

MATH 112 B and C

Sample Exam II

These are a few problems of the type you can expect on the exam. It is not meant to be an exhaustive review of the course material. You should have a solid understanding of all material covered in the worksheets and in lecture. You should understand how to do all assigned Pre-Test problems. Solutions to this sample exam will be posted on the course web site.

1. Find the point of intersection of each pair of lines.

(a) $5x - 4y = 9$ and $x - 2y = -3$

(b) $2x - y = 6$ and $5x - 3y = 16$

2. Let

$$f(x) = \frac{1}{5}x^5 - \frac{7}{4}x^4 + \frac{10}{3}x^3 + 13.$$

Use the second derivative test to determine whether f has a maximum or a minimum value at $x = 5$.

3. The mean-square error function for a certain set of data is

$$E(b, m) = b^2 + 233m^2 + 46bm - 35.87b - 201.4m + 644.204.$$

Compute the partial derivatives $\frac{\partial E}{\partial b}$ and $\frac{\partial E}{\partial m}$ and find the best-fitting line for the data.

4. Consider the following set of data:

x	y
4	3
7	5
8	8
11	12

(a) Compute $\sum y_i^2$.

(b) Compute $\sum x_i y_i$.

5. The Blonco Magic Food Chopper has a suggested retail price of \$18. The total cost for producing and shipping the Choppers is

$$TC : C(q) = \frac{q^3}{60} - \frac{3}{5}q^2 + \frac{27}{5}q + 15,$$

where q is in **thousands** of Choppers per week and C is in dollars.

(a) Find all values of q at which $C(q)$ has a horizontal tangent.

(b) Using the second derivative test, determine whether the quantities you found in (a) give a local maximum or a local minimum.

(c) Suppose that, due to contractual obligations, you must produce and ship at least 4,000 Choppers per week. Further, your capacity for producing and shipping Choppers is limited to 25,000 Choppers per week. Find the quantity that produces the global maximum value of Total Cost.

6. The Benezera-Okrant production model for a particular company is

$$P(L, K) = 1.5L^{0.4}K^{0.5} + 0.3L + 0.2K,$$

where L is labor in thousands of dollars (in employee salaries, for example) and K is capital in thousands of dollars.

(a) Compute the partial derivatives $P_L(L, K)$ and $P_K(L, K)$.

- (b) Suppose the company has already invested \$12,000 in labor and \$10,000 in capital. If \$1000 is to be invested, should the investment be made in labor or capital? (HINT: Your answer to part (a) should help.)
7. The members of the Society for People Who Love Math and Pie (SPWLMP) conduct a fundraiser in which they sell two types of greeting: the singing Math-o-gram and the singing Pie-o-gram. Each Math-o-gram requires 2 hours of material preparation (the math!), followed by 3 hours of rehearsal (the singing!). Each Pie-o-gram requires 4 hours of material preparation (the pie!) and 1 hour of rehearsal (you get the picture). The profit for each Math-o-gram is \$14 and the profit for each Pie-o-gram is \$6. The SPWLMP can spend only 148 hours in their rented preparation space and 92 hours in the rehearsal space.
- Let x be the number of Math-o-grams sold and let y be the number of Pie-o-grams sold.
- Find a formula for profit $P(x, y)$.
 - Find a formula for $m(x, y)$, the number of hours of material preparation time the group will spend.
 - Find a formula for $r(x, y)$, the number of rehearsal hours the group will spend.
 - We would like to find the values of x and y that maximize profit. Sketch the feasible region for this problem.
 - How many of each greeting should the group sell in order to maximize profit?
 - What is maximum profit?