

Name: _____

Section: _____

MA 109

Fall 2013

Exam 3

November 20, 2013

Directions:

- Do not remove this page—you will turn in the entire exam. You have two hours to do this exam. No books or notes may be used. You may use a graphing calculator during the exam, but NO calculator with a Computer Algebra System (CAS) or a QWERTY keyboard is permitted. Absolutely no cell phone use during the exam is allowed.
- The exam consists of multiple choice and short answer questions. Record your answers on this page by filling in the appropriate selection, for example:

A B C D E.

- The exam is out of 100 total points: 5 points for each of 20 questions. **Only** this front page will be graded and **no partial credit** will be awarded. It is recommended that you check your work!

1. A B C D E

2. A B C D E

3. A B C D E

4. A B C D E

5. A B C D E

6. A B C D E

7. A B C D E

8. A B C D E

9. A B C D E

10. A B C D E

11. A B C D E

12. A B C D E

13. A B C D E

14. A B C D E

15.

16.

17.

18.

19.

20.

For grading use:

Total	
	(out of 100 pts)

Name: _____

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Multiple Choice: Show your work in the space below and shade the correct answer on the front page for each of the following.

1. For $f(x) = x^2 + 1$ and $g(x) = \sqrt{x - 3}$, find a formula for the composition $g(f(x))$.

Choices:

- (a) $x + \sqrt{2}$
 - (b) $x - 2$
 - (c) $\sqrt{x^2 - 2}$
 - (d) 2
 - (e) $\sqrt{x - 3}$
-

2. Which of the following functions are one-to-one?

$$f(x) = x - 5$$

$$g(x) = |x - 5|$$

$$h(x) = \sqrt{x - 5}$$

Choices:

- (a) $f(x)$ and $h(x)$ are the only one-to-one functions.
 - (b) $g(x)$ and $h(x)$ are the only one-to-one functions.
 - (c) $f(x)$, $g(x)$ and $h(x)$ are all one-to-one functions.
 - (d) $f(x)$ is the only one-to-one function.
 - (e) $f(x)$ and $g(x)$ are the only one-to-one functions.
-

3. Translate the following exponential statement into an equivalent logarithmic statement.

$$37^t = 9261$$

Choices:

- (a) $\log_{37}(9261) = t$
 - (b) $\log_{9261}(t) = 37$
 - (c) $\log_{9261}(37) = t$
 - (d) $\log_{37}(t) = 9261$
 - (e) $\log_t(37) = 9261$
-

4. Write the logarithmic expression below as a single logarithm.

$$\ln(a) - 2\ln(b) + 3\ln(c)$$

Choices:

- (a) $\ln\left(\frac{a}{b^2c^3}\right)$
 - (b) $\ln(a - b^2 + c^3)$
 - (c) $\ln\left(\frac{ac^3}{b^2}\right)$
 - (d) $\ln\left(\frac{a}{6bc}\right)$
 - (e) $\ln\left(\frac{3ac}{2b}\right)$
-

5. For $f(x) = x^2 + 1$ and $g(x) = 2x + 3$, find the domain of $\frac{f}{g}(x)$ in interval notation.

Choices:

- (a) $(-\infty, 0)$
 - (b) $\left(\frac{-3}{2}, \infty\right)$
 - (c) $(-\infty, \infty)$
 - (d) $\left(-\infty, \frac{-3}{2}\right) \cup \left(\frac{-3}{2}, \infty\right)$
 - (e) $(-\infty, 0) \cup (0, \infty)$
-

6. Find all real solutions to the equation below.

$$\log_4(x) + \log_4(x - 6) = 2$$

Choices:

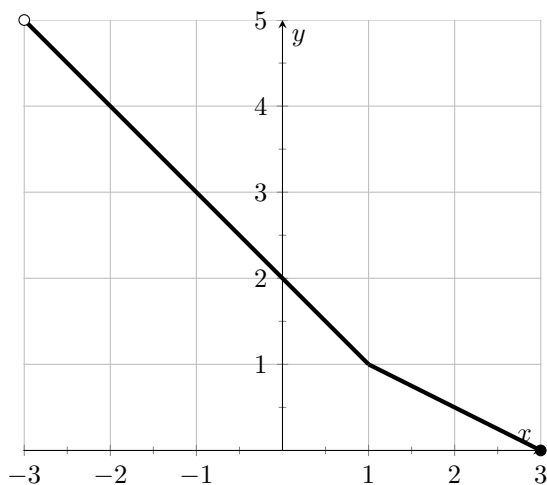
- (a) -2 and -8
 - (b) 6
 - (c) 6 and 2
 - (d) 8
 - (e) -2
-

7. Let $f(x) = \sqrt{x-1}$. Which of the following is $f^{-1}(2)$?

Choices:

- (a) 1
 - (b) 2
 - (c) 3
 - (d) 4
 - (e) 5
-

8. In the graph below the graph of $y = f(x)$ is depicted. What is the domain of $f^{-1}(x)$?



Choices:

- (a) $[0, 5)$
 - (b) $[5, 0)$
 - (c) $(-3, 3]$
 - (d) $f^{-1}(x)$ does not exist
 - (e) $(-3, 1) \cup (1, 3]$
-

9. At what annual interest rate should \$4000 be invested, compounded continuously, so that 6 years later the investment will be worth \$5000?

