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Course Guide

Independent Study in Idaho

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Math 130
Finite Mathematics

University of Idaho
3 Semester-Hour Credits

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3-Math 130

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Math 130: Finite Mathematics 3 Semester-Hour Credits: UI

Welcome!

Whether you are a new or returning student, welcome to the Independent Study in Idaho (ISI) program. Below, you will find information pertinent to your course including the course description, course materials, course objectives, as well as information about assignments, exams, and grading. If you have any questions or concerns, please contact the ISI office for clarification before beginning your course.

Policies and Procedures

Refer to the ISI website at **www.uidaho.edu/isi** and select *Students* for the most current policies and procedures, including information on setting up accounts, student confidentiality, exams, proctors, transcripts, course exchanges, refunds, academic integrity, library resources, and disability support and other services.

Course Description

Systems of linear equations and inequalities, matrices, linear programming, and probability. Prerequisite: Sufficient score on SAT, ACT, or COMPASS Math Test; or Math 108 with a C or better. Required test scores can be found here: **ww.uidaho.edu/registrar/registration/placement/math.htm.**
University of Idaho students: May be used as core credit in J-3-c.

10 graded lessons, 1 self-study lesson, 4 proctored exams

Students may submit up to 3 assignments per week. Before taking exams, students MUST wait for grades and feedback on assignments, which may take up to three weeks after date of receipt by the instructor.

ALL assignments and exams must be submitted to receive a final grade for the course.

Course Materials

Required Course Materials

Rolf, Howard L. *Finite Mathematic*. 7th ed. Brooks Cole, 2007. ISBN-10: 0495118427. ISBN-13: 9780495118428.

Recommended Course Materials

Rolf, Howard L. *Student Solutions Manual for Rolf's Finite Mathematics*. 7th ed. Belmont, CA: Thomson Brooks/Cole, 2007. ISBN-10: 0-495-11843-5. ISBN-13: 978-0495118435.

If you are unsure if your background is sufficient or if it has been a long time since you have done any formal mathematics, you may want to try some problems that have answers in the back of the book. Also, the material in Chapter 1 on Functions and Chapter 2 on Lines and Linear Systems should primarily be review from algebra. If it seems unfamiliar to you, then you should consider taking the algebra course, Math 108 [Intermediate Algebra], before proceeding with this course.

Course Delivery

This course is available online. An electronic course guide is accessible through Canvas at no additional cost. Refer to your *Registration Confirmation Email* for instructions on how to access Canvas.

Course Introduction

The goal of the first two-thirds of this course is to teach you to solve a particular type of application, called **linear programming.** These problems occur in numerous settings in the "real" world, as you will see from the variety of applications we will do. We will be studying two methods for solving this type of problem: a **graphical** method and a **matrix** method. The first two chapters lay the groundwork for linear programming, and then the graphical approach is presented in Chapter 3 "Linear Programming," and the matrix method in Chapter 4 "Linear Programming: The Simplex Method."

The last one-third of this course is devoted to studying **probability.** Probability lays the groundwork for statistical methods, which most students now study, regardless of their majors. Chapters 6 "Sets and Counting" and 7 "Probability" will discuss counting and probabilities.

Please note that the textbook is set up in the same manner as most of the math textbooks you have used in the past. The notation "Section 2.3" means Chapter 2, Section 3. The exercise sets are at the end of each section and there is a set of review exercises at the end of every chapter. Also, the answers to the odd numbered problems are all in the back to the textbook beginning on page 807.

Course Objectives

Upon successful completion of this course, the student will be able to:

- Solve systems of linear equations by the Elimination Method.
- Solve systems of linear equations by the Gauss-Jordan Method.
- Solve systems of linear equations using Matrix Inversion.
- Solve applications of linear equations.
- Solve linear programming problems by graphing.
- Solve linear programming problems by the Simplex Method.
- Use sets and Venn diagrams to solve counting problems.
- Use permutations and combinations to solve counting problems.
- Find probabilities for equally likely events and compound events.
- Use conditional probabilities and independence to solve probability problems.
- Use Bayes' Rule to determine probabilities.
- Solve Markov Chain problems.

