

MATH 111 Mathematical Models for the Management Sciences

Spring 2019

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Office Hours: Monday 4:00 to 5:00, Tuesday/Thursday 8:30 to 10:00 and Wednesday 8:30 to 11:30.

All office hours are by appointment. To make an appointment, please use the link:

<https://rreakes24.youcanbook.me>

If these hours do not work with your schedule, please call or email me to set up an appointment.

Text: *Mathematical Applications for the Management, Life, and Social Sciences, (10th edition)*,
by Ronald Harshbarger and James J. Reynolds.

Required Materials: All students will need a graphing calculator, preferably a TI-83 or TI-84.
All students should use a notebook which contains graph paper.

Note: This course may not be taken for credit if credit has been received for Mathematics 112 or higher. If you have questions concerning this, please contact your advisor immediately. Also, you need to earn a C or better in this course or in INQ 240 to declare a major in Business Administration. Once again, please contact your advisor if you have questions regarding the necessary grades/courses.

Academic Integrity: You are expected to be familiar with the Academic Integrity Code outlined in the booklet,

[Academic Integrity at Roanoke College.](#)

https://www.roanoke.edu/inside/a-z_index/academic_affairs/academic_integrity

- 1) The use of any electronic device other than a calculator during a quiz or exam is strictly prohibited. Any use of such devices during a quiz or exam will be considered a breach of academic integrity. You will not be allowed to share a calculator.
- 2) Cell phones must be turned off prior to entering the classroom. You are not to either send or receive text messages during class!
- 3) You are expected to do all work graded for accuracy independently. This includes tests, quizzes, and graded practice problems. You are allowed to work alone, with a partner or a group on the daily independent practice problems which will only be checked for completion.

Course Objective: to provide the background in the quantitative techniques necessary to better understand more advance courses in Business and Economics.

Course Outcomes: Upon completing this course, the student should be able to:

- 1) solve linear equations (and applications) in one or more variables.
- 2) solve systems of linear equations (and applications) by utilizing graphing, elimination, and matrix row-reduction techniques.
- 3) solve quadratic functions and to utilize these functions in applications.
- 4) utilize both graphical methods and Excel Solver to find the optimal value of a linear function, subject to constraints.
- 5) Select a best fit line or curve function for a data set and find the regression equation.
- 6) find the derivative of a function, interpret the derivative, and use the derivative for business applications.

Policy on expected number of hours of work per week: Per the Academic Catalog, "For each one-unit course, students are expected to complete 12 hours of work inside and outside of class each week." Realistically, this may vary due to the strength of the background of each individual student with respect to course content.

Grading:

Accuracy of Graded Practice Problems:	10%
Completion of Independent Practice Problems:	10%
Tests:	80%

Grades will be assigned using the scale below:

A	93-100	C	73-76
A-	90-92	C-	70-72
B+	87-89	D+	67-69
B	83-86	D	63-66
B-	80-82	D-	60-62
C+	77-79	F	Below 60

Testing Policy: We will use Mastery-Based Testing rather than Points-Based Testing. Mastery-based testing is

very different from what you are used to - do not hesitate to ask me questions!
 You will only receive credit for answers that demonstrate you completely understand (have mastered) a topic. But you will get MANY chances to display mastery throughout the semester with NO PENALTY for earlier attempts.

- The course has been summarized by 16 topics.
- Your mastery of questions on these topics is assessed through the working of problems each week and during the final exam period.
- Each problem submitted is graded as either “Mastered” or “Not Mastered”. A grade of Mastery indicates that you have demonstrated full understanding of the concept being tested and further work on the topic is unnecessary.
- Once you have mastered a topic, you need not attempt it again.
- There is no penalty for multiple attempts taken to achieve mastery.
- Mastery does not mean perfect! It means you understand and can demonstrate all fundamentals of the topic and are proficient at the level desired for the course you do not need to study the topic further.
- Your overall test grade is determined by the number of topics you have mastered illustrated in the table below:

