MA 161
Final Exam
December 13, 2016

NAME ______________________ YOUR TA'S NAME ______________________

STUDENT ID # ____________________ RECITATION TIME ____________________

1. You must use a #2 pencil on the scantron sheet (answer sheet).

2. Write the following in the TEST/QUIZ NUMBER boxes (and blacken in the appropriate spaces below the boxes):

01

3. On the scantron sheet, fill in your TA's name and the course number.

4. Fill in your NAME and 10-digit STUDENT IDENTIFICATION NUMBER and blacken in the appropriate spaces. Note that your PUID MUST start with TWO zeroes to be registered properly here.

5. Fill in your four-digit SECTION NUMBER. If you do not know your section number, please ask your TA.

6. Sign the scantron sheet.

7. Fill in your name, etc. on this paper (above).

8. There are 25 questions, each worth 8 points. Blacken in your choice of the correct answer in the spaces provided for questions 1–25. Do all your work on the question sheets. Show your work and mark your answers on the question sheets as a back-up for a lost scantron.

9. Turn in both the scantron sheets and the question sheets when you are finished.

10. If you finish the exam before 12:20, you may leave the room after turning in the scantron sheet and the exam booklet. You may not leave the room before 10:50.
If you don't finish before 12:20, you MUST REMAIN SEATED until your TA comes and collects your scantron sheet and your exam booklet.

11. NO CALCULATORS, PHONES, SMART WATCHES, BOOKS, OR PAPERS ARE ALLOWED. Use the back of the test pages for scrap paper.

Exam Rules

1. Students may not open the exam until instructed to do so.
2. Students must obey the orders and requests by all proctors, TAs, and lecturers.
3. No student may leave in the first 20 min or in the last 10 min of the exam.
4. Books, notes, calculators, or any electronic devices are not allowed on the exam, and they should not even be in sight in the exam room. Students may not look at anybody else's test, and may not communicate with anybody else except, if they have a question, with their TA or lecturer.
5. After time is called, the students have to put down all writing instruments and remain in their seats, while the TAs will collect the scantrons and the exams.
6. Any violation of these rules and any act of academic dishonesty may result in severe penalties. Additionally, all violators will be reported to the Office of the Dean of Students.

I have read and understand the exam rules stated above:

STUDENT NAME: ______________________________

STUDENT SIGNATURE: ______________________________

1. Find the slope of the tangent line to the graph of $y = e^{2\tan(3\ln x)}$ at the point $(1, 1)$.

A. 0

B. 1

C. 2

D. 3

E. 6

2. Find the derivative of the function $f(x) = x^3 \ln(1 + x^2)$ at the point $x = 1$.

A. 3

B. $1 + 3\ln 2$

C. $\frac{3}{2}$

D. $\frac{1}{2} + 3\ln 2$

E. $\frac{1}{2}$

3. The slope of the tangent line to the curve $2y^4 - x^2y = x^3$ at the point $(1, 1)$ is

A. 1

B. $\frac{1}{3}$

C. $\frac{5}{9}$

D. $\frac{5}{8}$

E. $\frac{5}{7}$

4. Let $f(x) = x^{x^2+1}$, $x > 0$. Find $f'(x)$.

A. $(x^2+1)(\ln x)x^{x^2}$

B. $(x^2+1)x^{x^2}$

C. $(2x)(x^2+1)x^{x^2}$

D. $\left(2x\ln x + \frac{x^2+1}{x}\right)x^{x^2+1}$

E. $(2x\ln x)x^{x^2+1}$

5. Find the derivative of the function $f(x) = \frac{(x+1)^7}{(x-1)^3}$ at the point $x = 0$.

A. -10

B. 10

C. 4

D. -4

E. $\frac{7}{3}$

6. What is the x-intercept of the line tangent to the parabola $y = x^2 + 2x + 3$ at the point $(1, 6)$?

A. $(-\frac{3}{2}, 0)$
B. $(-\frac{1}{2}, 0)$
C. $(0, 0)$
D. $(\frac{1}{2}, 0)$
E. $(\frac{3}{2}, 0)$

7. Find the value of c that makes the function

$$f(x) = \begin{cases} \dfrac{x^2 - 4}{x - 2} & \text{if } x < 2 \\ cx^2 - 8 & \text{if } x \geq 2 \end{cases}$$

continuous for all x.

A. $-\frac{5}{3}$
B. $-\frac{5}{4}$
C. $\frac{5}{2}$
D. 4
E. 3

8. $\lim_{x \to 0} \dfrac{\sqrt{1-8x} - \sqrt{1-3x}}{x} =$

A. $\frac{5}{2}$

B. $-\frac{5}{2}$

C. -5

D. 0

E. ∞

9. Each edge of a cube increases at the rate of 2 inches per second. At what rate does the volume of the cube increase at the instant when the edges of the cube are each 4 inches? Express your answer in cubic inches per second.