Lessons

Each lesson includes the following components:

- reading assignments
- overview
- ***self-study*** practice problems
- graded assignments

Reading mathematics takes practice, time, and effort. You should spend a lot of time reading the text. Read very slowly, thinking about each sentence. Read with a pencil in hand so you can write in the margins and work through the given examples. Often you will need to fill in a step or two. Authors sometimes leave out a few steps of arithmetic or algebra in order to keep the number of pages down to a manageable size. If you have any questions on the reading, you can always contact the instructor.

I hope that you will find the textbook to be very readable. I chose it because students seem to like it and find the author to be highly understandable. There are two features that I particularly like that I would like you to look at right now. In the margins of some pages, the author sometimes writes little "cautions" (see p. 20) or "notes" (see p. 23). These are bits of information that I would have included in the overview, but don't need to because this author is very thorough. So, pay attention to these tidbits of information. The second really nice feature, especially for an independent learner, is the direct link that the author provides between examples and exercises. Please look at the end of example 12 on page 23 in the textbook. Note where it says, in blue, "Now you are ready to Work Exercise 92, pg. 30." Now turn to that exercise and notice how it refers you to the example. I hope you will find this to be a very helpful feature. And, while we are looking at the textbook, notice the very large number of examples that are in each section. Quite frankly, I love this textbook for a course like this. I hope you appreciate it and find that it eases your learning.

In the **overview** section of each lesson, I point out material that is especially important, any topics in the reading that you may skip, some tips of my own and, sometimes, I give other examples that I think you will find helpful.

The ***self-study*** **practice problems** are intended to help develop your understanding of the basic concepts and to increase your competence with the algebraic and arithmetic manipulations needed to solve problems.

There is an old saying: "Math is not a spectator sport." I can read and understand the rules of basketball or directions on how to drive a car. However, unless I train my muscles and practice, I would not be a very competent basketball team member, nor would you want to ride in a car with me driving!

Practice is the key to succeeding in a math class. It is a lot of work; that is true. However, the rewards come when each problem gets a little bit easier and then each lesson gets a little bit easier as you exercise your math brain muscles. There are a lot of false starts in mathematics. That's okay. The key is to be aware of this and to not get frustrated. Take a break, go for a walk and clear your head. This is what we all have to do; it is the nature of math problem solving and indeed, of all problem solving in life.

These practice problems are the same ones that I assign to my on-campus students. The answers to the ***self-study*** practice problems are in the back of the textbook and in the *Student's Solution Manual for Rolf's Finite Mathematics*. Do not turn these problems in, but do not neglect them. Feel free to contact the grader if you need help on any of these.

Graded assignments take the place of in-class quizzes. They give both of us a way to access which concepts you need more practice on before taking an exam. Equally important is that you learn to write mathematics correctly. These assignments need to be done neatly and completely. You are going to be graded on the thoroughness of your work as well as its accuracy.

Study Hints:

- Complete all reading assignments.
- Complete all the ***self-study*** problems before doing the graded problems.
- Set a schedule allowing for course completion one month prior to your personal deadline. An *Assignment Submission Log* is provided for this purpose.
- Web pages and URL links in the World Wide Web are continuously changing. Contact your instructor if you find a broken webpage or URL.
- Keep a copy of every lesson submitted. Submit the entire lesson at one time (partial or incomplete assignments will receive a zero).

Exams

- You must wait for grades and comments on lessons prior to taking subsequent exams.
- In this course guide, on the *Exam Information* pages, there are test outlines containing textbook exercises that are similar to what you will be tested on. You should do all of those problems to prepare for the test. You may find that you need to do them more than once. Keep track of the problems you had to look up in the textbook, in this guide, or on your past homework before you could solve the problems. Do those over again until you can do every problem without any references.

Exams are sent to proctors one at a time once the instructor has completed grading applicable lessons. For example, Exam 2 sent after lessons 1-3 graded, Exam 2 after lessons 4-6, etc. Exceptions made upon written instructor approval.

Refer to *Grading* for specific information on lesson/exam points and percentages.

Proctor Selection/Scheduling Exams
All exams require a proctor. At least 2 weeks prior to taking your first exam, submit the completed *Proctor/Exam Request Form* (available at uidaho.edu/isi, under *Forms*) to the ISI office. ISI mails all exams directly to the proctor after receiving the *Proctor/Exam Request Form*. You must schedule the examination time with your proctor prior to each exam. The proctor administers the exam and returns it to the ISI office.

