DEPARTMENT OF MATHEMATICS AND STATISTICS UNIVERSITY OF MASSACHUSETTS

MATH 127 MIDTERM #2 17 November 2005 SPECIAL CODE: 111705 p. 1 of 5

NAME (print): _____

SIGNATURE: _____

8 DIGIT SPIRE ID #: ____ ____ ____ ____ ____ ____ ____ ____

CIRCLE the name of your instructor below: Rudvalis Sect. 1 MWF 9:05

Pedit Sect. 2 MWF 12:200 Cook Sect. 3 TuTh 9:30 Markman Sect. 4 TuTh 1:00

DIRECTIONS: This is a 90 minute exam. It consists of 20 multiple choice questions. Your (percentage) score on this exam is 5 times the number of correct responses. Your responses must be recorded on the green "bubble" sheets using a No. 2 pencil.

You are allowed to use any kind of calculator for this exam. You are responsible for having a working calculator and knowing how to use it and also for having at least one No. 2 pencil.

YOU MAY NOT SHARE A CALCULATOR WITH ANOTHER STUDENT DURING THIS EXAM

You MAY use a one sided 8.5 x 11 page as a review sheet during the exam.

If you need more paper for work than is provided on the exam page, raise your hand and we will supply you with scratch paper. Besides the things mentioned above you may not have anything else on your desk except your ID card which will be checked when you turn in your exam.

On your green "bubble" sheet you MUST DO THE FOLLOWING:

- **WRITE your name at the top left side in the section labeled NAME and BUBBLE it in below.**
- **WRITE your 8 digit SPIRE ID in the section labeled IDENTIFICATION NUMBER in the spaces labeled A through H in the middle of the bottom left and BUBBLE it in below that.**
- **WRITE and BUBBLE in 111705 in the section labeled SPECIAL CODE.**
- **BUBBLE in your section number (1, 2 or 3) in the column labeled GRADE or EDUC.**
- **DO NOT write nor "bubble" in the sections for SEX or BIRTH DATE. (-1 pts each if you do.)**
- **Your responses to each of the 20 questions must be made by filling in the appropriate bubble on your answer sheet. In GRADING your exam the grading machine reads only the bubbles you have filled out so entering these bubbles correctly is vital to correctly recording your performance.**
- **All bubbles must be filled in solidly using a # 2 pencil in items 1-20 of the answer sheet.**

- **DO NOT LEAVE YOUR SEAT once you have started the exam until you are ready to turn it in. If you have a question or need extra paper raise your hand and we will come to you.**

- **When you have finished MARK your answers in the test booklet BEFORE you TURN IN the green "bubble" sheet AND this COVER PAGE of the test booklet. Take the rest of the test booklet with you so that you can figure out your score as the correct answers will be put online after the exam. Grades will NOT be posted but will appear in OWL within a week so do not call the department or your instructor for grades as no grades will be given over the phone. BEST OF LUCK!**

.1. Calculate the derivative f′(x) for f(x) = $e^{-2x}/(x^2)$

a) $-2(x + 1)\, e^{-2x}/(x^3)$ **b)** $-2(x - 1)\, e^{-2x}/(x^3)$ **c)** $-2(x + 1)\, e^{-2x}/(x^2)$

d) $-2(x - 1)\, e^{-2x}/(x^2)$ **e)** $-2\, e^{-2x-1}/(x^3)$

.2. Which of the equations given below best approximates the equation of the tangent line to the graph of y = x ln(x) at the point (x = 2, y = 2ln(2)):

a) y - 2 = 1.386(x - .693) **b)** y - 1.386 = 1.693(x - 2) **c)** y - 1.386 = 2(x - 1.386)

d) y - .693 = 1.386(x - .693) **e)** y - 2.386 = 1.693(x - 2)

