

MA 161  
EXAM 3 GREEN  
November 14, 2016

NAME \_\_\_\_\_ YOUR TA'S NAME \_\_\_\_\_

STUDENT ID # \_\_\_\_\_ RECITATION TIME \_\_\_\_\_

1. You must use a #2 pencil on the scantron sheet (answer sheet).
2. Be sure the paper you are looking at right now is GREEN!
3. Write the following in the TEST/QUIZ NUMBER boxes (and blacken in the appropriate spaces below the boxes):  

01
4. On the scantron sheet, fill in your TA's name and the course number.
5. 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.
6. Fill in your four-digit SECTION NUMBER. If you do not know your section number, please ask your TA.
7. Sign the scantron sheet.
8. Fill in your name, etc. on this paper (above).
9. There are 12 questions, each worth 8 points (you will automatically earn 4 points for taking the exam). Blacken in your choice of the correct answer in the spaces provided for questions 1–12. 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.
10. Turn in both the scantron sheets and the question sheets when you are finished.
11. If you finish the exam before 8:50, you may leave the room after turning in the scantron sheet and the exam booklet. You may not leave the room before 8:20.  
If you don't finish before 8:50, you MUST REMAIN SEATED until your TA comes and collects your scantron sheet and your exam booklet.
12. 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:

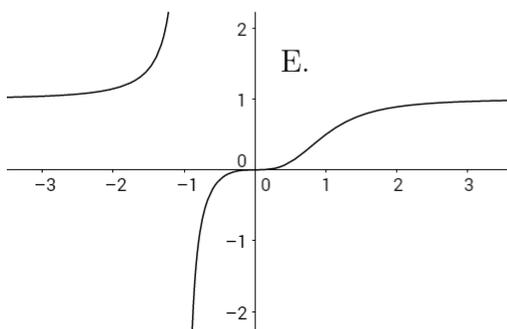
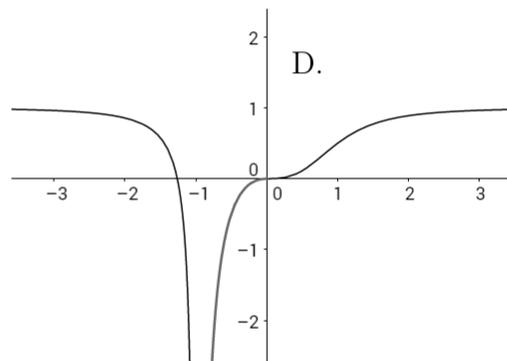
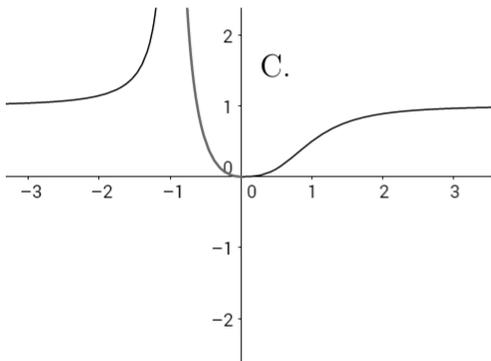
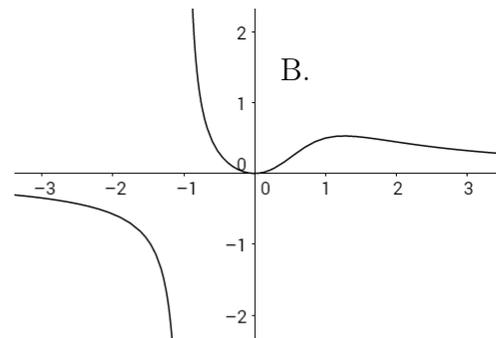
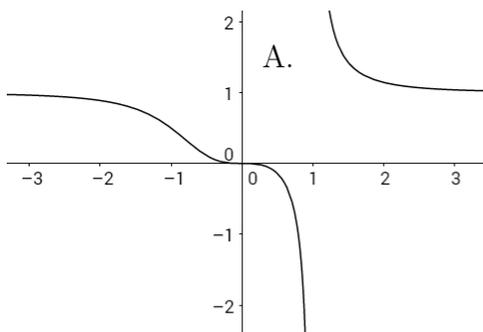
STUDENT NAME: \_\_\_\_\_