Grading

The course grade will be based upon the following considerations:

Assignments	(10 @ 10 points each)	100 points
Unit Exams	(3 @ 100 points each)	300 points
Comprehensive Final Exam		100 points
	Total	500 points

A letter grade will be assigned at the end of the course based on the standard 10 percent scale.

A = 500 – 450 points
B = 449 – 400 points
C = 399 – 350 points
D = 349 – 300 points
F = 299 points or lower

Self-study Lessons
Lesson 11 is the only lesson for which there is no graded assignment. As with the self-study exercises listed in the other lessons, the answers to lesson 11's problems are in the back of the textbook.

The final course grade is issued after all lessons and exams have been graded.

Acts of academic dishonesty, including cheating or plagiarism are considered a very serious transgression and may result in a grade of F for the course.

About the Course Developer

Judith Terrio got her math ability from her father and her love of people from her mother. She grew up and went to college on the east coast. Judi obtained her secondary teaching certificate and taught a few years in Colorado before moving to beautiful Idaho. In north Idaho, Judi taught high school for many years before earning a master's degree in mathematics and subsequently becoming an instructor at the University of Idaho. She thinks she is one of the most fortunate people alive because her passion and her job are one in the same. She loves teaching! She is also a cat whisperer. ☺

Contacting Your Instructor

Instructor contact information is posted on your Canvas site under *Course Rules.*

Assignment Submission Log

Send the completed *Proctor Information Form* to the ISI office at least two weeks prior to taking your first exam.

Lesson	Projected Date for Completion	Date Submitted	Grade Received	Cumulative Point Totals
1				
2				
3				
It is time to make arrangements with your proctor to take Exam 1.				
Exam 1				
4				
5				
6				
It is time to make arrangements with your proctor to take Exam 2.				
Exam 2				
7				
8				
9				
10				
It is time to make arrangements with your proctor to take Exam 3.				
Exam 3				
It is time to make arrangements with your proctor to take the Final Exam.				
Exam 4				

Lesson 1
Linear Functions

Reading Assignment

Preface "To the Student," pp. xi–xii
Chapter 1, *Functions and Lines*, Sections 1.1, 1.2, and 1.3

Overview

As mentioned in the introduction, the goal of the first two-thirds of this course is to teach you to solve a particular type of application, called **linear programming.** One of the very nice things about these problems is that the variables are only to the first power and are only added or subtracted to one another (i.e., no square roots, no *xy* or *x/y* in the equations). Sounds great, doesn't it? This means that we will be concerned mostly with lines. In actuality, applications may involve many, many variables, but fortunately we have technology to lend a helping hand in solving those more complex problems. The technological methods used are just an extension of the methods used with lines or with three or four variables. So, we start with the study of functions, particularly **linear functions,** as the foundation for this course.

Section 1.1 Functions

Please pay special attention to how variables are defined when using mathematics to describe an application. For instance, let's say I'm going to the store to buy bananas. To define a variable by only saying, "let x = bananas," is not a sufficient definition. Is x the number of individual bananas, the number of bunches, or the number of pounds of bananas? You must include a quantifier (like "number of" or "pounds of") when defining a variable.

Section 1.2 Lines

This section provides you with an opportunity to review and refresh your algebra skills concerning lines. Here is a list of formulas that you will need.

- Slope of a line between two given points (x_1, y_1) and (x_2, y_2) is $m = \frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1}$, provided $x_2 \neq x_1$

  Note that this is said "delta y over delta x" or "change in y over change in x." Δ is the capital Greek letter "delta" and "change" means the difference in two numbers (like the change you get when you make a cash purchase.)

- Slope-Intercept Form — $y = mx + b$, where m is the slope and the point $(0, b)$ is the y-intercept
- Point-Slope Form — $y - y_1 = m(x - x_1)$, where m is the slope and (x_1, y_1) is a known point
- Standard Form — $Ax + By = C$, where A is a whole number greater than or equal to 0
- Horizontal Line — $y = b$ [$m = 0$, y-intercept is $(0, b)$, there is no x-intercept]
- Vertical Line — $x = a$ [slope is undefined, there is no y-intercept, x-intercept is $(a, 0)$]

*There are basically two methods for sketching a line:

(1) Using a point on the line and its slope (see textbook examples 4 [pp. 17-8], 9 [p. 21], and 10 [pp. 21-2])
(2) Using the line's x- and y- intercepts

The second method is the one that we will use most often, so it is important for you to understand how to find these two points.