.3. If f(x) = ln(x^2) then the SECOND derivative f″(x) is:

a) $1/x^2$ **b)** $2/x^2$ **c)** $2/x$ **d)** $-2/x^2$ **e)** $-2/x^3$

.4. If y = f(x) = $(x^2 + 1)^{1/2}$, then f′(x) is:

a) $(1/2)(x^2 + 1)^{1/2}$ **b)** $(2x)(x^2 + 1)^{1/2}$ **c)** $(2x)(x^2 + 1)^{-1/2}$

d) $x(x^2 + 1)^{-1/2}$ **e)** $x(x^2 + 1)^{1/2}$

.5. If f(x) = $(e^{2x} - x)^{1/2}$, then f′(x) is:

a) $(2e^{2x} - 1)^{1/2}$ **b)** $(1/2)(e^{2x} - x)^{-1/2}$ **c)** $(1/2)(e^{2x} - x)^{1/2}(2e^{2x} - x)$

d) $(1/2)(e^{2x} - x)^{-1/2}(2e^{2x} - 1)$ **e)** $-1/2\ (e^{2x} - x)^{1/2}(2e^{2x} - 1)$

.6. The cost of producing q units of a certain product is given by C(q) = 1000 + 30 e^{kq} where k is a positive constant. At a production level of 30 units, the cost of producing an additional unit is about:

a) 30 **b)** 30 e^{30k} **c)** 30k e^{30k} **d)** 30k e^{kq} **e)** 1000 + 30 e^{30k}

.7. Suppose f(x) = x/e^x . Then f′(x) is which of the following:

a) $1/e^x$ **b)** $(1 + xe^x)/e^x$ **c)** $(1 - xe^x)/e^x$ **d)** $(1 - x)/e^x$ **e)** $(1 + x)/e^x$

.8. Find the equation of the tangent line to the graph of $y = e^2 + xe^{-2x}$ at $x = -1$.

a) $y = 3e^2(x + 1)$ b) $y = 3e^2x + e^2$ c) $y = xe^{-2x} + e^2$ d) $y = 22x + 23$ e) None of these

.9. At $x = 1$ the function $y = f(x) = x^6 - 2x^3$:

a) has a local maximum b) has a zero c) is concave down

d) has a point of inflection e) has a local minimum

.10. Use your calculator to graph the function $y = f(x) = 200 - 0.1(x + 1)(10x - 22)^3$ using the window $-1 < x < 4$ and $-2000 < y < 2000$. Basing your answer on this graph and on analytic methods describe those critical points of f whose x values are in the interval $-1 < x < 4$.

.a) f has only one such critical point, which corresponds to a local maximum.

.b) f has only one such critical point, which corresponds to a local minimum.

.c) f has two such critical points, which correspond to a local max and a local min of f.

.d) f has two such critical points, which correspond to a local max and a point of inflection.

.e) f has two critical points, which correspond to two local maxima of f.

.11. The inflection points of the graph of $y = f(x) = x^4 + 2x^3 - 36x^2 + 12x - 12$ are best described by:

.a) There are three inflection points with x values close to -5, 0 and 3.5.

.b) There are three inflection points with x values close to -7.2, 0 and 4.9.

.c) There are three inflection points with x values close to -2, 0 and 3.

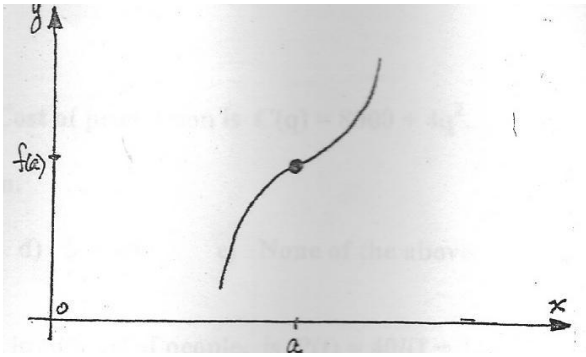
.d) There are two inflection points with x values close to -3 and 2.

.e) There are at least four inflection points.

