MA109 — College Algebra Spring 2019
Final Exam 2019-05-01

Name: _____ **Sec.:** _____

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The exam consists of multiple choice questions. Record your answers on this page. For each multiple choice question, you will need to fill in the circle corresponding to the correct answer. For example, if (a) is correct, you must write

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GOOD LUCK!

1.	(a)	(b)	(c)	(d)	(e)	**12.**	(a)	(b)	(c)	(d)	(e)
2.	(a)	(b)	(c)	(d)	(e)	**13.**	(a)	(b)	(c)	(d)	(e)
3.	(a)	(b)	(c)	(d)	(e)	**14.**	(a)	(b)	(c)	(d)	(e)
4.	(a)	(b)	(c)	(d)	(e)	**15.**	(a)	(b)	(c)	(d)	(e)
5.	(a)	(b)	(c)	(d)	(e)	**16.**	(a)	(b)	(c)	(d)	(e)
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8.	(a)	(b)	(c)	(d)	(e)	**19.**	(a)	(b)	(c)	(d)	(e)
9.	(a)	(b)	(c)	(d)	(e)	**20.**	(a)	(b)	(c)	(d)	(e)
10.	(a)	(b)	(c)	(d)	(e)	**21.**	(a)	(b)	(c)	(d)	(e)
11.	(a)	(b)	(c)	(d)	(e)	**22.**	(a)	(b)	(c)	(d)	(e)

For grading use:

Number Correct	
	(out of 20 problems)

Total	
	(out of 100 points)

General Function Forms:

Linear:	$L(x) = Mx + B$
Quadratic:	$Q(x) = A(x - H)^2 + K$
Exponential:	$E(x) = AB^x$ or $E(t) = Ae^{Kt}$

Slope:

$$M = \frac{y_2 - y_1}{x_2 - x_1}$$

Distance:

$$D = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}$$

Quadratic formula:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Graph transformations:

Shift right by H:	$y = f(x - H)$
Shift up by K:	$y = f(x) + K$
Reflect vertically over the x-axis:	$y = -f(x)$
Reflect horizontally over the y-axis:	$y = f(-x)$
Stretch vertically by A:	$y = A \cdot f(x)$
Shrink horizontally by A:	$y = f(A \cdot x)$

Logarithm rules:

Definition:	$B^P = C$ and $\log_B(C) = P$ are equivalent
Product:	$\log_B(X \cdot Y) = \log_B(X) + \log_B(Y)$
Quotient:	$\log_B\left(\frac{X}{Y}\right) = \log_B(X) - \log_B(Y)$
Power:	$\log_B\left(X^P\right) = P \cdot \log_B(X)$
Change of Base:	$\log_B(X) = \frac{\log_C(X)}{\log_C(B)}$
Natural log:	$\ln(X) = \log_e(X)$ for $e \approx 2.718\ldots$

Name: _____

Multiple Choice Questions

Show all your work on the page where the question appears.
Clearly mark your answer both on the cover page on this exam
and in the corresponding questions that follow.

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1. Find an equation for a line whose slope is 7 that goes through the point $(2, 11)$.

   Possibilities:

   (a) $y = 7(x-2)^2 + 11$

   (b) $y = 7(x+11) + 2$

   (c) $y = 11(x-2) - 7$

   (d) $y = 7(x-2) + 11$

   (e) $y = 2(x+7) - 11$

---

2. Which of these points (x, y) is on the graph $y = \log_5(x-7) + 3$.
   You may use the fact that $(1, 0)$ is on the graph of $y = \log_5(x)$.

   Possibilities:

   (a) $(x, y) = (0, 3)$

   (b) $(x, y) = (3, 7)$

   (c) $(x, y) = (5, 10)$

   (d) $(x, y) = (7, 1)$

   (e) $(x, y) = (8, 3)$

---

3. What is the domain of $\log_7(11 - 2x)$?

   Possibilities:

   (a) $(-\infty, \frac{11}{2})$

   (b) $(-\infty, 7]$

   (c) $(-11, \infty)$

   (d) $(-\infty, -11)$

   (e) $(\frac{11}{2}, \infty)$

---

4. Consider $f(x) = -7(5^x)$. What is the end behavior on the right?

Possibilities:

(a) $y \to \infty$ as $x \to \infty$

(b) $y \to 0$ as $x \to \infty$

(c) $y \to -7$ as $x \to \infty$

(d) $y \to -\infty$ as $x \to \infty$

(e) $y \to 5$ as $x \to \infty$

---

5. What is the y-intercept of $f(x) = 6\log_2(x+8) + 7$?

Possibilities:

(a) 55

(b) 7

(c) -7

(d) 25

(e) None

---

6. What asymptote does the graph of $y = 999999^{(x-77)} + 5$ have and what is its equation?

Possibilities:

(a) Vertical: $x = 77$

(b) Horizontal: $y = 999999$

(c) Vertical: $x = -999999$

(d) Vertical: $x = 0$

(e) Horizontal: $y = 5$

---

7. Write $2\log(x) - 3\log(y) + \frac{1}{2}\log(z+1)$ as a single logarithm.

Possibilities:

(a) $\log\left(x^2 - y^3 + (z+1)^{1/2}\right)$

(b) $\log\left(\dfrac{x^2(z+1)^2}{\sqrt[3]{y}}\right)$

(c) $\log\left(\dfrac{x^2\sqrt{z+1}}{y^3}\right)$

(d) $\log\left(2x - 3y + z + \frac{1}{2}\right)$

(e) $-\frac{1}{2}\log\left(\dfrac{xy}{z+1}\right)$

---

8. Solve $5x^3 = 40$.

Possibilities:

