

FILE COPY

MATH 1070 UNIFORM FINAL EXAM

May 8, 2004

Print your name _____

Circle your section:

Creek	Gryboski	Kammerling	Morrison	Witulski
TTh 11:30	TTh 10:00	Online	MW 5:30	MW 8:30

Instructions: Read the problems carefully. If you do not understand a question, ask for clarification. You have three hours to complete the exam. You may use the page of notes and formulas attached to the exam and a calculator. The maximum score for this exam is 100 points: 50 points for Part 1 and 50 points for Part 2. To receive credit for Part 1 questions, you must transfer your answers to the answer sheet. To receive **partial** credit for Part 2 questions, you must **show all work**. Good luck!

DO NOT WRITE BELOW THIS LINE

Part 1: Short Answer (50 pts) _____

26. (10 pts) _____

27. (10 pts) _____

28. (10 pts) _____

29. (10 pts) _____

30. (10 pts) _____

Total (100 pts): _____

ANSWER SHEET FOR PART 1

You must transfer your answers to questions in Part 1 to this sheet.

Print your name and section _____

- | | |
|-----------|-----------|
| 1. _____ | 14. _____ |
| 2. _____ | 15. _____ |
| 3. _____ | 16. _____ |
| 4. _____ | 17. _____ |
| 5. _____ | 18. _____ |
| 6. _____ | 19. _____ |
| 7. _____ | 20. _____ |
| 8. _____ | 21. _____ |
| 9. _____ | 22. _____ |
| 10. _____ | 23. _____ |
| 11. _____ | 24. _____ |
| 12. _____ | 25. _____ |
| 13. _____ | |

Total points: _____

Print your name and section _____

SHORT ANSWER (2 POINTS EACH)

Functions

1. Given $f(x) = \sqrt{x+3}$ and $g(x) = x^2 - 1$, find $\frac{g(-5)}{f(6)}$.
2. Find the equation of the line through the points $(-1, 5)$ and $(2, -3)$ and give your answer in point-slope form.
3. Find the coordinates of the vertex of the parabola $f(x) = -(x - 3)^2 + 2$.
4. Give the horizontal and vertical asymptotes of the function $g(x) = \frac{-3x-4}{x^2-9}$.
5. Solve the equation $5^{2x-3} = 5^{-7x-2}$ for x .

Probability

6. A person purchasing a new car has several options: four interior colors, six exterior colors, two types of radios, and three types of engine. How many different cars are possible if one choice is made for each option?
7. From a standard 52-card deck, how many 5-card hands contain all spades?
8. A company with 20 sales people and 15 technical people plans to send 3 sales people and 2 technical people to a conference. How many different groups of people can be sent to the conference?
9. A combination lock has three dials, each labeled 0 through 20. How many combinations are possible if numbers cannot be repeated?
10. A museum curator has five paintings by a particular artist and wants to display three of them. In how many ways can the paintings be displayed if the position of the paintings matters?

Finance

11. Suppose Payday Loans lends you \$550 with the agreement that you will pay back \$600 in two months (principal and interest). If the loan has simple interest, what is the annual interest rate?

12. You deposit \$1500 in an account that earns 11% annual interest, compounded monthly. How much will you have in the account at the end of 25 years?
13. What is the present value of an annuity that pays \$4000 quarterly for 20 years if the annuity has an annual interest rate of 9% compounded quarterly?
14. If you make a one-time deposit of \$3000 in an account that earns 16% per year compounded annually, after how many years will the balance reach \$20,000?
15. Suppose you take out a 60-month car loan for \$9500 at an annual interest rate of 5.25% compounded monthly. How much are your monthly payments?

Linear Systems

16. Evaluate the product

$$\begin{pmatrix} 3 & 1 & 4 \\ -2 & 9 & 9 \end{pmatrix} \begin{pmatrix} 3 & 1 \\ 3 & -6 \\ 2 & 2 \end{pmatrix}.$$

17. Evaluate the sum

$$\begin{pmatrix} a & b \\ 1 & 2 \end{pmatrix} + \begin{pmatrix} -2 & 0 \\ a & 1 \end{pmatrix}.$$

18. Consider the following augmented matrix A :

$$A = \begin{pmatrix} 1 & -2 & 3 & -10 \\ 4 & 6 & -5 & 12 \\ 0 & -1 & 4 & 7 \end{pmatrix}$$

Write the equation that corresponds to the first row of this matrix.