# Mastered	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Mastery Grade	100	95	90	85	80	75	70	65	60	55	50	45	40	35	30	25

- All students are required to attempt to master topics the first time in class on the date listed in the course schedule.
- Retrying to master the topics after the first attempt may be done any time after the first attempt either in class on mastery opportunity days or during office hours.
 - To retry a topic in class you will request which topics you want to attempt to master using a Google Form link sent to you via email or use the link in Inquire. This request must be submitted by NOON the day prior to the mastery opportunity class.
 - To retry a topic during office hours, you must book an appointment during office hours. If my posted office hours do not work with your schedule, you may email me to set up a time that works for both of us.

Late Work Policy: Independent practice problems will be collected the day they are due and checked for completion. This work will only be accepted on the day it is due. No late papers will be accepted without arrangements approved prior to absence OR without written documentation from a college official.

Graded practice problems will be checked for accuracy and may be submitted until solved correctly. They will not be accepted after the last day our class meets prior to the final exam.

Attendance: Attendance is critical to the understanding of the material in the course; it is both required and expected. Any absence that is not discussed with the instructor prior to the missed class is considered unexcused. I will assume that if you accumulate 3 unexcused absences you are not interested in completing the course and will drop you from the class with a grade of DF (dropped-failing) recorded, regardless of your current average in the course. You, your advisor, and the registrar will receive a warning email at your second unexcused absence. When absent, excused or unexcused, you are responsible for all material covered in class. Work missed due to either an unexcused or excused absence can only be made up when arrangements are made in advance of the absence.

MCSP Conversation Series: The Department of Mathematics, Computer Science and Physics offers a series of discussions that appeal to a broad range of interests related to these fields of study. These co-curricular sessions will engage the community to think about ongoing research, novel applications and other issues that face our discipline. Members of this class are invited to be involved with all of these meetings; however participation in at least one of these sessions is mandatory. After attending, students will submit a one page paper within a week reflecting on the discussion. This should not simply be a regurgitation of the content, but rather a personal contemplation of the experience. This does not have to be a formal paper. This reflection paper will be counted as a graded practice assignment. Please submit electronically by attaching your paper to an email send to: reakes@roanoke.edu.

Subject Tutoring: Subject Tutoring is a CRLA Nationally Certified Program located on the lower level of Fintel Library in room 005. Subject Tutoring offers individual appointments in 30-minute intervals for Lab Sciences, Modern Languages, Math and CPSC, Social Sciences, Business and Economics. Hours are Sunday - Thursday 4 p.m. - 9 p.m. For a list of tutorials or to make an appointment, go to www.roanoke.edu/tutoring.

Tentative Schedule and Assignments:

Day	Date	Topic	Section	Topic	Independent Practice
Mon	1/14			Introduction	
		1	7.5	Permutations, Combinations	pp470-471/ 1,3,15,17,27,31,41,43
Wed	1/16	2	2.5	Scatter Plots, Correlation & Linear Regression	pp171-172/ 9,10,25,26,29
		3	1.2	Functions	
Mon	1/21	3	1.2	Functions Cont...	pp73-74/ 1,3,4,5,13,15,17,19a,b pp163-164/ 39,49
		4	1.1	Linear equations in one variable	p62/ 1,3,7,9,11,13,17,19,25, 31
Wed	1/23	5	1.3	Writing Linear functions , Graphing lines	pp85-87/ 5,7,9,13,19,23,27,29,33,35,37
Mon	1/28	6	1.5	Solutions of systems of linear equations graphically	p104/ 1-8 all
		6		Solutions of systems of linear equations algebraically	p104/ 9,11,15,17,23,29,33
Wed	1/30	4-6	1.6	Applications of functions in Business and Economics	pp112-115/ 1,3,5,9,13,17,19,23,45,47
				Required Mastery Opportunity for Topics 1-6	
Mon	2/4	7	2.5	Scatter Plots, Correlation & Quadratic Regression	pp171-172/ 11,12,28,31
		9	2.2	Quadratic Functions: Graphing & Properties of Parabolas	pp143-145/ 3,5,31,33,9,11,27,28,35,37

