MA 113 Calculus I   Spring 2014
Exam 1   Tuesday, 11 February 2014

Name: —————————————————

Section: —————————————————

Last 4 digits of student ID #: ————
This exam has ten multiple choice questions
(five points each) and five free response ques-
tions (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-plugs during
the exam. You may use a calculator, but not
one which has symbolic manipulation capa-
bilities.
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 deci-
  mal approximations to the answer (un-
  less otherwise stated).

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

Multiple Choice Answers

Question					
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

Exam Scores

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

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

1. Let $f(x) = \sqrt{x-1}$ and $g(x) = x^2$. Find the domain of the composite function $(f \circ g) = f(g(x))$.

   (A) $[-1, 1]$
   (B) $\mathbb{R} = (-\infty, \infty)$
   (C) $(-\infty, -1] \cup [1, \infty)$
   (D) $[1, \infty)$
   (E) $(-1, 1)$

2. Find the equation of the line parallel to $y = 5x - 2$ passing through the point $(-1, 1)$.

   (A) $y = -5x - 2$
   (B) $y = 5x - 1$
   (C) $y = -\frac{1}{5}x - 4$
   (D) $y = \frac{1}{5}x - 2$
   (E) $y = 5x + 6$

3. Find the limit

$$\lim_{x \to a} \frac{x^2 + (1-a)x - a}{x - a}.$$

    (A) 0

    (B) 2

    (C) a

    (D) $a + 1$

    (E) $1 - a$

4. Solve for x when $e^{4(t+x)} = 2e^{4t}$.

    (A) $x = \ln 4$

    (B) $x = \ln 2$

    (C) $x = 2$

    (D) $x = 4$

    (E) $x = \dfrac{\ln 2}{4}$

5. Simplify $\sin(\arccos(x))$. The function arccos is also denoted by $\cos^{-1}$.

    (A) π

    (B) $\sqrt{1-x^2}$

    (C) x

    (D) 0

    (E) $\dfrac{1}{x}$

6. Suppose that a function f is defined by

$$f(x) = \begin{cases} x^2 - c & x \leq 1 \\ cx + 2 & x > 1. \end{cases}$$

Find c such that $\lim\limits_{x\to 1} f(x)$ exists.

    (A) $-\dfrac{1}{2}$

    (B) 4

    (C) 0

    (D) -2

    (E) There is not enough information to answer this question.

7. Suppose that f is a function defined for every real number and satisfies the following properties:

$$\lim_{x \to 2} f(x) = 1, \quad f(2) = 1, \quad \lim_{x \to 3^-} f(x) = 0, \quad \lim_{x \to 3^+} f(x) = -2, \quad \text{and} \quad f(3) = 0.$$

Which of the following statements is NOT true?

(A) f is continuous at $x = 2$

(B) f is left-continuous at $x = 3$

(C) $\lim\limits_{x \to 3} f(x) = 0$

(D) $\lim\limits_{x \to 2^+} f(x) = 1$

(E) $\lim\limits_{x \to 2^+} f(x) = \lim\limits_{x \to 2^-} f(x)$

8. Let $f(x) = e^{x^2}$. Find the slope of the secant line that passes through $(0, f(0))$ and $(2, f(2))$.

(A) $\frac{1}{2}(e^4 - 1)$

(B) $1 - e^4$

(C) 1

(D) -3

(E) $\ln 4$

9. Find the limit
$$\lim_{x \to 0} \frac{\sin 2x}{x}.$$

   (A) 0

   (B) The limit does not exist.

   (C) 2

   (D) $\frac{1}{2}$

   (E) 1

10. A rectangle has width w and length ℓ in meters. If the perimeter of the rectangle is fixed at 14 meters, find the function that describes the area of the rectangle as a function of w.

   (A) $7w - w^2$

   (B) $14w$

   (C) w^4

   (D) 14ℓ

   (E) $14w - 2w^2$

11. For each limit below, find the limit if it exists or explain why it does not exist. Carefully justify your answers.

    (a) $\lim\limits_{x \to 0} \dfrac{\ln(1-x)}{1+x}$

    (b) $\lim\limits_{t \to 1} \left(\dfrac{1}{t-1} - \dfrac{1}{t^2 - 3t + 2} \right)$

12. (a) State the squeeze theorem.

    (b) Evaluate the following limit. Justify your work.

    $$\lim_{x \to 0} x^2 \sin(\frac{\pi}{x})$$

13. An object is thrown straight into the air from the surface of a distant planet. The height of the object in meters after t seconds is given by $h(t) = 4t - t^2$.

   (a) Find the average velocity of the object over the time interval $[1.4, 1.6]$. Include units in your answer.

   (b) Find the average velocity of the object over the time interval $[3, 3 + k]$. Include units in your answer.

   (c) Compute the instantaneous velocity of the object at $t = 3$ by taking the limit as k tends to 0 of the expression found in part (b). Use limit laws to justify your answer.

14. Let $f(x) = \dfrac{4x - 1}{2x + 3}$. Find the inverse function f^{-1} and the domain and range of f^{-1}.

15. Using the graph of the function f below, complete the following. If a function value or limit does not exist, write DNE.

(a) $\lim\limits_{x \to -2^+} f(x) =$ _____

(b) $\lim\limits_{x \to -2^-} f(x) =$ _____

(c) $\lim\limits_{x \to -2} f(x) =$ _____

(d) $f(-2) =$ _____

(e) Is f right-continuous at -2? _____

(f) $\lim\limits_{x \to 1^-} f(x) =$ _____

(g) $\lim\limits_{x \to 1^+} f(x) =$ _____

(h) $\lim\limits_{x \to 1} f(x) =$ _____

(i) $f(1) =$ _____

(j) Is f continuous at 1? _____