MA 109 — College Algebra FALL 2007
FINAL EXAM 12/10/2007

Name: Key **Sec.:** _____

Do not remove this answer 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 20 multiple choice questions. Record your answers on this page by filling in the box corresponding to the correct answer. For example, if (a) is correct, you must write

[a] [b] [c] [d] [e]

Do not circle answers on this page, but please do circle the letter of each correct response in the body of the exam. It is your responsibility to make it CLEAR which response has been chosen. You will not get credit unless the correct answer has been marked on both this page and in the body of the exam.

GOOD LUCK!

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. [a] [b] [c] [d] [e]
16. [a] [b] [c] [d] [e]
17. [a] [b] [c] [d] [e]
18. [a] [b] [c] [d] [e]
19. [a] [b] [c] [d] [e]
20. [a] [b] [c] [d] [e]

For grading use:

Total	
	(out of 100 pts)

MA 109 — College Algebra FALL 2007
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Name: _____ **Sec.:** _____

Please make sure to list the correct section number on the front page of your exam and on this page.

Section #	Instructor	Lectures
001	Robbins	MWF 8:00am-8:50am, CP 320
002	Jung	MWF 8:00am-8:50am, CB 337
003	Harrison	MWF 9:00am-9:50am, CB 339
004	Nie	MWF 9:00am-9:50am, FB 213
005	Bagchi Misra	MWF 10:00am-10:50am, CB 337
006	Jung	MWF 10:00am-10:50am, CB 349
007	Nie	MWF 10:00am-10:50am, FB 213
008	Li	MWF 11:00am-11:50am, FB 213
009	Butcher	MWF 12:00pm-12:50pm, CB 337
010	Kirby	MWF 12:00pm-12:50pm, CB 341
011	Li	MWF 12:00pm-12:50pm, FB 213
012	Slone	MWF 1:00pm-1:50pm, FB 213
013	Bagchi Misra	MWF 1:00pm-1:50pm, CB 239
014	Slone	MWF 2:00pm-2:50pm, FB 213
015	Petrovic	MWF 2:00pm-2:50pm, CB 239
016	Petrovic	MWF 3:00pm-3:50pm, CB 337
017	Kirby	MWF 3:00pm-3:50pm, CB 339
018	Schubert	MWF 3:00pm-3:50pm, CP 320
019	Ho	TR 8:00am-9:15am, CB 341
020	Robbins	TR 8:00am-9:15am, CP 153
021	Ho	TR 9:30am-10:45am, CB 341
023	Boucher	TR 9:30am-10:45am, CB 239
024	Merrick	TR 11:00am-12:15pm, CB 341
026	Wells	TR 11:00am-12:15pm, CB 239
027	Merrick	TR 12:30pm-1:45pm, CB 341
028	Bouchat	TR 12:30pm-1:45pm, CB 215
029	Wells	TR 12:30pm-1:45pm, CB 239
030	Mattingly	TR 2:00pm-3:15pm, CB 239
031	Bouchat	TR 2:00pm-3:15pm, CB 213
032	Nanwani	TR 2:00pm-3:15pm, CB 333
033	Nanwani	TR 3:30pm-4:45pm, CB 341
034	Mattingly	TR 3:30pm-4:45pm, CB 213
035	Butcher	MWF 9:00am-9:50am, CB 239
036	Boucher	TR 8:00am-9:15am, CB 341
401	Foege	TR 6:00pm-7:15pm, CB 339
402	Foege	TR 7:30pm-8:45pm, CB 339
403	Vanderpool	TR 6:00pm-7:15pm, CB 341
404	Vanderpool	TR 7:30pm-8:45pm, CB 341

Formula Sheet:

Compound Interest: If a principal P is invested at an interest rate r for a period of t years, then the amount $A(t)$ of the investment is given by:

$$A(t) = P\left(1 + \frac{r}{n}\right)^{nt} \quad \text{(if compounded } n \text{ times per year)}$$

$$A(t) = P\,e^{rt} \quad \text{(if compounded continuously).}$$

Exponential Growth Model If n_0 is the initial size of a population that experiences **exponential growth**, then the population $n(t)$ at time t increases according to the model:

$$\boxed{n(t) = n_0 e^{rt}}$$

where r is the relative rate of growth of the population (expressed as a proportion of the population).

