MA 113 Calculus I Fall 2015 Exam 1 Tuesday, 22 September 2015

Name: \_\_\_\_\_

Section: \_\_\_\_\_

# Last 4 digits of student ID #: \_\_\_\_\_

This exam has ten multiple choice questions (five points each) and five free response questions (ten points each). Additional blank sheets are available if necessary for scratch work. No books or notes may be used. Turn off your cell phones and do not wear ear-phones during the exam. You may use a calculator, but not one which has symbolic manipulation capabilities.

### On the multiple choice problems:

- Select your answer by placing an X in the appropriate square of the multiple choice answer box on the front page of the exam.
- Carefully check your answers. No credit will be given for answers other than those indicated on the *multiple choice answer* box.

## On the free response problems:

- Clearly indicate your answer and the reasoning used to arrive at that answer (unsupported answers may not receive credit),
- Give exact answers, rather than decimal approximations to the answer (unless otherwise stated).

Each free response question is followed by space to write your answer. Please write your solutions neatly in the space below the question.

#### Multiple Choice Answers

Question					
1	A	В	С	D	Е
2	A	В	С	D	Е
3	A	В	С	D	Е
4	А	В	С	D	Е
5	A	В	С	D	Е
6	A	В	С	D	Е
7	A	В	С	D	Е
8	A	В	С	D	Е
9	A	В	С	D	Е
10	A	В	С	D	Е

### Exam Scores

Question	Score	Total
MC		50
11		10
12		10
13		10
14		10
15		10
Total		100

- If f(x) = x<sup>2</sup> 1, find f(f(0)).
  (A) -2
  (B) -1
  (C) 0
  (D) 1
  - (E) 2

- 2. Suppose that f(x) = |x+1| and the domain of f is  $(-\infty, -1]$ . Find  $f^{-1}(2)$ .
  - (A) -5
  - (B) -4
  - (C) -3
  - (D) -2
  - (E) -1

- 3. Which function below is equal to  $5^x$ ?
  - (A)  $e^{5x}$
  - (B)  $(\ln(x))^5$
  - (C)  $e^{5\ln(x)}$
  - (D)  $e^{x \ln(5)}$
  - (E)  $5^{\ln(x)}$

- 4. A bug crawls in a counter clockwise direction along a circle centered at the origin and of radius 3 units. The bug begins at the point (3,0) and crawls for 9 minutes at a rate of 4 units per minute. Give the bug's location after 9 minutes.
  - (A)  $(\cos(4/3), \sin(4/3))$
  - (B)  $(3\cos(12), 3\sin(12))$
  - (C)  $(3\cos(36), 3\sin(36))$
  - (D)  $(3\cos(4/3), 3\sin(4/3))$
  - (E)  $(\cos(12), \sin(12))$

Record the correct answer to the following problems on the front page of this exam.

- 5. Solve  $10^{2x+1} = 100$ .
  - (A) 0
  - (B) 1/2
  - (C) 1
  - (D) 3/2
  - (E) 2

6. Find the value of the limit

$$\lim_{x \to 3} \frac{x-3}{x^2 - 2x - 3}.$$

- (A)  $+\infty$
- (B)  $-\infty$
- (C) The limit does not exist and is not  $+\infty$  or  $-\infty$ .
- (D) 1/4
- (E) 0/0

7. Suppose that

$$\lim_{x \to 3} (4f(x) - 3) = 1.$$

Find the value of

$$\lim_{x \to 3} f(x).$$

- (A) 0
- (B) 1
- (C) 2
- (D) 3
- (E) None of the above.

8. Suppose

$$f(x) = \begin{cases} \frac{\cos(2x) - 1}{x}, & x \neq 0\\ c, & x = 0 \end{cases}$$

If f is continuous for all real numbers, what is the value of c?

- (A) -2
- (B) -1
- (C) 0
- (D) 1
- (E) 2

#### Record the correct answer to the following problems on the front page of this exam.

9. Suppose that f is a continuous function on the interval [0,5] and we know that

$$f(0) = 1, f(1) = -1, f(2) = 1, f(3) = -1, f(4) = 1, \text{ and } f(5) = -1.$$

Which of the following statements will be true for any such f?

- (A) There are at least five solutions of the equation f(x) = 0 in the interval [0, 5].
- (B) There are at most five solutions of the equation f(x) = 0 in the interval [0, 5].
- (C) There are exactly five solutions of the equation f(x) = 0 in the interval [0, 5].
- (D) There are no solutions of the equation f(x) = 0 in the interval [0, 5].
- (E) The equation f(x) = 1 has exactly three solutions in the interval [0, 5].

- 10. Suppose that the position of a particle at time t seconds is  $p(t) = t^3 4t^2$  meters to the right of the origin. Find the average velocity of the particle on the interval [1,3].
  - (A) -6 meters/second
  - (B) -3 meters/second
  - (C) 6 meters/second
  - (D) 3 meters/second
  - (E) -18 meters/second

11. (a) Find the inverse function of the function given by

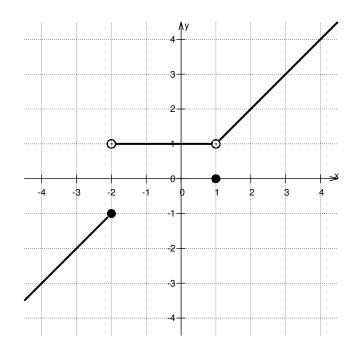
$$f(x) = \frac{4+3x}{3+2x}.$$

(b) Give the domain and range of the function  $f^{-1}$  you find in part (a).

 Find the limits or state that the limit does not exist. In each case, justify your answer. (Students who guess the answer based on a few values of the function will not receive full credit.)

(a) 
$$\lim_{t \to 0} \frac{t}{|t|}$$
  
(b) 
$$\lim_{x \to 0} \frac{x^2 - 2x}{xe^x}$$

- 13. Using the graph of the function f below, complete the following. If the requested information does not exist, write DNE.
  - (a)  $\lim_{x \to -2^+} f(x) =$  \_\_\_\_\_
  - (b)  $\lim_{x \to -2^{-}} f(x) =$ \_\_\_\_\_
  - (c)  $\lim_{x \to -2} f(x) =$ \_\_\_\_\_
  - (d) f(-2) = \_\_\_\_\_
  - (e) Is f left-continuous at -2?
  - (f)  $\lim_{x \to 1^+} f(x) =$ \_\_\_\_\_
  - (g)  $\lim_{x \to 1^{-}} f(x) =$ \_\_\_\_\_
  - (h)  $\lim_{x \to 1} f(x) =$ \_\_\_\_\_
  - (i) f(1) =\_\_\_\_\_
  - (j) Is f left-continuous at 1? \_\_\_\_\_



- 14. (a) State the squeeze theorem.
  - (b) Use the squeeze theorem to find

$$\lim_{x \to 0} x^2 \cos(1/x).$$

- 15. Consider the function f(x) = 1/(x+3).
  - (a) Write an expression for the slope of the secant line that passes through the point (x, f(x)) and (-1, f(-1)).
  - (b) Take the limit as x approaches -1 of the expression you found in part (a) to find the slope of the tangent line to the graph of f at x = -1.
  - (c) Write the equation of the tangent line to the graph of f at x = -1 in point-slope form.