MATH 161 & 161E - THIRD EXAM - SPRING 2003

Student Name:

Student ID:

Recitation Instructor:

Instructions:

1. This test booklet has 7 pages including this page.
2. Fill in your name, your student ID number, and your recitation instructor's name above.
3. Use a number 2 pencil on the mark-sense sheet (answer sheet).
4. On the mark-sense sheet, fill in the recitation instructor's name and the course number.
5. Fill in your name and student ID number, blacken the appropriate spaces, and sign the mark-sense sheet.
6. Mark the division and section number of your class and blacken the corresponding circles, including the circles for the zeros. If you do not know your division and section number ask your instructor.
7. There are 11 questions, each worth 9 points. Blacken your choice of the correct answer in the spaces provided. Turn in BOTH the answer sheet and the question sheets to your instructor when you are finished.
8. No books, notes, or calculators may be used. Good luck!

1. What is the minimum value of the function $f(x) = \sqrt{1+2x^2} - 2x$ on the interval $[-1, 2]$?

   (a) $\sqrt{3} + 2$

   (b) 1

   (c) $\sqrt{3} - 2$

   (d) $\sqrt{\frac{3}{2}} - 1$

   (e) -1

2. The function $g(x) = x^6 - 5x^5$ is increasing on

   (a) $-\infty < x < 0$

   (b) $-\frac{25}{6} < x < \frac{25}{6}$

   (c) $0 < x < \infty$

   (d) $0 < x < \frac{25}{6}$

   (e) $\frac{25}{6} < x < \infty$

3. The approximate value of $(8.3)^{\frac{2}{3}}$ obtained from the linear approximation of $f(x) = x^{\frac{2}{3}}$ near $a = 8$ is

(a) 3.9

(b) 4.099

(c) 4.1

(d) 4.2

(e) 4.09

4. If $f(x) = xe^{-x}$, find the interval where f is concave up.

(a) $(-\infty, 0)$

(b) $(0, \infty)$

(c) $(-\infty, 2)$

(d) $(2, \infty)$

(e) $(-\infty, 1)$

5. $\lim_{x \to \infty} x^2 e^{-x^2} =$

(a) 1

(b) 0

(c) ∞

(d) $-\infty$

(e) Does not exist

6. Given the function $f(x) = x^3 - 3x + 5$ on the interval $[-1, 1]$, the number (or numbers) a that satisfies the conclusion of the Mean Value Theorem is:

(a) $a = \pm\frac{\sqrt{3}}{3}$

(b) $a = 0$

(c) $a = \pm\frac{1}{2}$

(d) $a = \frac{\sqrt{3}}{3}$

(e) $= \pm\frac{1}{4}$

7. Find the absolute maximum of the function $f(x) = \dfrac{1+x}{\sqrt{1+2x^2}}$ on the interval $[-1, 3]$.

(a) 1

(b) $\sqrt{\dfrac{3}{2}}$

(c) $\sqrt{2}$

(d) $\dfrac{3}{\sqrt{2}}$

(e) $\dfrac{2}{\sqrt{3}}$

8. Evaluate $\lim\limits_{x \to 0+} (1-2x)^{\frac{2}{x}}$.

(a) $-\ln 4$

(b) e^2

(c) e^{-4}

(d) 2

(e) -4

9. A rectangle R with sides parallel to the axes is inscribed in the region defined by $x^2 < y < 4$. Find the maximum area of R.

   (a) $4\sqrt{3}$

   (b) 16

   (c) 32

   (d) $\dfrac{32\sqrt{3}}{9}$

   (e) $8\sqrt{3}$

10. Suppose that a box with a square base has a volume of 16 ft^3. Suppose that the material used for the sides costs \$1 per square foot and that the material for the top and bottom costs \$2 per square foot. What must the length of any side of the base be in order to minimize the total cost of the box?

    (a) 4

    (b) 8

    (c) $\dfrac{8}{3}$

    (d) 2

    (e) $\dfrac{3}{2}$

11. The function f has derivative

$$f'(x) = (x+3)(x-2)(x+1).$$

Then f has

(a) local minimum at -3 and 2 and local maximum at -1.

(b) local maximum at -3 and 2 and local minimum at -1.

(c) local minimum at -3 and local maximum at -1 and 2.

(d) local maximum at 2 and local minimum at -1 and -3.

(e) local minimum at 2 and local maximum at -1 and -3.