MA 113 Calculus I Fall 2018
Exam 3 Tuesday, 13 November 2018

Name: ______________________

Section: ______________________

Last 4 digits of student ID #: ________

This exam has 12 multiple choice questions (five points each) and 4 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-buds 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	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

Exam Scores

Question	Score	Total
MC		60
13		10
14		10
15		10
16		10
Total		100

1. Write $f(x) = 7 \cdot 10^x$ in the form $f(x) = Ae^{kx}$ for some constants A and k.

   (A) $A = 7$ and $k = \ln(70)$
   (B) $A = 70$ and $k = e$
   (C) $A = 10$ and $k = \ln(7)$
   (D) $A = 7$ and $k = \ln(10)$
   (E) None of the above

2. A 5 kg quantity of radioactive isotope decays to 1 kg after 1 year. If the mass of the isotope at time t is $m(t) = Ae^{kt}$ for some constants A and k, find the value of k.

   (A) $k = \ln(5)$
   (B) $k = -\ln(5)$
   (C) $k = \ln(-5)$
   (D) $k = \dfrac{1}{\ln(1/5)}$
   (E) None of the above

3. Find the absolute maximum of $f(x) = 2x^3 - 3x^2 - 36x + 3$ on the interval $[-3, 4]$.

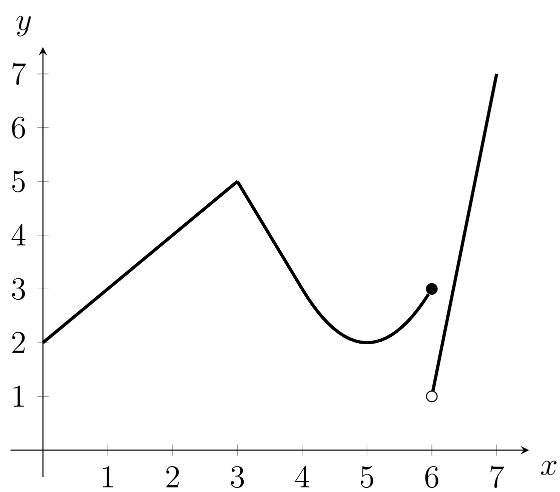
   (A) -2
   (B) 47
   (C) 3
   (D) 36
   (E) None of the above

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

4. Find the intervals where $f(x) = 7x^5 - 5x^3 + 6$ is increasing.

   (A) $(-\infty, -\sqrt{3/7}) \cup (\sqrt{3/7}, \infty)$
   (B) $(-\infty, -2/3) \cup (2/3, \infty)$
   (C) $(-\sqrt{3/7}, \sqrt{3/7})$
   (D) $(-2/3, 2/3)$
   (E) None of the above

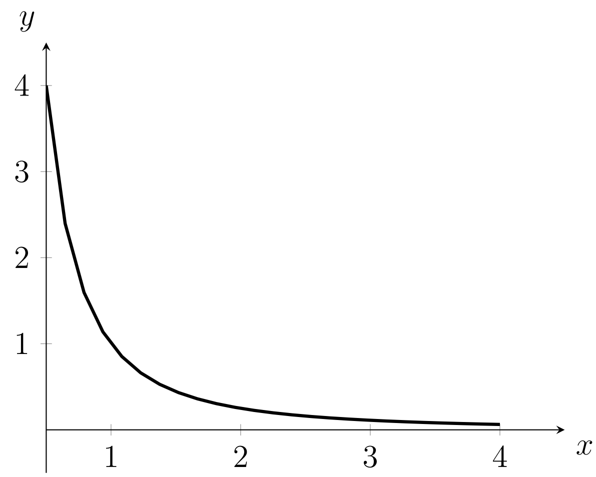
5. Let $f(x)$ be the function whose graph is shown below. How many critical numbers does $f(x)$ have on the interval $(0, 7)$?



   (A) 1
   (B) 2
   (C) 3
   (D) 4
   (E) None of the above.

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

6. Referring to the graph of $f(x)$ below, which of the following statements is true?



(A) $f''(x)$ changes sign from $+$ to $-$

(B) $f''(x)$ changes sign from $-$ to $+$

(C) $f''(x) < 0$

(D) $f''(x) > 0$

(E) None of the above

7. Evaluate the limit $\lim_{x\to\infty} \dfrac{x^5}{e^x + x^3}$.

(A) 120

(B) 6

(C) 1

(D) ∞

(E) None of the above.

8. Find a positive number x such that the sum of $4x$ and $\dfrac{1}{x}$ is as small as possible.

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

(B) 1

(C) 2

(D) $\dfrac{1}{\sqrt{2}}$

(E) None of the above

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

9. Find the general antiderivative of $f(x) = 10\cos(x) + \dfrac{13}{x}$ on $(0, \infty)$.

   (A) $10\sin(x) + 13\ln(x)$
   (B) $-10\sin(x) + 13\ln(x) + C$
   (C) $10\sin(x) + 13\ln(x) + C$
   (D) $10\sin(x) - \dfrac{13}{x^2} + C$
   (E) None of the above

10. Use the basic properties of the integral to calculate $\displaystyle\int_0^7 (2x + 4)\, dx$.

   (A) 77
   (B) 126
   (C) 63
   (D) 28
   (E) None of the above

11. Calculate the integral below, assuming that $\displaystyle\int_0^5 f(x)\, dx = 5$ and $\displaystyle\int_0^5 g(x)\, dx = 13$.

$$\int_0^5 (2f(x) - 3g(x))\, dx$$

   (A) -39
   (B) 10
   (C) 29
   (D) -29
   (E) None of the above.

12. Compute $\displaystyle\sum_{i=1}^{3} \left(\sum_{j=3}^{4} (i + j) \right)$.

   (A) 10
   (B) 33
   (C) 20
   (D) 36
   (E) None of the above

Free Response Questions: Show your work!

13. Recall that $\displaystyle\sum_{i=1}^{n} i = \frac{n(n+1)}{2}$.

    (a) Find the value of $\displaystyle\sum_{i=1}^{30}(19j-3)$.

    (b) Calculate R_4 for $f(x) = 8 - x$ over the interval $[3, 5]$.

Free Response Questions: Show your work!

14. Recall that the volume of a cylinder is height times the area of the base.

    (a) Find a formula for the cost of a cylinder C with circular base radius r and height h if the base and top are made of material that costs twice as much as the material for the side.

    (b) If the volume of a cylinder C from part (a) is 41 cubic meters, find the height and radius of the base that minimize the cost of the materials. *Include units!*

Free Response Questions: Show your work!

15. (a) Evaluate the following limit, or explain why the limit does not exist:

$$\lim_{x\to 0} \frac{1-e^x}{\ln(x+1)}$$

(b) Find the value of A for which we can use l'Hôpital's rule to evaluate the limit $\displaystyle\lim_{x\to 2} \frac{x^2+Ax-2}{x-2}$ and find the value of the limit.

Free Response Questions: Show your work!

16. (a) State the Mean Value Theorem.

(b) Find a point c satisfying the conclusion of the Mean Value Theorem for the following function and interval: $f(x) = x^{-1}$ on $[1, 10]$.