19. What are the dimensions of the matrix

$$B = \begin{pmatrix} 1 & 2 & 9 & 6 \\ 5 & 4 & m & q \\ 8 & x & 1 & 5 \end{pmatrix}?$$

20. Solve the following system by any method.

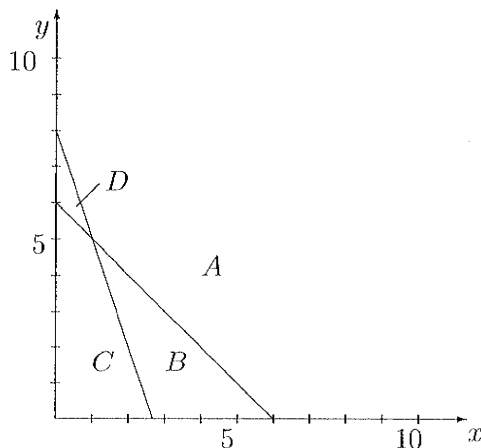
$$\begin{aligned} 2x - 4 &= 8y \\ 9 + 2y &= 5x \end{aligned}$$

Linear Programming

21. The corner points for a system of linear inequalities are $(0,0)$, $(6,0)$, $(7,4)$, and $(0,8)$. Find the maximum value of $P = 2x + 3y$ over this region.
22. The corner points for a system of linear inequalities are $(0,0)$, $(6,0)$, $(7,4)$, and $(0,8)$. Find the maximum value of $P = -x + y$ over this region.

Refer to the figure below for problems 23–24.

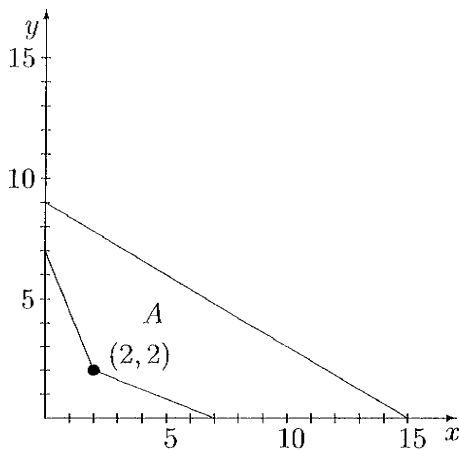
$$\begin{aligned} y + 3x &\geq 8 \\ x + y &\leq 6 \\ x &\geq 0 \\ y &\geq 0 \end{aligned}$$



23. Which region, A , B , C , or D , is the feasible region for the given set of inequalities?
24. Find the corner points for the region D .

25. Consider the feasible region A shown to the right. Which of the following points are in the feasible region?

$(2, 5)$ $(3, 3)$ $(10, 9)$ $(7, 4)$ $(1, 10)$



APPLICATIONS (10 POINTS EACH, PARTIAL CREDIT)

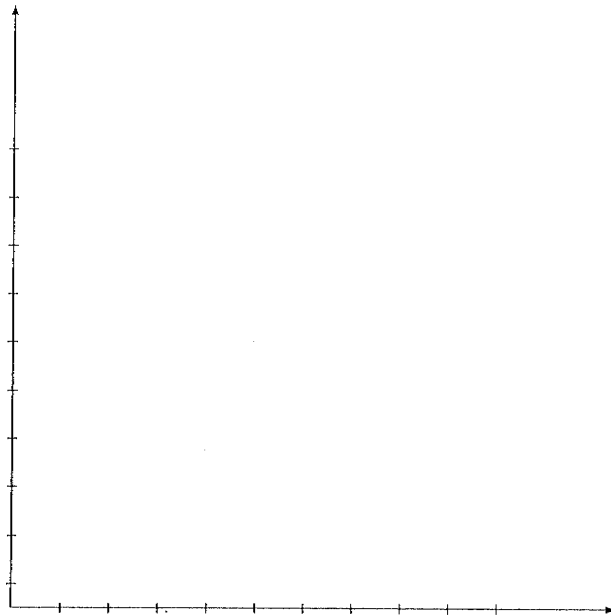
26. A company manufactures and sells books. The company can sell x books at a price of $p(x) = 160 - 4x$, for $1 \leq x \leq 40$. The cost of manufacturing x books is $C(x) = 800 + 15x$.