STUDENT SIGNATURE: \_\_\_\_\_

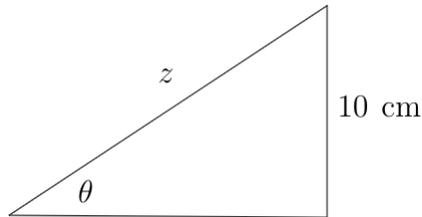
1. A cylindrical tank with radius 2 in and height 12 in is being filled with water at a rate of 8 in<sup>3</sup>/min. How fast is the height of the water increasing when  $h < 12$  in? *Hint:*  $V = \pi r^2 h$

- A.  $32\pi$  in/min
- B.  $6\pi$  in/min
- C.  $48\pi$  in/min
- D.  $\frac{2}{\pi}$  in/min
- E.  $\frac{1}{6\pi}$  in/min

2. Which of the following is the graph of  $y = \frac{x^3}{x^3 + 1}$  ?



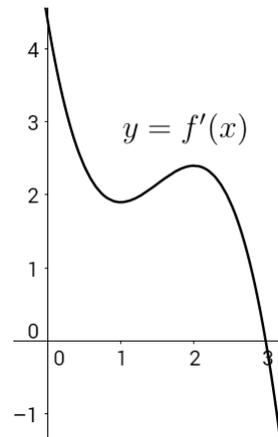
3. Suppose  $z$  denotes the length of the hypotenuse of a right triangle, and that  $\theta$  is an acute angle in the triangle whose opposite side has a fixed length of 10 cm. If  $\theta = \frac{\pi}{6}$ , then  $z = 20$  cm. Use differentials to find  $dz$ , the approximate change in  $z$ , if  $d\theta = -0.05$  radians.



- A.  $1/10$  cm  
B.  $\sqrt{3}$  cm  
C.  $\sqrt{3}/2$  cm  
D.  $1/2$  cm  
E.  $1/3$  cm
4. Suppose  $f(x) = \sqrt{3}\sin x + \cos x$ . If  $M$  is the absolute maximum of  $f$  on the interval  $[0, \pi]$ , and  $m$  is the absolute minimum value on the same interval, what is the sum  $M + m$ ?
- A. 0  
B.  $\sqrt{3} - 1$   
C. 1  
D. 2  
E. 3

5. Which of these statements describes the graph of  $y = e^{2x} + e^{-x}$  ?
- A. One local maximum and no inflection points
  - B. One local minimum and no inflection points
  - C. One local minimum and one inflection point
  - D. One local maximum and one inflection point
  - E. None of the above
6. At noon, ship A is 20 miles west of ship B. Ship A is sailing north at 6 miles/hr and ship B is sailing east at 4 miles/hr. How fast is the distance between the ships changing at 5:00 PM?
- A. 10 miles/hr
  - B.  $2\sqrt{13}$  miles/hr
  - C.  $\frac{34}{5}$  miles/hr
  - D.  $\frac{132}{\sqrt{30}}$  miles/hr
  - E. 5 miles/hr

7. The graph of  $f'$ , the **derivative of  $f$** , is pictured below:



Which of the following statements are true?

- I.  $f$  has a local minimum at  $x = 3$ .
- II.  $f$  is concave up on the interval  $(1, 2)$ .
- III.  $f$  is increasing on the interval  $(0, 3)$ .

- A. Only one of the statements is true.
- B. I and II
- C. II and III
- D. I and III
- E. All three statements are true.

8.  $\lim_{x \rightarrow 0} \frac{1 - \cos 4x}{x^2} =$

- A. 0
- B.  $\infty$
- C. 4
- D. 8
- E. 16

9.  $\lim_{x \rightarrow 0^+} (1 + \sin(x))^{1/x} =$

- A. 1
- B.  $\ln 2$
- C. 0
- D.  $\infty$
- E.  $e$

10. If you use the linear approximation of  $f(x) = x^{100}$  at  $a = 100$  to find an approximate value of  $99^{100}$ , the approximate value found is

- A. 0
- B.  $100^{99}$
- C.  $99^{99}$
- D.  $100^{100} - 99$
- E.  $100^{100} - 100$

11. If  $f(5) = 6$  and the derivative of  $f$  is always less than or equal to 10, what is the largest value  $f(10)$  could take?

- A. 50
- B. 56
- C. 16
- D. 44
- E. 66

12. The minimum value of  $x^3 - 3x + 9$  on the interval  $[-3, 2]$  is

- A.  $-9$
- B. 7
- C. 11
- D.  $-1$
- E. 3