

MATH 112 B
Exam II - Version 1
May 22, 2003

Name _____

Student ID # _____

Section _____

1	17	
2	16	
3	17	
Total	50	

- Check that your exam contains three questions.
- You are allowed to use a calculator, a ruler, and one sheet of handwritten notes.
- You must show your work on all problems. The correct answer with no supporting work may result in no credit.
- Write your answers in the specified locations.
- If you need more room, use the backs of the pages and indicate to the reader that you have done so. If you still need more paper, please ask for some.
- Raise your hand if you have a question.
- Put your name on your sheet of notes and turn it in with the exam.
- You have 50 minutes to complete the exam.

GOOD LUCK!

1. (17 points) The value of a stock you're keeping your eye on appears to grow exponentially. You wish to find an exponential model to predict $V(t)$, the value of one share of the stock in dollars, t days after your observation begins. As a good Math 112 student, you know that the way to do this is to take natural logarithms and find $z = mt + b$, the line of best fit for the logarithmic data. You compute the mean-squared error function for the logarithmic data:

$$E(b, m) = b^2 + 7.5m^2 + 5bm - 0.4b - 1.19m + 0.0474.$$

- (a) (6 points) Compute the partial derivatives $\frac{\partial E}{\partial b}$ and $\frac{\partial E}{\partial m}$.

ANSWERS: $\frac{\partial E}{\partial b} =$ _____
 $\frac{\partial E}{\partial m} =$ _____

- (b) (5 points) Find the line of best-fit: $z = mt + b$.

ANSWER: _____

- (c) (2 points) What is the smallest possible value of $E(b, m)$? (Do not round your answer.)

ANSWER: _____

- (d) (4 points) Compute the value of your stock in dollars, 6 days after your observation begins. (Round to the nearest cent.)

ANSWER: \$ _____

2. (16 points)

- (a) (4 points) Compute the partial derivative $\frac{\partial t}{\partial r}$ if $t = s^2 e^r + \frac{r^2 + 2r}{\sqrt{s}}$.

ANSWER: $\frac{\partial t}{\partial r} =$ _____

- (b) (6 points) The demand function for selling items is $h(q) = q^2 - 24q + 153$. Recall that Total Revenue, $R(q)$, is given by the area of a rectangle under the demand curve. That is, $R(q) = q \cdot h(q)$. Find all positive values of q at which the graph of Total Revenue has a horizontal tangent.

ANSWER: $q =$ _____

- (c) (6 points) Let $k(x) = -\frac{1}{4}x^4 + \frac{13}{3}x^3 - 28x^2 + 80x + 15$. Use the Second Derivative Test to determine whether $k(x)$ has a local maximum, a local minimum, or neither at $x = 5$. If the Second Derivative Test is inconclusive, state why.

ANSWER: (circle one) maximum minimum neither inconclusive

3. (17 points) A lawyer handles two kinds of cases: medical malpractice suits and corporate negligence claims. The malpractice suits each require 4 weeks of preparation and the hiring of 3 expert witnesses. Corporate negligence cases require 4 weeks of preparation and the hiring of 9 expert witnesses. Assume that the lawyer can work on only one case at a time and that she wins all her cases. She can devote as much as 40 weeks a year preparing for cases and can afford to hire no more than 54 expert witnesses per year. On average, each medical malpractice suit brings in \$40,000 in profit and each corporate case brings in \$60,000 in profit.

Let x be the number of medical malpractice suits the lawyer takes on in a year and let y be the number of corporate negligence cases she takes on in a year. She wishes to maximize her yearly profit.

- (a) (6 points) Find the objective function and the constraints for this problem.

ANSWER: objective function: _____
 constraints: _____

- (b) (6 points) Sketch the feasible region, clearly labelling all vertices.

- (c) (3 points) Determine how many of each type of case the lawyer should take on each year in order to maximize profit.

ANSWER: medical: _____ cases, corporate: _____ cases

- (d) (2 points) What is her maximum possible profit?

ANSWER: \$ _____