(a) Find the revenue function, $R(x)$.

(b) Find the break-even points where $R(x) = C(x)$.

(c) Find the profit function.

(d) Graph the profit function carefully, label at least two points on the graph, and find the maximum profit.



27. Suppose you now pay \$800 per month in rent for your apartment. You plan to purchase a home and decide that you can afford monthly mortgage payments of \$900. Thirty-year home mortgages currently have an interest rate of 5.75% compounded monthly.

(a) What is the present value of the mortgage that you can afford?

(b) After 30 years, how much interest will you have paid?

(c) If you could get an interest rate of 5.5%, how much total interest would you save?

28. College students in an experiment will be fed a special diet consisting of three basic foods: pizza, chocolate, and chips. The diet will include exactly 340 units of calcium, 180 units of iron, and 220 units of vitamin A. For each ounce of food, pizza contains 30 units of calcium, 10 units of iron, and 10 units of vitamin A; chocolate contains 10 units of calcium, 10 units of iron, and 30 units of vitamin A; chips contain 20 units of calcium, 20 units of iron, and 20

units of vitamin A. Determine how many ounces of each food must be eaten to meet the diet requirements.

29. The officers of a high school senior class are planning to rent buses and vans for a class trip. Each bus can transport 40 students, requires 3 chaperones, and costs \$1200 to rent. Each van can transport 8 students, requires 1 chaperone, and costs \$100 to rent. The officers expect at least 400 students to make the trip and can count on at most 36 chaperones.
- (a) How many vehicles of each type should be rented in order to minimize transportation costs?

(b) What is the minimum transportation cost?

30. A market research department surveyed 200 people and found that 100 people watch the 5:00 news, 70 people watch the 10:00 news, and 60 people watch neither news program.

(a) Draw a Venn diagram to describe the viewing habits of the people surveyed.

(b) What is the probability that a randomly selected person watches a news program?

(c) What is the probability that a randomly selected person watches the 5:00 news, but not the 10:00 news?

(d) What is the probability that a randomly selected person watches the 10:00 news, but not the 5:00 news?

Facts and Formulas

Algebra

$$a^x \cdot a^y = a^{x+y} \quad \frac{a^x}{a^y} = a^{x-y} \quad (a^x)^y = a^{xy} \quad \left(\frac{a}{b}\right)^x = \frac{a^x}{b^x} \quad (ab)^x = a^x b^x$$

$$a^x = a^y \text{ iff } x = y \quad a^x = b^x \text{ iff } a = b, x \neq 0$$

$$\log_b 1 = 0 \quad \log_b b = 1 \quad \log_b b^x = x \quad b^{\log_b x} = x \quad (x > 0)$$

$$\log_b(xy) = \log_b x + \log_b y \quad \log_b(x^n) = n \log_b x \quad \log_b\left(\frac{x}{y}\right) = \log_b x - \log_b y \quad \log_b x = \log_b y \text{ iff } x = y$$

$$\text{Cost function: } C = (\text{fixed costs}) + (\text{variable costs}) = a + bx$$

$$\text{Price-demand: } p = m - nx$$

$$\text{Revenue function: } R = xp = x(m - nx)$$

$$\text{Profit function: } P = R - C = x(m - nx) - (a + bx)$$

Finance

$$\text{Simple interest: } I = Prt$$

$$\text{Simple interest: } A = P(1 + rt)$$

$$\text{Compound interest: } A = P(1 + i)^n \text{ or } A = P\left(1 + \frac{r}{m}\right)^{mt}$$

$$\text{Continuous interest: } A = Pe^{rt}$$

$$\text{Annual percentage yield: } APY = \left(1 + \frac{r}{m}\right)^m - 1$$

$$\text{Future value ordinary annuity: } FV = PMT \frac{(1+i)^n - 1}{i}$$

$$\text{Present value ordinary annuity: } PV = PMT \frac{1 - (1+i)^{-n}}{i}$$

Counting and Probability

$$\text{Permutations: } {}_n P_k = \frac{n!}{(n-k)!} \quad \text{Combinations: } {}_n C_k = \frac{n!}{(n-k)! k!}$$

$$n(A \cup B) = n(A) + n(B) - n(A \cap B)$$