Radioactive Decay Model: If m_0 is the initial mass of a radioactive substance with half-life h, then the mass $m(t)$ remaining at time t is modeled by the function:

$$\boxed{m(t) = m_0 e^{-rt}}$$

where $r = \dfrac{\ln 2}{h}$.

Newton's Law of Cooling: If D_0 is the initial temperature difference between an object and its surroundings, and if its surroundings have temperature T_S, then the temperature of the object at time t is modeled by the function:

$$\boxed{T(t) = T_S + D_0 e^{-kt}}$$

where k is a positive constant that depends on the object.

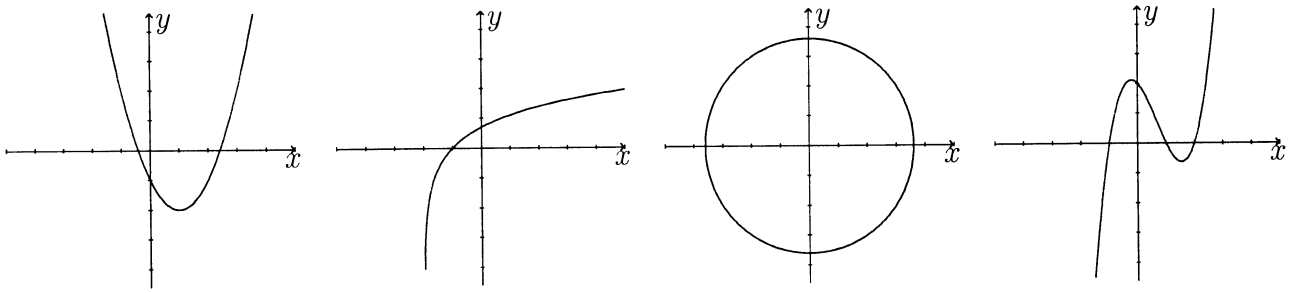
Change of Base Formula: Let a and b be two positive numbers with $a, b \neq 1$. If $x > 0$, then:

$$\boxed{\log_b x = \frac{\log_a x}{\log_a b}}$$

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.

1. Four graphs are shown below. Which graph represents a one-to-one function of x?



(A) (B) (C) (D)

Possibilities:

(a) (A)
(b) (B)
(c) (C)
(d) (D)
(e) None of the graphs depicts a one-to-one function of x.

2. Find all solutions of the equation.

$$2x^4 + 3 = 1253$$

$2x^4 = 1250$
$x^4 = 625$
$x = \pm\sqrt[4]{625}$
$x = \pm 5$

Possibilities:

(a) The only solution is $x = 5$.
(b) The only solution is $x = 6$.
(c) There are two solutions: $x_1 = 5$ and $x_2 = -5$.
(d) There are two solutions: $x_1 = 6$ and $x_2 = -6$.
(e) There are four solutions: $x_1 = 5$, $x_2 = -5$, $x_3 = 6$, and $x_4 = -6$.

3. Express the equation in logarithmic form.

$$4^7 = 16384$$

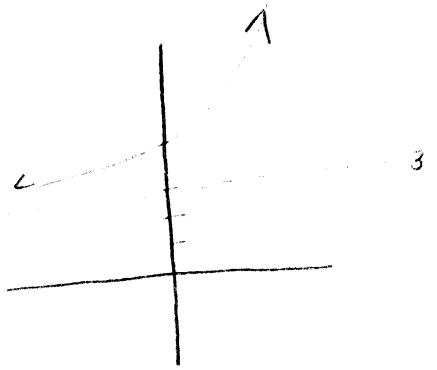
$\log_4 16384 = 7$

Possibilities:

(a) $\log_4 16384 = 7$
(b) $\log_7 16384 = 4$
(c) $\log_4 7 = 16384$
(d) $\log_7 4 = 16384$
(e) $\log_{16384} 7 = 4$

4. Find the range of the exponential function.

$$f(x) = 2^x + 3$$



Possibilities:

(a) $(3, \infty)$
(b) $(-3, \infty)$
(c) $(2, \infty)$
(d) $(-2, \infty)$
(e) $(-\infty, \infty)$

