MATH 161 & 161E – THIRD EXAM – FALL 2002
NOVEMBER 21, 2002

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 12 questions, each worth 8 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.

1) The limit

$$\lim_{x \to 0} \frac{1 - \cos 2x}{3x^2} \quad \text{is equal to}$$

A) 1

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

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

D) 3

E) the limit is 0/0 and therefore it does not exist.

2) The function $f(x) = x \ln x$, defined for $x > 0$, is increasing for

A) $e < x < \infty$

B) $x > 1$ C) $0 < x < e$

D) $0 < x < \frac{1}{e}$

E) $\frac{1}{e} < x < \infty$

3) Let $f(x)$ be a function whose derivative satisfies
$$f'(x) = (x - 1)(x + 2)(x - 5)$$
The function $f(x)$ has

A) relative minima at -2 and 5 and a relative maximum at 1.

B) relative maxima at -2 and 5 and a relative minimum at 1.

C) relative maxima at -2 and 1 and a relative minimum at -5.

D) relative minima at -2 and 1 and a relative maximum at 5.

E) relative minima at -2 and 5 and an inflection point at 1.

4) The function $g(x) = x^4 - 4x^3$ is decreasing on

A) $-\infty < x < 0$

B) $-3 < x < 3$

C) $3 < x < \infty$

D) $-\infty < x < 3$

E) $0 < x < 3$

5) The function
$$h(x) = \frac{3x^2(x-2)}{(x^2+1)(x+4)}$$
has

A) a horizontal asymptote at $y = 3$ and vertical asymptotes at $x = -1$ and $x = -4$

B) a horizontal asymptote at $y = 3$ and a vertical asymptote at $x = -4$

C) a horizontal asymptote at $y = 3$ and a vertical asymptote at $x = -1$

D) a horizontal asymptote at $y = -3$ and a vertical asymptote at $x = 1$

E) a horizontal asymptote at $y = 4$ a vertical asymptote at $x = -1$

6) Which ones of the following are inflection points of

$$f(x) = \frac{1}{5}x^5 - \frac{1}{3}x^4 - \frac{1}{5}x?$$
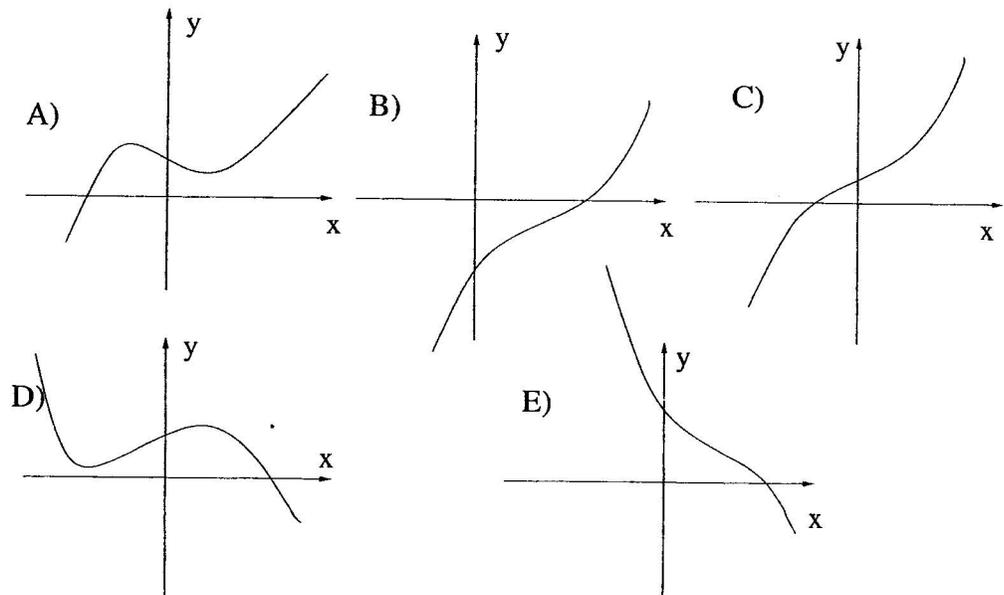
A) $(0,0)$ and $(1, -\frac{1}{3})$

B) only $(0,0)$

C) only $(1, -\frac{1}{3})$

D) $(0,0)$, $(1, -\frac{1}{3})$ and $(-1, -\frac{1}{3})$

E) the function does not have inflection points

7) The graph of the function $f(x) = x^3 + 3x + 2$ looks most like

8) The graph of the function $g(x) = 3x^5 + 10x^3 + 12x$ is

A) concave upwards if $x > 0$ and downwards if $x < 0$

B) concave upwards if $x < 0$ and downwards if $x > 0$

C) concave upwards if $-1 < x < 1$ and downwards if $x < -1$ or $x > 1$

D) concave upwards if $x < -1$ or $x > 1$ and downwards if $-1 < x < 1$

E) concave downwards in $(-\infty, \infty)$

9) A rectangle in the first quadrant is bounded by $x = 0$, $y = 0$, $x = a$ and $y = b$ with (a, b) on the circle $x^2 + y^2 = 1$. The largest possible area of the rectangle is

A) $\frac{1}{\sqrt{2}}$

B) $\frac{1}{2}$

C) 1

D) $\sqrt{2}$

E) $\frac{2}{3}$
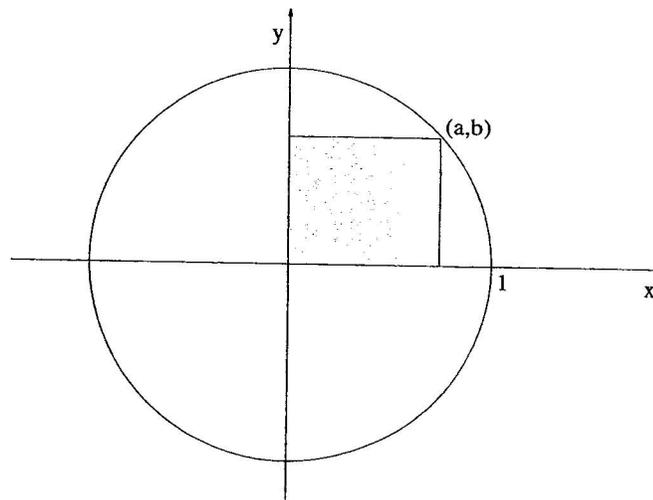
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10) A box with square base and no top is to have a volume 4 cubic feet. What is the minimum surface area of the box?

A) 2 square feet

B) 12 square feet

C) 17 square feet

D) 5 square feet

E) 14 square feet

11) If $f(x)$ is a differentiable function which satisfies
$$f'(x) = x^2 - 2x \quad \text{and} \quad f(1) = 1$$
then $f(2)$ is equal to

A) 5

B) 2

C) 0

D) $\frac{1}{3}$

E) $-\frac{11}{3}$

12) Which of the following is an antiderivative of
$$f(x) = (4x + 1)(3x^2 + 4) \text{ ?}$$

A) $(2x^2 + x)(x^3 + 4x) + C$

B) $x^3 + 2x^2 + 4x + C$

C) $5x^4 + 3x^2 + 2x^3 + 4x + C$

D) $4x^3 + 5x^2 + 4x + C$

E) $3x^4 + 8x^2 + x^3 + 4x + C$