{16} \)
   - D) -3

6) \( \frac{800}{1 + 99e^{-0.3t}} = 200 \)
   - A) 11.655
   - B) 13.174
   - C) 12.174
   - D) 6.098
   - E) 9.003

7) \( \log x^2 = 8 \)
   - A) \( \pm 10^8 \)
   - B) \( \pm 2.828 \)
   - C) \( \pm 673.977 \)
   - D) \( \pm 10,000 \)
   - E) \( \pm 64 \)

8) \( \log 5x = \log 2 + \log (x + 5) \)
   - A) \( \frac{7}{4} \)
   - B) 5
   - C) 3.3333333
   - D) \( \frac{10}{7} \)
   - E) -3.3333333
Determine a formula for the exponential function.

9) \[ f(x) = \begin{array}{ll}
A) & 3 \cdot 0.8^x \\
B) & 3 \cdot 1.2^x \\
C) & 4.32 \cdot 1.2^x \\
D) & 3 \cdot 1.3^x \\
E) & 3 \cdot 1.4^x \\
\end{array} \]

Decide if the function is an exponential function. If it is, state the initial value and the base.

10) \[ y = 9^{-x} \]
   A) Exponential Function; base = 1; initial value = 5
   B) Exponential Function; base = 9; initial value = 1
   C) Exponential Function; base = 0.2; initial value = 1
   D) Exponential Function; base = 9; initial value = 0
   E) Not an exponential function

11) \[ y = x^{9x} \]
   A) Exponential Function; base = x; initial value = 1
   B) Not an exponential function
   C) Exponential Function; base = 9x; initial value = 1
   D) Exponential Function; base = x^8; initial value = 0
   E) Exponential Function; base = x^8; initial value = 1

12) \[ y = 6.6 \cdot 6^x \]
   A) Exponential Function; base = 19.2; initial value = 1
   B) Exponential Function; base = -39.6; initial value = 1
   C) Not an exponential function
   D) Exponential Function; base = 6; initial value = -6.6
   E) Exponential Function; base = 6; initial value = 6.6

Use a calculator to find an approximate solution to the equation.

13) \[ 2^{(3x - 2)} = 17 \]
   A) 3.500        B) 0.696        C) 2.029        D) 1.402        E) 1.380
14) \((3.4)^x = 42\)
   A) 3.1776  
   B) 3.0665  
   C) 3.0409  
   D) 3.0419  
   E) 3.0542

Find the exponential function that satisfies the given conditions.
15) Initial value = 33, increasing at a rate of 14% per year
   A) \(f(t) = 33 \cdot 14^t\)  
   B) \(f(t) = 33 \cdot 1.013^t\)  
   C) \(f(t) = 14 \cdot 1.14^t\)  
   D) \(f(t) = 33 \cdot 1.14^t\)  
   E) \(f(t) = 33 \cdot 0.14^t\)

16) Initial population = 1112, doubling every 8 hours
   A) \(P(t) = 1112 \cdot \left(\frac{1}{2}\right)^{t/8}\)  
   B) \(P(t) = 1112 \cdot 2^{8t}\)  
   C) \(P(t) = 1112 \cdot \left(\frac{1}{2}\right)^{6t}\)  
   D) \(P(t) = 1112 \cdot 2^{t/8}\)  
   E) \(P(t) = 8 \cdot 2^t\)

Use the change of base rule to find the logarithm to four decimal places.
17) \(\log_{4.8} 2.4\)
   A) 0.5581  
   B) 0.5000  
   C) 0.3802  
   D) 0.3902  
   E) 1.7917

18) \(\log_{6} 25.54\)
   A) 1.4072  
   B) 4.2567  
   C) 1.2570  
   D) 0.5530  
   E) 1.8084

Compute the exact value of the function for the given x-value without using a calculator.
19) \(f(x) = 5 \cdot 4^x\) for \(x = -4/2\)
   A) 40  
   B) \(\frac{5}{16}\)  
   C) \(-\frac{5}{16}\)  
   D) 80  
   E) -128

20) \(f(x) = \left(\frac{1}{4}\right)^x\) for \(x = 3\)
   A) \(\frac{1}{64}\)  
   B) \(\frac{1}{12}\)  
   C) 64  
   D) \(\frac{1}{81}\)  
   E) 15

21) \(f(x) = 6^x\) for \(x = -2\)
   A) \(-\frac{1}{36}\)  
   B) -12  
   C) \(-\frac{1}{12}\)  
   D) \(-\frac{1}{64}\)  
   E) \(\frac{1}{36}\)
Match the function with its graph.

22) \( f(x) = \log(x - 2) \)

A) 

![Graph A](image)

B) 

![Graph B](image)

C) 

![Graph C](image)

D) 

![Graph D](image)
23) \( f(x) = 4 \log x \)

A)

B)

C)

D)
24) \( f(x) = \ln x - \ln(x - 2) \)

A)

B)

C)

D)

Determine the doubling time of the investment.

25) 4\% \text{ APR} compounded continuously

A) 17.33 years  
B) 34.66 years  
C) 13.86 years  
D) 25.99 years

26) \$1200 \text{ at 6\% compounded quarterly}

A) 9.31 years  
B) 17.46 years  
C) 11.64 years  
D) 23.28 years

Decide whether the function is an exponential growth or exponential decay function and find the constant percentage rate of growth or decay.

27) \( f(x) = 5 \cdot 1.07^x \)

A) Exponential decay function; 107\%  
B) Exponential decay function; 94\%  
C) Exponential growth function; 7\%  
D) Exponential growth function; 0.07\%  
E) Exponential growth function; 107\%

Graph the function. Describe its position relative to the graph of the indicated basic function.
28) \( f(x) = 1 - 2^{-x} \); relative to \( f(x) = 2^x \)

A) Moved up 1 unit(s);
   reflected across, \( y \)-axis;
   reflected across \( x \)-axis;

B) Reflect across the \( x \) axis
   Reflect across the \( y \) axis
   Move down 3 unit(s)
C) Reflected across y-axis; reflected across x-axis; moved down 1 unit(s)

D) Moved up 1 unit(s); reflected across, y-axis; reflected across x-axis;

E) Reflected across y-axis; reflected across x-axis; moved up 1 unit(s)

Graph the function.
29) \[ f(x) = \frac{7}{1 + 4e^{-x}} \]
Write the expression using only the indicated logarithms.

30) \( \log_{1/8} (a - b) \) using natural logarithms

A) \( \frac{\ln (a - b)}{\ln 8} \)

B) \( \frac{\ln 8}{\ln (a - b)} \)

C) \( -\frac{\ln (a - b)}{\ln 8} \)

D) \( \frac{1}{\ln 8} \)

E) \( \frac{\ln a - \ln b}{\ln 8} \)
1) E  
2) A  
3) B  
4) C  
5) A  
6) A  
7) D  
8) C  
9) B  
10) B  
11) B  
12) E  
13) C  
14) E  
15) D  
16) D  
17) A  
18) E  
19) B  
20) A  
21) E  
22) B  
23) B  
24) C  
25) A  
26) C  
27) C  
28) E  
29) D  
30) C