• This exam covers material from Sections 6.1 - 6.4.

• Students MAY NOT use a graphing calculator on this exam.

• Unless otherwise indicated exact answers, i.e. \( \frac{1}{3} \) or \( \sqrt{7} \), should be given rather than decimal approximations.

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Exponential and Logarithmic Expressions

1. Evaluate \( \log_5 \sqrt{5} \).

   \[ (1) \]

2. Approximate \( \log_4 9 \) to three decimal places.

   \[ (2) \]

Exponential and Logarithmic Equations

3. Find an exponential equation that is equivalent to \( \log_3(6x - 6) = 5 \).

   \[ (3) \]
4. Solve the equation $5(4^{4x+4} + 3) = 95.$

5. Find a logarithmic equation that is equivalent to $7^{7x-6} = 2.$

6. Solve the equation $(2^{x+3})^3 = 4.$

7. Solve the equation $2 \log_3 (10x + 4) = 0.$

8. Solve the equation $4^{5x+1} = 14.$

9. Solve the equation $e^{3x+3} = e^2.$

Exponential and Logarithmic Functions

10. Given $g(x) = \log_5(x + 2)$, what is the numerical value of $g(623)?$
11. Given \( g(x) = 4 \log_7(5x + 3) \), solve the equation \( g(x) = 0 \).

\( 11 \)__________________

12. Given \( f(x) = \sqrt{-x - 2} \), which of the following is NOT in the domain of \( f \)?

(A) \(-9\)
(B) \(-2\)
(C) \(-6\)
(D) \(-11\)
(E) All of the above are in the domain of \( f \)

13. If \( f(x) = 2x + 1 \) and \( g(x) = 2x^2 + x + 7 \), determine \( f(g(1)) \).

\( 13 \)__________________

Applications

14. If $2136 is invested in a bank account where interest is compounded continuously at a rate of 3\%, the amount of money in the bank in \( t \) years is approximated by \( A(t) = 2136e^{0.03t} \). How many years (rounded to the nearest tenth of a year) will it take the investment to be worth $3553?

\( 14 \)__________________

15. If $3752 is invested in a bank account where interest is compounded continuously at a rate of 1.5\%, the amount of money in the bank in \( t \) years is approximated by \( A(t) = 3752e^{0.015t} \). What is the amount of money in the bank (rounded to the nearest cent) after 11 years?

\( 15 \)__________________
Exponential and Logarithmic Expressions

1. \( \frac{1}{3} \)

2. \( x = 1.58496250072 \)

Exponential and Logarithmic Equations

3. \( 6x - 6 = 3^5 \)

4. \( x = -\frac{1}{2} \)

5. \( 7x - 6 = \log_7(2) \)

6. \( x = -\frac{7}{3} \)

7. \( x = -\frac{3}{10} \)

8. \( x = \frac{\log_4(14) - 1}{5} \) or \( x = \frac{\ln 14}{\ln 4} - 1 \)

9. \( x = -\frac{1}{3} \)

Exponential and Logarithmic Functions

10. 4

11. \( x = -\frac{2}{5} \)

12. E

13. 21

Applications

14. 17.0 years

15. $4425.08
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Exponential and Logarithmic Expressions

1. Approximate \( \log_6 8 \) to three decimal places.

   \[ \log_6 8 \]

2. Evaluate \( \log_3 \sqrt{3} \).

   \[ \log_3 \sqrt{3} \]

Exponential and Logarithmic Equations

3. Find an exponential equation that is equivalent to \( \log_7 (6x + 4) = -5 \).

   \[ \log_7 (6x + 4) = -5 \]
4. Find a logarithmic equation that is equivalent to $4^{2x+2} = 7$.

5. Solve the equation $2 \cdot 3^{4x+4} + 1 = 55$.

6. Solve the equation $5^2 \cdot 5^{5x-5} = 25$.

7. Solve the equation $\log_5(x + 5) = 4$.

8. Solve the equation $e^{3x+2} = e^3$.

9. Solve the equation $e^{4x+3} = 23$.

Exponential and Logarithmic Functions

10. Given $f(x) = \sqrt{-5x - 20}$, which of the following is NOT in the domain of $f$?
    (A) $-4$
    (B) $-8$
    (C) $-2$
    (D) $-7$
    (E) All of the above are in the domain of $f$
11. If \( f(x) = x - 6 \) and \( g(x) = 5x^3 - 6 \), determine \( f(g(-4)) \).

