MA 16100
FINAL EXAM Form A
MAY 1, 2017

NAME _____ YOUR TA'S NAME _____

STUDENT ID # _____ RECITATION TIME _____

1. You must use a #2 pencil on the scantron

2. a. If the cover of your exam is GREEN, write 01 in the TEST/QUIZ NUMBER boxes and darken the appropriate bubbles on your scantron.

b. If the cover of your exam is ORANGE, write 02 in the TEST/QUIZ NUMBER boxes and darken the appropriate bubbles on your scantron.

c. **The color of your scantron MUST match the color of the cover page of your exam**

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

4. Fill in your NAME and STUDENT IDENTIFICATION NUMBER and blacken in the appropriate spaces.

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 and your instructor's name on the question sheets above.

8. There are 25 questions, each one is worth 8 points. Blacken in your choice of the correct answer in the spaces provided for questions 1–25. Also circle your answers on the exam itself. Do all your work on the question sheets.

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

10. If you finish the exam before 5:20 pm, you may leave the room after turning in the scantron sheet and the exam booklet. If you don't finish before 5:20 pm, you MUST REMAIN SEATED until your TA comes and collects your scantron sheet and your exam booklet.

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

EXAM POLICIES

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. **ANY talking or writing during this time will result in an AUTOMATIC ZERO.**
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. If $\sin(\theta) = \dfrac{3}{5}, 0 < \theta < \dfrac{\pi}{2}$, then $\sec(\theta) =$

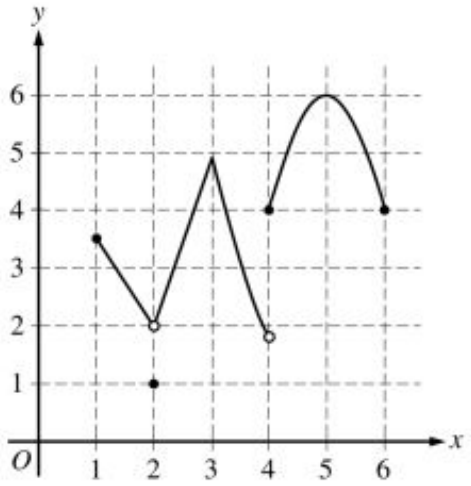
A. $\frac{4}{5}$
B. $\frac{3}{4}$
C. $\frac{5}{4}$
D. $\frac{4}{3}$
E. $\frac{5}{6}$

2. Find the domain of

$$f(x) = \frac{\sqrt{4 - x^2}}{x^2 - 2x - 3}.$$

A. $(-\infty, -1) \cup (-1, 3) \cup (3, \infty)$
B. $(-\infty, 1] \cup [3, \infty)$
C. $[-2, -1) \cup (-1, 2]$
D. $(-2, -1) \cup (-1, 2)$
E. $[-2, 2]$

3. The graph of a function $f(x)$ is given below. Which of the following statements is **false**?



Graph of f

A. $\lim_{x\to 2} f(x)$ exists

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

C. $\lim_{x\to 4} f(x)$ exists

D. $\lim_{x\to 5} f(x)$ exists

E. The function f is continuous at $x = 3$

4. If $f(x) = -2x + 1$ and $g(x) = x^3$, then $g(f^{-1}(5))$ equals

A. -273

B. -250

C. -27

D. -9

E. -8

5. For what value(s) of c is

$$f(x) = \begin{cases} -cx + 1, & \text{if } x < 2 \\ 3, & \text{if } x = 2 \\ c^2x^2 + 2, & \text{if } x > 2 \end{cases}$$

continuous from the left at 2.

A. $-\frac{1}{2}\sqrt{\frac{3}{2}}, \frac{1}{2}\sqrt{\frac{3}{2}}$

B. 0

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

D. 2

E. -1

6. Compute $\dfrac{dy}{dx}$ if $y = \cos(\tan(3x))$

A. $-3\sin(\tan(3x))\sec(3x)\tan(3x)$

B. $-\sin(\tan(3x))\sec^2(3x)$

C. $-3\sin(\tan(3x))\sec^2(3x)$

D. $-3\sin(\sec^2(3x))$

E. $-\sin(\sec^2(3x))$

7. For $t \geq 0$, the position of a particle is given by $s(t) = \sin t - \cos t$. What is the acceleration of the particle at the point where the velocity is first equal to 0?