Wed	2/6	8	2.1	Solving Quadratic Equations by Factoring and Quadratic Formula	p134/ 5-15 odd, 23,25,41, 45-51 odd
Mon	2/11	8-10	2.3	Business Applications of Quadratic Functions	pp151-153/ 3-11 odd,15,23,25
Wed	2/13	11	2.4	Special Functions and their Graphs: Linear, Constant, Absolute Value, Polynomial Functions	pp162-165/ 5,7,8,13,15,17,19,41,47
				Required Mastery Opportunity for Topics 7-11	
				Mastery Redo Opportunity for Topics 1-6	
Mon	2/18	11	2.4	Special Functions and their Graphs: Power, Rational & Piecewise Functions	pp162-165/ 3,9,21,33,37,39,43,46,49,53
Wed	2/20	11	2.5	Cubic, Quatic, Power and Exponential Regression	pp171-173/ 1-8 all, 17-23 odd
		11		Using Correlation to Find Best Fit Curve	27,30,32-35 all
Mon	2/25	12	3.1	Matrices	p194/ 11, 15-27 odd
		12	3.2	Multiplication of Matrices	pp206-207/ 1-15 odd
Wed	2/27			Required Mastery Opportunity for Topics 11 & 12	
				Mastery Redo Opportunity for Topics 1-10	
Mon	3/4			Spring Break	
Wed	3/6			Spring Break	
Mon	3/11	13	3.4	Using Matrix Matrix Equation to Solve Linear System	pp234-236/ 29,31,33,35,57a
Wed	3/13	13	3.3	Using Gauss Jordan Elimination (Rref on TI83/84)	pp219-221/ 5,17,19,23,25,29,37,39,60
Mon	3/18	14	4.1	Linear Inequalities	pp265-267/ 7,9,11,13,17,21
		14	4.2	Linear Programming: Graphical Methods	pp275-279/ 1,3,5,9,15, 25
Wed	3/20	14	4.2	Linear Programming Word Problems: Graphical Methods	
				Required Mastery Opportunity for Topic 13	
				Mastery Redo Opportunity for Topics 1-12	
Mon	3/25	14	4.3	The Simplex Method (Using Excel)	pp294-297/ 27,33,46,57 Use Shared Excel file from Inquire!
Wed	3/27	15	9.1 & 9.2	Limits and Continuous functions	pp553-554/ 1-13 odd, 17,21,23,25,31,41
Mon	4/1	15	9.3	The Derivative with Limits	577-8/ 2,12
		15	9.4	The Derivative with Formulas	pp588-589/ 3,7,9,15,21,25,27,47
Wed	4/3	15	9.5	The Product Rule and the Quotient Rule	pp596-597/ 3,7,9,11,13,17,21,39,41,43
				Required Mastery Opportunity for Topics 14 & 15	
				Mastery Redo Opportunity for Topics 1-13	
Mon	4/8	15	9.6	The Chain Rule and Power Rule	pp603-604/ 5,7,11,15,17,25,41,47

		15	9.7	Using Derivative formulas	pp610-611/ 13,15,17,23,37,43
Wed	4/10	16	9.8	Higher order Derivatives	pp615-616/ 3,11,17
		16	9.9	Applications of derivatives in Business and Economics	pp624-626/ 3,5,13,17,27
Mon	4/15	16	10.1	Relative Maxima and Minima	pp647-649/ 1,5,7,51,53
		16	10.2	Concavity and Points of Inflection	p660/ 23a,23b,35,39
Wed	4/17			Course Evaluations	
				Required Mastery Opportunity for Topic 16	
				Mastery Redo Opportunity for Topics 1-15	
Tue	4/30		Block 7A	Final Exam (Mastery Redo Opportunity Topics 1-16)	2:00 pm to 5:00pm

Topics:

All graphs will be done electronically on calculator and checked by instructor unless otherwise specified.