Choices:

- (a) 3.79%
 - (b) 3.72%
 - (c) 1.25%
 - (d) -1.57%
 - (e) 1.57%
-

10. A colony of bacteria grows exponentially according to the following data. Find a formula for the number of bacteria f as a function of the number of days x .

Day	0	1	2	3	4
Population	6	102	1,734	29,478	501,126

Choices:

- (a) $f(x) = 102(17)^x$
 - (b) $f(x) = 17^x$
 - (c) $f(x) = 17(6)^x$
 - (d) $f(x) = 96x + 6$
 - (e) $f(x) = 6(17)^x$
-

11. A colony of bacteria grows exponentially according to the following data. Find the average rate of change in population with respect to time from Day 0 to Day 3.

Day	0	1	2	3	4
Population	6	102	1,734	29,478	501,126

Choices:

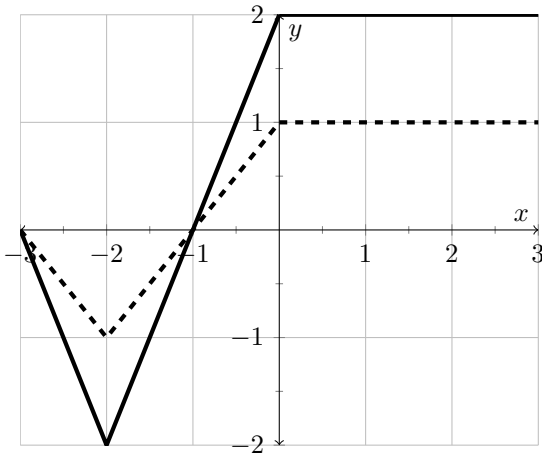
- (a) 17 bacteria per day
 - (b) 14736 bacteria per day
 - (c) 102 bacteria per day
 - (d) 14742 bacteria per day
 - (e) 9824 bacteria per day
-

12. Suppose the graph of $y = f(x)$ is a line with slope $\frac{1}{2}$ and which goes through the point $(0, 3)$. Find the average rate of change of $f(x)$ as x changes from 5 to $5 + h$.

Choices:

- (a) 1
 - (b) h
 - (c) $1/2$
 - (d) $2x + h$
 - (e) $5/3$
-

13. In the picture below, the graph of $y = f(x)$ is the solid graph, and the graph of $y = g(x)$ is the dashed graph. Find a formula for $g(x)$.



Choices:

- (a) $g(x) = \frac{f(x)}{2}$
- (b) $g(x) = f\left(\frac{x}{2}\right)$
- (c) $g(x) = f(x - 4)$
- (d) $g(x) = f(x) - 0.75$
- (e) $g(x) = 2f(x)$

14. If \$150 is invested at an annual interest rate of 3.50% per year compounded monthly, find the amount of the investment at the end of five years.

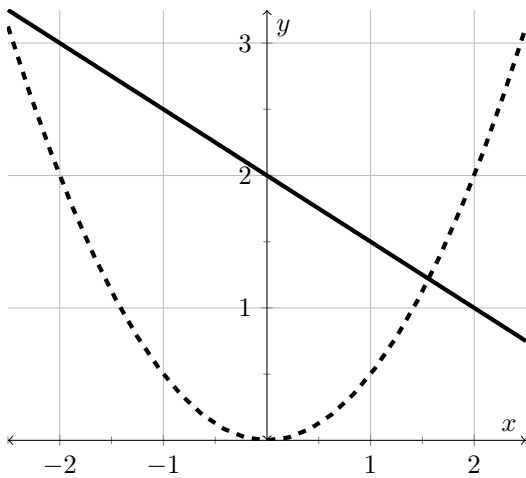
Choices:

- (a) \$178.64
- (b) \$1181.71
- (c) \$178.15
- (d) \$776.68
- (e) \$787.83

Short Answer: Show your work below and place the appropriate answer on front page for each of the following.

15. Let $f(x) = \frac{x}{7} - 3$. Find a formula for $f^{-1}(x)$.

16. In the picture below, the graph of $y = f(x)$ is the solid graph, and the graph of $y = g(x)$ is the dashed graph. Evaluate $f(g(-2))$.



17. Find the average rate of change of the function $f(x) = x^2 - 2x + 7$ as x changes from 1 to 5.

18. Let $f(x) = \log_3(4x + 20)$. Find the domain of $f(x)$. **Be sure to write your answer in interval notation.**

19. If $(6, -2)$ lies on the graph of $f(x)$, find a point on the graph of $y = g(x)$ if $g(x) = f(2x) + 4$.

20. Solve the equation for x : $127^{19x} = 127^{38}$