A. $-\sqrt{2}$

B. -1

C. 0

D. 1

E. $\sqrt{2}$

8. Find $\dfrac{dy}{dx}$ if $xe^y + ye^x = 2$

A. $\dfrac{y}{x}$

B. $\dfrac{2 + ye^x}{xe^y}$

C. $\dfrac{e^y + ye^x}{e^x + xe^y}$

D. $\dfrac{-e^y - ye^x}{e^x + xe^y}$

E. $\dfrac{-e^x}{xe^y}$

9. The population of a certain type of bacteria doubles every 2 days. How many days will it take for the population to triple?

A. $2\ln\left(\frac{3}{2}\right)$

B. 2.5

C. 3

D. $2\ln 6$

E. $\dfrac{2\ln 3}{\ln 2}$

10. The line $y = 5$ is a horizontal asymptote to the graph of which of the following functions?

A. $y = \dfrac{\sin(5x)}{x}$

B. $y = 5x$

C. $y = \dfrac{1}{x-5}$

D. $y = \dfrac{5x}{1-x}$

E. $y = \dfrac{20x^2 - x}{1+4x^2}$

11. Let $g(x) = x^2 e^{kx}$, where k is a constant. For what value of k does g have a critical point at $x = \frac{2}{3}$?

A. -3

B. $-\frac{3}{2}$

C. $-\frac{1}{3}$

D. 0

E. There is no such k

12. If $f(x) = x^3 - 2x^2 - 3x$, $0 \leq x \leq 2$, then find a number c that satisfies the conclusion of the Mean Value Theorem.

A. $\frac{3}{4}$

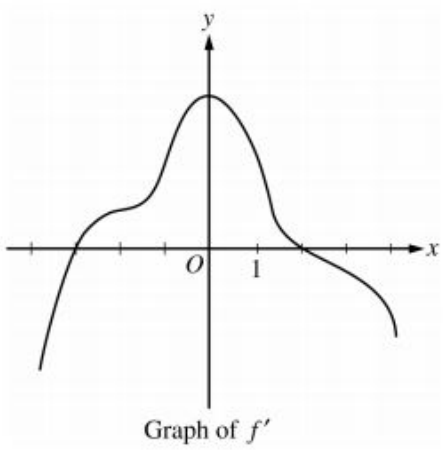
B. 1

C. $\frac{5}{4}$

D. $\frac{4}{3}$

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

13. The graph of the **first derivative** of a function f is shown below. Which of the following statements must be true?



Graph of f'

I. f has a relative minimum at $x = -3$

II. The graph of f has an inflection point at $x = -2$

III. The graph of f is concave down for $0 < x < 4$

A. I only

B. II only

C. III only

D. I and II only

E. I and III only

14. If $f'(x) = \cos x$ and $g'(x) = 1$ for all x, and if $f(0) = g(0) = 0$, then

$$\lim_{x \to 0} \frac{f(x)}{g(x)} =$$

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

B. 1

C. 0

D. -1

E. nonexistent

15. A person whose height is 6 feet is walking away from the base of a streetlight along a straight path at a rate of 4 feet per second. If the height of the streetlight is 15 feet, what is the rate at which the length of the person's shadow is growing?

A. $\frac{3}{2}$ ft/s

B. $\frac{8}{3}$ ft/s

C. $\frac{15}{4}$ ft/s

D. 6 ft/s

E. 10 ft/s

16. If $f(x) = x^{\sin x}$ for $x > 0$, then $f'(x) =$

A. $(\sin x)x^{\sin x - 1}$

B. $x^{\sin x}(\cos x)(\ln x)$

C. $\dfrac{\sin x}{x} + (\cos x)(\ln x)$

D. $x^{\sin x}\left[\dfrac{\sin x}{x} + (\cos x)(\ln x)\right]$

E. $x\cos x + \sin x$

17. Determine the total number of vertical and horizontal asymptotes of the function

$$f(x) = \frac{x^4 + 1}{x^2(1 - x^2)}.$$

A. 0

B. 2

C. 3

D. 4

E. 5

18. A farmer wants to fence off a rectangular field that borders a river on one side. No fence is required along the river. If the area of the field is to be 100 square feet, what is the least amount of fence (in feet) required?