Topic Number	Title	Description
1	Number of Outcomes	1) Find the number of outcomes using the counting principle, factorials, permutations and combinations.
2	Linear Regression	1) Use technology to find and interpret the linear correlation coefficient. 2) Use technology to find a linear regression equation. 3) Make meaningful predictions using a linear regression equation.
3	Functions	1) Identify if a relation is a function. 2) Evaluate functions numerically and algebraically. Include evaluating piecewise functions!
4	Linear Equations	1) Find the profit function using the revenue and cost functions. 2) Find the break even point. Find marginal profit, revenue or costs.
5	Equations of a Line	1) Find the slope of a line using real world scenario. 2) Find the slope and y-intercept of an equation of a line in slope intercept form. 3) Find the x and y intercept of a line using its equation algebraically. 4) Write the equation of a line given two points using the point-slope equation form of a line.
6	Linear Systems	1) Find the quality and price that give market equilibrium graphically. 2) Find the quality and price that give market equilibrium algebraically using elimination.

7	Quadratic Regression	<ol style="list-style-type: none"> 1) Use technology to find and interpret the quadratic correlation coefficient. 2) Use technology to find a quadratic regression equation. 3) Make meaningful predictions using a quadratic regression equation.
8	Quadratic Equations	<ol style="list-style-type: none"> 1) Use the profit, revenue and/or cost functions to find the break even point. 2) Find the level of production (x) using a cost, revenue or profit function given the value of the cost, revenue or profit.
9	Axis of Symmetry and Vertex of a Parabola	<ol style="list-style-type: none"> 1) Find the max or min production (x) and profit, revenue or cost graphically. 2) Find the max or min production (x) and profit, revenue or cost algebraically..
10	Quadratic Systems	<ol style="list-style-type: none"> 1) Find the quality and price that give market equilibrium graphically. 2) Find the quality and price that give market equilibrium algebraically using substitution.
11	Curve Fitting	<ol style="list-style-type: none"> 1) Use technology to find and interpret the cubic, quartic, power and exponential correlation coefficient. 2) Determine the best fit curve using correlation coefficients. 3) Use technology to find a cubic, quartic, power or exponential regression equation. 4) Make meaningful predictions using regression equations.
12	Matrix Operations	<ol style="list-style-type: none"> 1) Add, subtract, transpose and multiply matrices by constants and each other.
13	3 by 3 Systems	<ol style="list-style-type: none"> 1) Solve a 3 by 3 system using a matrix equation and inverse matrices. 2) Solve a 3 by 3 system using a reduced row echelon form of a matrix with a calculator. 3) Identify the number of solutions for a 3 by 3 system using reduced row echelon form matrices. (One solution, no solutions, infinite solutions) 4) Translate a 3 by 3 system from words into symbols.
14	Linear Programming	<ol style="list-style-type: none"> 1) Solve a maximise or minimise linear program graphically using paper and pencil. 2) Solve a maximise or minimise linear program using Excel. 3) Translate a minimize or maximize linear program and solve using paper and pencil graphs and/or excel.
15	Derivatives with Formulas	<ol style="list-style-type: none"> 1) Find the marginal cost, revenue or profit using derivative formulas such as: <ol style="list-style-type: none"> a) Powers Rule b) Product Rule c) Quotient Rule d) Chain/Power Rule 2) Interpret the marginal cost, revenue or profit in the context of a "real world" scenario.
16	First and Second Derivative Rules	<ol style="list-style-type: none"> 1) Use the first derivative of a cost, revenue or profit function to find where the function increases or decreases.

		<ol style="list-style-type: none">2) Use the first derivative to find the minima and maxima of a cost, revenue or profit function.3) Use the second derivative to determine if a critical point is the minima and maxima of a production function.4) Use the second derivative to find the point of diminishing returns of a production function.
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