12. Given \( g(x) = \log_3(x + 1) \), what is the numerical value of \( g(26) \)?

13. Given \( f(x) = \ln(4x + 2) \), solve the equation \( f(x) = 4 \).

Applications

14. If $2165 is invested in a bank account where interest is compounded continuously at a rate of 1%, the amount of money in the bank in \( t \) years is approximated by \( A(t) = 2165e^{0.01t} \). How many years (rounded to the nearest tenth of a year) will it take the investment to be worth $3776?

15. If $3524 is invested in a bank account where interest is compounded continuously at a rate of 2%, the amount of money in the bank in \( t \) years is approximated by \( A(t) = 3524e^{0.02t} \). What is the amount of money in the bank (rounded to the nearest cent) after 13 years?
Exponential and Logarithmic Expressions

1. \( x = 1.1605584217 \)

2. \( \frac{1}{2} \)

Exponential and Logarithmic Equations

3. \( 6x + 4 = 7^{-5} \)

4. \( 2x + 2 = \log_4(7) \)

5. \( x = -\frac{1}{4} \)

6. \( x = 1 \)

7. \( x = 1291 \)

8. \( x = \frac{1}{3} \)

9. \( x = \frac{\ln(23) - 3}{4} \)

Exponential and Logarithmic Functions

10. C

11. -332

12. 3

13. \( x = \frac{e^4 - 2}{4} \)

14. 55.6 years

15. $4570.38
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Exponential and Logarithmic Expressions

1. Approximate \( \log_3 10 \) to three decimal places.

   (1) ____________

2. Evaluate \( \log_2 \sqrt{2} \).

   (2) ____________

Exponential and Logarithmic Equations

3. Find a logarithmic equation that is equivalent to \( 5^{2x-5} = 2 \).

   (3) ____________
4. Solve the equation $e^{5x+4} = 10$.

5. Solve the equation $2^2 \cdot 2^{4x+3} = 512$.

6. Solve the equation $e^{4x+4} = \frac{1}{e^3}$.

7. Solve the equation $3^{4x+2} + 5 = 32$.

8. Find an exponential equation that is equivalent to $\log_5(3x + 5) = 4$.

9. Solve the equation $\ln(8x + 7) = 4$.

Exponential and Logarithmic Functions

10. Given $g(x) = \log_5\left(\frac{1}{x+5}\right)$, what is the numerical value of $g(211)$?
11. If \( f(x) = x - 2 \) and \( g(x) = x^3 - 7 \), determine \( f(g(3)) \).

\[ \text{(11)} \]

12. Given \( f(x) = \sqrt{2x - 4} \), which of the following is NOT in the domain of \( f \)?

(A) 2  
(B) 3  
(C) 11  
(D) 7  
(E) All of the above are in the domain of \( f \)

13. Given \( g(x) = \log_{8}(7x + 4) \), solve the equation \( g(x) = 2 \).

\[ \text{(13)} \]

Applications

14. The population of a small Texas town was 1819 in the year 2000. The population has since declined by approximately 1% per year. Thus the population of the town is approximated by \( p(t) = 1819e^{-0.01t} \) where \( t \) is measured in years since 2000. How many years (rounded to the nearest tenth of a year) will it take for the population of the town to reach 1605 people?

\[ \text{(14)} \]

15. The population of a small Texas town was 3903 in the year 2003. The population has since increased by approximately 0.5% per year. Thus the population of the town is approximated by \( p(t) = 3903e^{0.005t} \) where \( t \) is measured in years since 2003. What was the population of the town (rounded to the nearest whole person) in 2011?

\[ \text{(15)} \]
Exponential and Logarithmic Expressions

1. \( x = 2.09590327429 \)
2. \( \frac{1}{4} \)

Exponential and Logarithmic Equations

3. \( 2x - 5 = \log_5(2) \)
4. \( x = \frac{\ln(10) - 4}{5} \)
5. \( x = 1 \)
6. \( x = -\frac{7}{4} \)
7. \( x = \frac{1}{4} \)
8. \( 3x + 5 = 5^4 \)
9. \( x = \frac{e^4 - 7}{8} \)

Exponential and Logarithmic Functions

10. \(-3\)
11. 18
12. E
13. \( x = \frac{60}{7} \)
14. 12.5 years
15. 4062.0 people