A. $2\sqrt{50}$

B. $4\sqrt{50}$

C. 30

D. $5\sqrt{50}$

E. 100

19. If $f(x)$ is continuous on the interval $a \leq x \leq b$ and $a < c < b$, then $\displaystyle\int_c^b f(x)\,dx$ is equal to

A. $\displaystyle\int_a^c f(x)\,dx + \int_c^b f(x)\,dx$

B. $\displaystyle\int_a^c f(x)\,dx - \int_a^b f(x)\,dx$

C. $\displaystyle\int_c^a f(x)\,dx + \int_b^a f(x)\,dx$

D. $\displaystyle\int_a^b f(x)\,dx - \int_a^c f(x)\,dx$

E. $\displaystyle\int_a^c f(x)\,dx - \int_b^c f(x)\,dx$

20. Using 50 rectangles and the right end point of each subinterval as the sample point, the Riemann sum approximation of the a certain definite integral is

$$\frac{1}{50}\left(\sqrt{\frac{1}{50}} + \sqrt{\frac{2}{50}} + \sqrt{\frac{3}{50}} + \cdots + \sqrt{\frac{50}{50}}\right)$$

What is the definite integral that is being approximated?

A. $\displaystyle\int_0^1 \sqrt{\frac{x}{50}}\,dx$

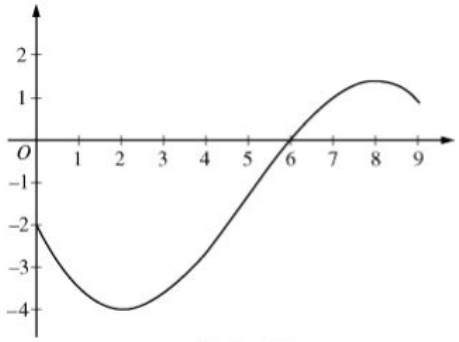
B. $\displaystyle\int_0^1 \sqrt{x}\,dx$

C. $\displaystyle\frac{1}{50}\int_0^1 \sqrt{\frac{x}{50}}\,dx$

D. $\displaystyle\frac{1}{50}\int_0^1 \sqrt{x}\,dx$

E. $\displaystyle\frac{1}{50}\int_0^{50} \sqrt{x}\,dx$

21. The graph of a differentiable function f is shown below. If $h(x) = \int_0^x f(t)\,dt$, which of the following is true?



Graph of f

A. $h(6) < h'(6) < h''(6)$
B. $h(6) < h''(6) < h'(6)$
C. $h'(6) < h(6) < h''(6)$
D. $h''(6) < h(6) < h'(6)$
E. $h''(6) < h'(6) < h(6)$

22. Compute

$$\int_1^4 |x-3|\,dx$$

A. $\frac{3}{2}$
B. $\frac{5}{2}$
C. $\frac{9}{2}$
D. 5
E. $\frac{-3}{2}$

23. $\displaystyle\int \frac{\cos x \; dx}{\sqrt{1+\sin x}} =$

A. $-\frac{1}{2}(1+\sin x)^{1/2} + C$

B. $\ln\sqrt{1+\sin x} + C$

C. $2\sqrt{1+\sin x} + C$

D. $\ln|1+\sin x| + C$

E. $\dfrac{2}{3(1+\sin x)^{3/2}} + C$

24. Evaluate

$$\int_0^1 (x-1)(2x+1)\; dx$$

A. -1

B. $\frac{-5}{6}$

C. 0

D. $\frac{5}{6}$

E. 1

25. Compute

$$\int_0^2 x^2 e^{x^3}\, dx$$

A. $\frac{1}{3}(e^8 - 1)$

B. $e^8 - 1$

C. $\frac{1}{3}(e - 1)$

D. $e - 1$

E. $\frac{1}{3}(e^{1/4} - 1)$