(a) $\log_{40}(5)$ only

(b) 2 only

(c) 2 and -2

(d) $40/3 + \sqrt{5}$ only

(e) $\log_3(40)$ only

---

9. Solve $3^x + 14 = 130$.

Possibilities:

(a) $x = \log_3(116)$

(b) $x = 130/14$

(c) $x = \sqrt[3]{116}$

(d) $x = \sqrt[3]{130} - 14$

(e) $x = 2$

---

10. Solve $\log_3(x) = A$ for x assuming A is a real number.

Possibilities:

(a) $x = \sqrt[3]{A}$

(b) $x = \sqrt{3}$

(c) $x = 3A/\log$

(d) $x = A^3$

(e) $x = 3^A$

---

11. Solve $\log_4(x) - \log_4(5) = \log_4(6) - \log_4(7)$.

Possibilities:

(a) $x = \log_4(6/7)$

(b) $x = \dfrac{30}{7}$

(c) $x = 210$

(d) $x = 4$

(e) $x = 1$

---

12. Solve $\log_7(x + 13) - \log_7(x + 11) = \log_7(3)$ for x.

Possibilities:

(a) $x = -10$

(b) $x = \sqrt[7]{\dfrac{39}{11}}$

(c) $x = \log_7\left(\dfrac{39}{11}\right)$

(d) $x = 7^5$

(e) $x = 7^{\frac{39}{11}}$

---

13. How much 13% solution should be mixed with 3% solution in order to get 250g of 7% solution?
(While the amount of 3% solution is important, this question only asks for the amount of 13% solution.)

Possibilities:

(a) 193g of 13% solution

(b) 150g of 13% solution

(c) 100g of 13% solution

(d) 235g of 13% solution

(e) 370g of 13% solution

---

14. Five towns have populations estimated by the following exponential models. Which town has the largest initial population?

Possibilities:

(a) $P(t) = 98(1.023)^t$

(b) $P(t) = 12345(0.96)^t$

(c) $P(t) = 4321(1.098)^t$

(d) $P(t) = 5432(0.87)^t$

(e) $P(t) = 321(1.98)^t$

---

15. A town's population starts at 789 people and increases by 6% each year. Which of these functions gives the population after t years?

Possibilities:

(a) $P(t) = 789(1.06)^t$

(b) $P(t) = 789(.06)^t$

(c) $P(t) = 789(0.94)^t$

(d) $P(t) = 789(6)^t$

(e) $P(t) = 6t + 789$

---

16. A substance is decaying over time with a half-life of 3 years. How long before only 1% of it is left?

Possibilities:

(a) $\dfrac{100}{3}$ years

(b) 30 years

(c) $\log\left(\dfrac{3}{0.01}\right)$ years

(d) $\dfrac{\log(3)}{\log(0.01)}$ years

(e) $3\dfrac{\log(0.01)}{\log(1/2)}$ years

---

17. Let $f(x) = \log_5(x) + 7$. Compute $f(x+h) - f(x)$.

Possibilities:

(a) 5

(b) $5^{x+h} - 5^x$

(c) $\log_5(x+h) - \log_5(x)$

(d) $5x + 7 + h$

(e) $\dfrac{5x+7}{h}$

---

18. Using laws of logarithms, write the expression below as a single logarithm.

$$11\left(\log(x+7) + \frac{3}{11}\log(x+5)\right)$$

Possibilities:

(a) $\log\left(\dfrac{11+(x+7)}{3-11+(x+5)}\right)$

(b) $\log\left(11(x+7)\sqrt[3]{x+5}\right)$

(c) $\log\left(\dfrac{11(x+7)}{3(x+5)}\right)$

(d) $\log\left((x+7)^{11}(x+5)^3\right)$

(e) $\log\left(11(x+7)+3(x+5)\right)$

---

19. The graph of the function $y = \log_B(x)$ goes through $(81, -1)$. The value of B must be:

Possibilities:

(a) $B = 80$

(b) $B = 9$

(c) $B = \frac{1}{81}$

(d) $B = \frac{1}{9}$

(e) $B = 81$

20. Let $f(x) = 2 \cdot 3^x$ and $g(x) = x + 4$. Which of these is a formula for $(f \circ g)(x)$, or $f(g(x))$?

Possibilities:

(a) $\log_3(4) \cdot 2^x$

(b) $2 \cdot 3^{(x+4)}$

(c) $\log_3(x) + 2$

(d) $\ln(3^x) + 4$

(e) $2x$

21. Students in a fifth-grade class were given an exam. During the next 2 years, the same students were tested again several times. The average score was given by the model:

$$f(t) = 87 - 4\log_{10}(t+1), \quad 0 \le t \le 24$$

where t is the time in months.

What was the average score after 6 months (rounded to one decimal place)?

Possibilities:

(a) 47.9

(b) 87.0

(c) 74.3

(d) 80.4

(e) 83.6

22. Let $P = f(t) = 1000(1.037)^t$ be the population of a community t years after today.

One could calculate that $f(10)$ is approximately 1438.0

Which of these statements correctly explains the practical meaning of the value for $f(10)$?

Possibilities:

(a) The population after 10 years will be 1438

(b) It will take 1438 years before the population is ten times as large

(c) The initial population of the community is 1438

(d) Every decade the population grows by 1438

(e) The average rate of growth is 1438 people per year

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Right	Grade	Wrong
22	110	0
21	105	1
20	100	2
19	95	3
18	90	4
17	85	5
16	80	6
15	75	7
14	70	8
13	65	9
12	60	10
11	55	11
10	50	12
9	45	13
8	40	14
7	35	15
6	30	16
5	25	17
4	20	18
3	15	19
2	10	20
1	5	21
0	0	22

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