MA 113 Calculus I Spring 2016
Exam 4 Wednesday, May 4, 2016

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-plugs during the exam. You may use a calculator, but not one which has symbolic manipulation capabilities.

On the multiple choice problems:

1. You must give your *final answers* in the *multiple choice answer box* on the front page of your exam.
2. 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:

1. Clearly indicate your answer and the reasoning used to arrive at that answer *(unsupported answers may not receive credit)*,
2. 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. You are not expected to write your solution next to the statement of the question.

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. Find the equation of the tangent line to the graph of $f(x) = \dfrac{32}{x^2}$ at $x = 4$.

   (A) $y = x - 2$

   (B) $y = -2x + 10$

   (C) $y = 2x - 6$

   (D) $y = -x + 6$

   (E) $y = -4x + 18$

2. Find $\lim\limits_{x \to 3} \dfrac{x^2 - (3+a)x + 3a}{x - 3}$.

   (A) $a - 3$

   (B) $3 - a$

   (C) $a + 3$

   (D) 3

   (E) Cannot be determined without knowing the value of a.

3. Assume that $f'(x) = (x+3)(x-5)$. Which of the following statements about local maximum values and local minimum values of $f(x)$ is true?

   (A) A local minimum occurs at $x = -3$ and a local maximum occurs at $x = 5$.

   (B) A local minimum occurs at $x = -3$ and a local minimum occurs at $x = 5$.

   (C) A local maximum occurs at $x = -3$ and a local maximum occurs at $x = 5$.

   (D) A local maximum occurs at $x = -3$ and a local minimum occurs at $x = 5$.

   (E) There is not enough information given to find where local maximum and minimum values of $f(x)$ occur.

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

4. Assume that $f''(x) = (x+3)(x-5)$. Which of the following statements about the graph of $f(x)$ is true?

   (A) $f(x)$ is concave down on $(-\infty, -3)$ and $(5, \infty)$, and $f(x)$ is concave up on $(-3, 5)$.

   (B) $f(x)$ is concave up on $(-\infty, -3)$ and $(5, \infty)$, and $f(x)$ is concave down on $(-3, 5)$.

   (C) $f'(x)$ is decreasing on $(-\infty, -3)$ and $f'(x)$ is increasing on $(5, \infty)$.

   (D) $f(x)$ is concave up on $(-\infty, 5)$ and $f(x)$ is concave down on $(5, \infty)$.

   (E) There is not enough information given to find the intervals of concavity on the graph of $f(x)$.

5. Let $A(x) = \displaystyle\int_2^{\sqrt{3x}} \sin(x)\, dx$. Find $A'(x)$.

   (A) $\sin(x)$

   (B) $\sin(\sqrt{3x})$

   (C) $\frac{1}{2}\sin(\sqrt{3x})(3x)^{\frac{-1}{2}}$

   (D) $\frac{3}{2}\sin(\sqrt{3x})(3x)^{\frac{-1}{2}}$

   (E) None of the above

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

6. There is a function $y = f(x)$ that satisfies $\dfrac{dy}{dx} = ky$ for some constant k. In addition $f(0) = 12$ and $f(2) = 48$. Find k.

   (A) $k = \ln 2$

   (B) $k = \ln 4$

   (C) $k = \frac{1}{2} \ln 2$

   (D) $k = 2$

   (E) $k = 4$

7. $f(x) = \dfrac{2x^3 + 7}{5x^2 - 3}$. Find $f'(x)$.

   (A) $\dfrac{10x^4 - 18x^2 + 70x}{(5x^2 - 3)^2}$

   (B) $\dfrac{6x^2}{10x}$

   (C) $\dfrac{50x^4 - 18x^2 + 70x}{(5x^2 - 3)^2}$

   (D) $\dfrac{10x^4 - 18x^2 - 70x}{(5x^2 - 3)^2}$

   (E) None of the above

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

8. $f(x) = \ln(\cos(x)) + e^{3x^2+4}$. Find $f'(x)$.

   (A) $\tan(x) + x^3 e^{3x^2+4}$
   (B) $-\cot(x) + x^3 e^{3x^2+4}$
   (C) $\cot(x) + x^3 e^{3x^2+4}$
   (D) $\tan(x) + 6xe^{3x^2+4}$
   (E) $-\tan(x) + 6xe^{3x^2+4}$

9. Find $\displaystyle\int_{-2}^{3} (x^2 - 4x + 7)\, dx$.

   (A) $\dfrac{94}{3}$
   (B) $\dfrac{98}{3}$
   (C) $\dfrac{102}{3}$
   (D) $\dfrac{106}{3}$
   (E) $\dfrac{110}{3}$

10. Find $\displaystyle\int_{-\frac{\pi}{6}}^{\frac{\pi}{3}} \cos(x)\, dx$.

    (A) $\dfrac{\sqrt{3}-1}{2}$
    (B) $\dfrac{\sqrt{3}+1}{2}$
    (C) $\dfrac{1-\sqrt{3}}{2}$
    (D) $\dfrac{\sqrt{2}+1}{2}$
    (E) $\dfrac{1-\sqrt{2}}{2}$

Free Response Questions: Show your work!

11. A particle moves in a straight line with velocity $v(t) = 20 - 4t$ m/s.

    (a) Find the displacement over the time interval $[0, 6]$.

    (b) Find the total distance traveled over the time interval $[0, 6]$.

12. (a) Find the linearization $L(x)$ of $f(x) = \tan(x)$ at $x = \dfrac{\pi}{4}$.

(b) Use $L(x)$ to estimate $\tan(\dfrac{\pi}{4} + .07)$.
(You must show your work to receive credit. Guessing the answer will not receive credit.)

13. Find the following antiderivatives.
(You must show your work to receive credit. Guessing the answer will not receive credit.)

(a) $\int \sqrt{5x-1}\,dx$

(b) $\int (x^3+1)\sin(x^4+4x)\,dx$

14. Find the positive numbers x and y such that $x^2y = 8$ and $x + y$ is as small as possible. Be sure to justify your answer.
(You must show your work to receive credit. Guessing the answer will not receive credit.)

15. Find the area of the region enclosed by the graphs of the curves $y = 4x^3 - 24x$ and $y = 12x$ over the interval $[-3, 3]$ by following the next three steps.

    (a) Find the points where the graphs of $y = 4x^3 - 24x$ and $y = 12x$ intersect.

    (b) Find the subintervals of $[-3, 3]$ where $4x^3 - 24x > 12x$ and the subintervals of $[-3, 3]$ where $12x > 4x^3 - 24x$.

    (c) Find the area between the graphs of the curves $y = 4x^3 - 24x$ and $y = 12x$ over the interval $[-3, 3]$.