.12. If $y = f(x)$ is a function such that the graphs of $y = f(x)$, $y = f'(x)$ and $y = f''(x)$ are all smooth curves (i.e. have no sharp corners) then for the SLOPE of f(x) to be maximized at $x = a$ which one of the following must occur:

a) $f'(a) = 0$ b) $f'(a) > 0$ c) $f''(a) > 0$ d) $f(a) = 0$ e) $f''(a) = 0$

.13. If y = f(x) has graph as shown at the right, then at the point (a, f(a)) on this graph:



a) $f''(a) > 0$ b) $f'(a) = 0$ c) $f'(a) < 0$

d) $f''(a) = 0$ e) $f''(a) < 0$

.14. Suppose y = f(x) is a function which satisfies the conditions given in the chart below:

x	x < a	x = a	x >a
f(x)		f(a)	
f′(x)	positive	0	positive
f″(x)	negative	0	positive

Given all this information we can conclude that the point (a, f(a)) is a:

a) point of inflection b) local maximum c) local minimum

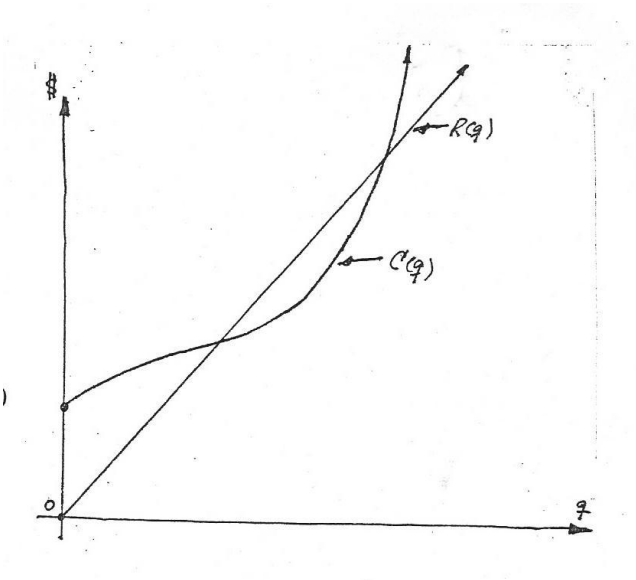
d) global maximum e) none of the above

.15. Let A denote the global maximum y value and B denote the global minimum y value of $y = f(x) = x^3 - 3x$ defined on the interval $-3/2 \le x \le 1/2$. Which of the following is correct:

a) A = 9/8 and B = –9/8 b) A = 2 and B = –2 c) A = 11/8 and B = –11/8

d) A = 2 and B = – 11/8 e) A = 2 and B = 0

.16. Suppose cost C(q) and revenue R(q) = pq functions are given by the graph at the right where p is a fixed (i.e. constant) price and q is the quantity sold. Which of the following must be true at the quantity q which maximizes the profit.



a) $R'(q) = q$ b) $C'(q) = p$ c) $R(q) = C(q)$

d) $C''(q) > 0$ e) $C''(q) = 0$

.17. A product sells for \$600 per unit and the Cost of production is $C(q) = 8000 + 4q^2$.

Find the maximum value of the profit function.

a) \$7500 b) \$11200 c) \$14500 d) \$16300 e) None of the above

.18. One model for the population of the world, in billions of people, is $P(t) = 40/[1 + 11e^{-0.08t}]$ where t is the number of years since 1990. During what year is the population predicted to grow most rapidly? Round your answer to the nearest whole year.

a) 2010 b) 2015 c) 2020 d) 2025 e) 2030

.19. Suppose $y = f(x) = xe^{-bx}$ where $b > 0$ and $x \geq 0$. Find x such that (x, f(x)) is an inflection point for the graph of y = f(x).

a) 2 b) 2b c) b/2 d) 2/b e) 2/(eb)

.20. The concentration of a drug in the bloodstream is given by $C(t) = 24te^{-0.5t}$ (μg/cc) where t is the number of hours since the drug was administered. Which of the following is true of C(t) at t = 3?

a) It is zero b) It is a minimum c) It is a maximum d) It is decreasing e) It is increasing