5. Find the minimum value of the function.

$$f(x) = 2x^2 + 4x + 7$$

$x = \frac{b}{2a} = \frac{-4}{2 \cdot 2} = -1$

$f(-1) = 2(-1)^2 + 4(-1) + 7 = 5$

Possibilities:

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

6. How many solutions does the following system of equations have?

$$\begin{cases} y &= x^2 \\ y &= -3 \end{cases}$$

$-3 = x^2$

Possibilities:

(a) No solutions

(b) One solution

(c) Two solutions

(d) Three solutions

(e) Infinitely many solutions

No solutions

---

7. Which of the following statements are true?

(I) $x^3x^2 = x^5$ ✓

(II) $x^3x^2 = x^6$

(III) $(x^2)^3 = x^6$ ✓

Possibilities:

(a) Only (I) is true.

(b) Only (II) is true.

(c) Only (III) is true.

(d) Both (I) and (III) are true.

(e) Both (II) and (III) are true.

---

8. Let $f(x) = \dfrac{x+3}{4}$. Find $f^{-1}(2)$.

Possibilities:

(a) 5

(b) 6

(c) 7

(d) 8

(e) 9

$y = \dfrac{x+3}{4}$

$x = \dfrac{y+3}{4}$

$4x = y+3$

$4x - 3 = y$

$f^{-1}(x) = 4x - 3$

$f^{-1}(2) = 4(2) - 3$

$= 5$

~~$4x = y$~~

9. Solve the inequality. Express the solution in interval notation.

$$|x+2| \le 8$$

$-8 \le x+2 \le 8$
$-2 \quad -2 \quad -2$
$-10 \le x \le 6$
$[-10, 6]$

Possibilities:

(a) $[-16, 4]$
(b) $[2, 8]$
(c) $(-\infty, -16] \cup [4, \infty)$
(d) $(-\infty, -10] \cup [6, \infty)$
(e) $[-10, 6]$

---

10. Solve the equation.

$$\log_4(x+3) + \log_4(x-3) = 2$$

$\log_4((x+3)(x-3)) = 2$
$\log_4(x^2-9) = 2$
$x^2 - 9 = 2^4$
$x^2 - 9 = 16$
$x^2 = 25$

$x = \pm 5$
BUT need to check

$\log_4(5+3) + \log_4(5-3) \stackrel{?}{=} 2$
$\log_4(8) + \log_4(2) \stackrel{?}{=} 2$
$\log_4(16) = 2$ ✓

$\log_4(-5+3) + \log_4(-5-3) \stackrel{?}{=} 2$
$\log_4(-2) + \log_4(-8) \stackrel{?}{=} 2$

negative numbers are not in the domain of the log function

Possibilities:

(a) $x = 8$
(b) $x = 5$ and $x = -5$
(c) $x = 5$
(d) $x = 3$ and $x = -3$
(e) $x = 3$

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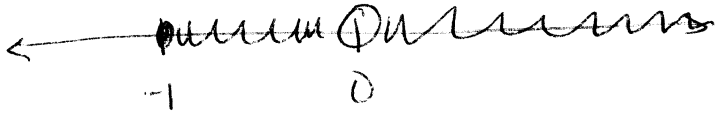
11. Let $f(x) = \dfrac{\sqrt{x+1}}{x}$. Find the domain of f, and express your answer in interval notation.

$x \ge -1$
$x \ne 0$



$[-1, 0) \cup (0, \infty)$

Possibilities:

(a) $[-1, \infty)$
(b) $[1, \infty)$
(c) $(-\infty, -1) \cup (-1, \infty)$
(d) $[-1, 0) \cup (0, \infty)$
(e) $(-\infty, \infty)$

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12. Find the average rate of change of $f(x) = \frac{1}{x}$ from $x = 2$ to $x = 5$.