Example: Given $2x-3y=12$.

A point on the *x*-axis has a *y*-coordinate of zero, so find the *x*-intercept by setting $y=0$.

$$2x-3(0)=12$$
$$2x=12$$
$$x=6$$

A point on the *y*-axis has a *x*-coordinate of zero, so find the *y*-intercept by setting $x=0$.

$$2(0)-3y=12$$
$$-3y=12$$
$$y=-4$$

To sketch the line, connect the two points $(6,0)$ and $(0,-4)$ with a line which continues in both directions.

*When given two points, there are two ways to find the equation of a line:

(1) Using the slope-intercept form (which is the method you are probably the most familiar with)
(2) Using the point-slope form

The second method is the one that we will use most often. It is actually less work and less prone to errors.

Example: Find an equation of the line passing through $(3,\ -1)$ and $(-2,\ 9)$.

First find the line's slope: $m=\dfrac{\Delta y}{\Delta x}=\dfrac{-1-9}{3-{}^{-}2}=\dfrac{-10}{5}=-2$

Then substitute the slope and either point into the form $y-y_1=m(x-x_1)$

$$y-{}^{-}1=-2(x-3)$$
$$y+1=-2x+6$$
$$y=-2x+5$$

$$y-9=-2(x-{}^{-}2)$$
$$y-9=-2x-4$$
$$y=-2x+5$$

Section 1.3 Linear Models

This section deals with the use of math to model real-world situations. The major focus in this section is on the **cost, revenue,** and **profit functions.**

If *x* = number of items sold, then:

The **cost function** C(*x*) = **a***x* + **b**; where C(*x*) is the total cost for producing *x* items,

a = unit cost, the cost for producing each item, which includes such things as material and labor costs; and

b = fixed costs, which don't depend on the number of items made, such as factory rent, heating and electricity, office staff salaries and insurance, etc.

The **revenue function** R(*x*) = **p***x*; where R(*x*) is the gross amount of money received for selling *x* items and,

p = unit selling price

The **profit function** P(*x*) = R(*x*) – C(*x*); the amount of money received from selling *x* items minus the cost of producing those *x* items.

The **break-even point** is the number of units needed to be sold so that P(*x*) = 0 or R(*x*) = C(*x*).

Example: Textbook exercise #40, p. 52.

There are three values given in this problem:
Fixed costs of \$28,000, unit costs of \$48/each, and selling price of \$62/each.
So, if we let x = the number of TV stands made, then the cost function is $C(x) = 48x + 28000$ and the revenue function is $R(x) = 62x$.

To find the break-even point, equate the revenue function and the cost function:

$$R(x) = C(x)$$
$$62x = 48x + 28000$$
$$14x = 28000$$
$$x = 2000$$

So, 2000 TV stands must be sold to break even.

Self-Study Practice Problems

These are not to be handed in. They are for you to check your understanding of the material; to exercise your math brain. Make sure you attempt each problem without looking in the solutions manual. As I mentioned above, it is crucial for you to practice, to **do** math, and not just read about it. The answers to the *self-study* practice problems are in the back of the textbook and in the *Student Solution Manual for Rolf's Finite Mathematics*.

Section 1.1 (p. 6): #1, 9, 13–23 odd
Section 1.2 (p. 28): #7–43 every other odd, 45–83 odd, 87, 89, 93, 95, 99, 103, 109
Section 1.3 (p. 50) #1–29 odd, 37, 43, 51

Graded Assignment #1

Show all your work in a neat and organized manner, or you will receive no credit.

Good luck and have some fun! Treat yourself when you finish the lesson. Your labors deserve a reward.

(16 problems)
Section 1.1 (p. 6): #10, 18
Section 1.2 (p. 28): #14, 16, 18, 54, 56, 64, 66, 92, 96
Section 1.3 (p. 50): #14, 16, 18, 30, 48