A. 32

B. 48

C. 64

D. 96

E. None of the above.

10. $\lim_{x\to\infty}\left(1-\frac{2}{x}\right)^{3x/5} =$

A. $e^{3/10}$

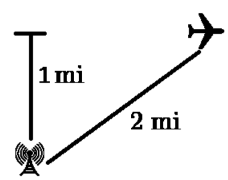
B. $e^{-3/10}$

C. $e^{-5/6}$

D. $e^{-6/5}$

E. 1

11. A plane is flying horizontally at an altitude of 1 mile and a speed of 500 miles per hour. It passes directly over a radar station. What is the rate at which the distance from the plane to the radar station is increasing when the plane is 2 miles from the station?



A. 500 miles/hour

B. $250\sqrt{3}$ miles/hour

C. $250\sqrt{2}$ miles/hour

D. 250 miles/hour

E. $200\sqrt{3}$ miles/hour

12. Which of the following statements are true about the function

$$f(x) = \frac{1}{3}x^3 + \frac{1}{2}x^2 - 2x?$$

(1) f is increasing on $(-2, 1)$
(2) f is concave up on $(-\frac{1}{2}, \infty)$
(3) f has one inflection point

A. (1), (2), and (3)

B. (1) and (2) only

C. (2) and (3) only

D. (2) only

E. (1) only

13. The linear approximation of $f(x) = \sqrt{x-1}$ at $a = 5$ is used to find an approximate value for $f(6)$. The approximate value found is

A. 2

B. 2.2

C. 2.25

D. 2.45

E. 2.5

14. The minimum value of $f(x) = 4x + \frac{9}{x}$ for $x > 0$ is

A. 97/6

B. 39/2

C. 13

D. 11

E. 12

15. The maximum value of $f(x) = \sin x + \cos x$ on the interval $0 \leq x \leq \pi$ is

A. $\sqrt{2}$

B. 1

C. 2

D. 3/2

E. $\sqrt{3}/2$

16. Given that $f(3) = 0$ and $f'(x) \geq 3$ for $0 \leq x \leq 3$, the largest $f(0)$ can be is

A. -9

B. -3

C. 0

D. 6

E. Cannot be determined.

17. $\lim\limits_{x \to 0} \dfrac{\sin x - x}{x^3} =$

A. $1/3$

B. 0

C. ∞

D. $-1/6$

E. $-1/3$

18. Find the point on the parabola $y = x^2$ that is closest to the point $\left(2, \frac{1}{2}\right)$.

Hint: The distance between two points (a, b) *and* (x, y) *is* $\sqrt{(x-a)^2 + (y-b)^2}$.

A. $\left(\frac{1}{\sqrt{2}}, \frac{1}{2}\right)$

B. $(2, 4)$

C. $(1, 1)$

D. $\left(\frac{5}{4}, \frac{25}{16}\right)$

E. $\left(\frac{1}{\sqrt[3]{4}}, \frac{1}{2\sqrt[3]{2}}\right)$

19. The velocity of a particle at various times is given in the following table:

t in sec	0	0.25	0.5	0.75	1
$v(t)$ in m/sec	3	2	3	4	5

Estimate the distance traveled by the particle from time $t = 0$ to $t = 1$ with a Riemann sum; use $n = 4$ rectangles and **right** endpoints for the sample points.

A. 14 m

B. 4.25 m

C. 3.4 m

D. 3.5 m

E. 3 m

20. Assume a is a positive number. If $\int_1^{\sqrt{a}} \frac{1}{x}\,dx = 3$, then $\int_1^{a} \frac{1}{x}\,dx$ equals

A. 9

B. 6

C. $\sqrt{3}$

D. 12

E. $\ln 9$

21. Find

$$\lim_{n\to\infty} \frac{1}{n}\left(e^{1/n} + e^{2/n} + e^{3/n} + \ldots + e^{n/n}\right).$$

Hint: Interpret this as the limit of a Riemann Sum for a function over the interval $[0,1]$.

A. $e-1$

B. e

C. 1

D. ∞

E. $1/e$

22. A particle moves on a number line with position $s(t)$ at time t and velocity $v(t) = \dfrac{2}{1+t^2}$. If $s(0) = 2$, what is $s(1)$?

A. $2 + \frac{\pi}{2}$

B. $2 + \ln 2$

C. $2 + 2\ln 2$

D. $\frac{3}{2}$

E. 3

23. Evaluate

$$\int_0^1 (x^2+1)e^{x^3+3x}\, dx$$

A. $\dfrac{e-1}{3}$

B. $\dfrac{4(e^4-1)}{3}$

C. $\dfrac{e^4-1}{3}$

D. $e - 1$

E. $2e^4 - 1$

24. Suppose $F(x) = \int_0^x \sin(\pi t^2)\ dt$. What is the slope of the tangent line to the curve $y = F(x)$ at $x = \frac{1}{2}$?

A. $\frac{\sqrt{3}}{2}$

B. $\frac{\pi}{\sqrt{2}}$

C. $\frac{\sqrt{2}}{2}$

D. 1

E. 0

25. Evaluate $\int_0^1 (x+1)\sqrt{x}\ dx$

A. 2

B. 1

C. $\frac{3}{2}$

D. $\frac{5}{3}$

E. $\frac{16}{15}$