Possibilities:

(a) $\frac{1}{10}$

(b) $\frac{-1}{10}$

(c) $\frac{3}{10}$

(d) $\frac{-3}{10}$

(e) 0

$$\frac{f(5) - f(2)}{5 - 2} = \frac{\frac{1}{5} - \frac{1}{2}}{5 - 2} = \frac{\frac{2}{10} - \frac{5}{10}}{3} = \frac{-3/10}{3} = -\frac{1}{10}$$

13. Find an equation for the line that passes through $(-2, 3)$ and has slope $\frac{1}{4}$.

Possibilities:

(a) $y + 3 = \frac{1}{4}(x - 2)$

(b) $y - 3 = \frac{1}{4}x + 2$

(c) $y - 2 = \frac{1}{4}(x + 3)$

(d) $y - 3 = \frac{1}{4}(x + 2)$

(e) $y + 2 = \frac{1}{4}(x - 3)$

$$y - 3 = \frac{1}{4}(x + 2)$$

14. Let $f(x) = 3x$ and $g(x) = x + 2$. Find $(f \circ g)(x)$.
RECALL: $(f \circ g)(x) = f(g(x))$

Possibilities:

(a) $3x + 6$

(b) $3x^2 + 6x$

(c) $4x + 2$

(d) $3x + 2$

(e) $3x^2 + 2$

$$f(g(x)) = f(x+2) = 3(x+2) = 3x + 6$$

15. Which of the following statements are true?

(I) $\log(3+4) = \log(3) + \log(4)$

(II) $\log(3+4) = \log(3) * \log(4)$

(III) $\log(3*4) = \log(3) + \log(4)$

(IV) $\log(3*4) = \log(3) * \log(4)$

Possibilities:

(a) Only (I) and (IV) are true.

(b) Only (II) and (III) are true.

(c) Only (II) is true.

(d) Only (III) is true.

(e) Only (IV) is true.

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16. List **all possible** rational zeros given by the Rational Zeros Theorem (but do not check to see which are actually zeros.)

$$P(x) = x^5 + 3x^2 + 7$$

$\pm 1 \quad \pm 7$

± 1

$\pm 1 \quad \pm 7$

Possibilities:

(a) $\pm 1, \pm 3, \pm 7$

(b) $\pm 1, \pm\frac{1}{3}, \pm\frac{1}{7}$

(c) $\pm 1, \pm\frac{1}{3}, \pm 3, \pm\frac{1}{7}, \pm 7$

(d) $\pm 1, \pm\frac{1}{7}$

(e) $\pm 1, \pm 7$

17.

$$\log_3 21 - \log_3 7 =$$

$\log_3\left(\frac{21}{7}\right)$

Possibilities:

(a) $\log_3(21-7)$

(b) $\log_3\left(\frac{21}{7}\right)$

(c) $\log_3(21 * 7)$

(d) $\log_3(21^7)$

(e) $\frac{\log_3 21}{\log_3 7}$

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18. Ed invests \$2000 at an interest rate of 5% per year compounded quarterly. What is the amount of Ed's investment at the end of 10 years?

$A(10) = 2000\left(1 + \frac{0.05}{4}\right)^{4(10)}$

$\approx \$3287.24$

Possibilities:

(a) \$3287.24

(b) \$3257.79

(c) \$2264.54

(d) \$14,079.98

(e) \$2441.59

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19. The number of bacteria in a culture is modeled by

$$n(t) = 200e^{0.5t}$$

where t is measured in hours. When will the number of bacteria reach 2000? Round your answer to the nearest tenth of an hour.

$\frac{2000}{200} = \frac{200e^{0.5t}}{200}$

$10 = e^{0.5t}$

$\ln(10) = \ln e^{0.5t}$

$\ln(10) = 0.5t$

$\frac{\ln(10)}{0.5} = t$

$t \approx 4.6$ hours

Possibilities:

(a) About 2.9 hours

(b) About 3.6 hours

(c) About 4.6 hours

(d) About 5.8 hours

(e) About 7.7 hours

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20. Which of the following statements are true?

(A) If $P(x) = x^3 - 9x^2 + 26x - 24$, then $P(2) = 0$.

(B) $(2, 0)$ is an x-intercept on the graph of $y = x^3 - 9x^2 + 26x - 24$.

(C) The remainder of the division problem $\dfrac{x^3 - 9x^2 + 26x - 24}{x - 2}$ is zero.

(D) $(x - 2)$ is a factor of $x^3 - 9x^2 + 26x - 24$.

These statements all mean the same thing. One of them is true, so all are true.

Possibilities:

(a) (A), (B), (C), and (D) are all true.

(b) Only (A) and (B) are true.

(c) Only (C) and (D) are true.

(d) Only (A), (B), and (C) are true.

(e) Only (A), (C), and (D) are true.

Happy Holidays!!!