

## Math 115

### Calculus, Part II with probability and matrices. (4h. 1 c.u.)

Functions of several variables, partial derivatives, multiple integrals, differential equations; introduction to linear algebra and matrices with applications to linear programming and Markov processes. Elements of probability and statistics. Applications to social and biological sciences. Use of symbolic manipulation and graphics software in Calculus. Note: This course uses Maple.

Texts:

[C] Stewart, James, *Calculus*, 5<sup>th</sup> Ed.

[P][F] Probability and Matrices, Custom Edition Containing Material Taken From:  
Probability and Statistics, 3rd Edition, Morris H. DeGroot and Mark J. Schervish  
and  
Finite Mathematics, 7th Edition, Margaret Lial, Raymond N. Greenwell and  
Nathan T. Ritchey  
Maple/Calculus Lab Manual for Math 104/114/115

### Syllabus:

<u>Chapter</u>	<u>Section &amp; Topic</u>	<u>Core Problems</u>
<b>15 [C] Partial Derivatives</b>		
15.1	Functions of Several Variables	1, 2, 6, 11, 30, 32
15.2	Limits and Continuity	3, 7, 10, 11, 37, 39
15.3	Partial Derivatives	1, 4, 5, 16, 21, 51, 66, 83
15.4	Tangent Planes and Linear Approximations	2, 12, 20, 24, 31
15.5	The Chain Rule	4, 8, 16, 36
15.7	Maximum and Minimum Values	1, 3, 5, 11, 23, 37
<b>16 [C] Multiple Integrals</b>		
16.1	Double Integrals over Rectangles	3, 6, 8, 12, 17
16.2	Iterated Integrals	4, 5, 14
16.3	Double Integrals over General Regions	3, 10, 24, 39, 43
<b>1 [P] Introduction to Probability</b>		
1.5	<i>The Definition of Probability</i>	7, 8
1.6	<i>Finite Sample Spaces</i>	1-4
1.7	<i>Counting Methods</i>	1, 3, 4, 5, 7, 8
1.8	<i>Combinatorial Methods</i>	2, 3, 4, 7, 17, 18
1.9	<i>Multinomial Coefficients</i>	1, 3, 6, 8
1.10	<i>The Probability of a Union of Events</i>	1, 4, 5, 6, 9

<u>Chapter</u>	<u>Section &amp; Topic</u>	<u>Core Problems</u>
<b>2 [P]</b>	<b>Conditional Probability</b>	
2.1	<i>The Definition of Conditional Probability</i>	6, 9, 10
2.2	<i>Independent Events</i>	7, 8, 9, 10, 12, 16, 19
2.3	<i>Bayes' Theorem</i>	1, 2, 10, 11, 12
<b>3 [P]</b>	<b>Random Variables</b>	
3.1	<i>Random Variables and Discrete Distribution</i>	2, 3, 4, 8
3.2	<i>Continuous Distribution</i>	2-8
3.3	<i>The Distribution Function</i>	3-8
3.4	<i>Bivariate Distribution</i>	see <a href="#">below</a>
<b>4 [P]</b>	<b>Expectation</b>	
4.1	<i>The Expectation of a Random Variable</i>	1, 2, 4, 5, 9
4.2	<i>Properties of Expectations</i>	6, 7, 8, 10
4.3	<i>Variance</i>	1, 2, 3, 6, 7, 9
<b>5 [P]</b>	<b>Special Distributions</b>	
5.2	<i>The Bernoulli and Binomial Distribution</i>	3-7, 10
5.4	<i>The Poisson Distribution</i>	2, 3, 6
5.6	<i>The Normal Distribution</i>	3, 7, 9, 10
5.9	<i>The Gamma Distribution</i>	8, 9, 13, 14
<b>1 [F]</b>	<b>Least Squares Fit</b>	
1.3	<i>The Least Squares Line</i>	8, 10, 11, 17
<b>2 [F]</b>	<b>Linear Equations and Matrices</b>	
2.1	<i>Solution of Linear Systems by the Echelon Method</i>	23, 25, 29
2.2	<i>Solution of Linear Systems by the Gauss-Jordan Method</i>	17, 24, 27, 28, 33, 39, 40
2.3	<i>Addition and Subtraction of Matrices</i>	27, 29
2.4	<i>Multiplication of Matrices</i>	15, 24, 30, 31
2.5	<i>Matrix Inverses</i>	11, 13, 15, 17, 19, 22, 23
2.6	<i>Input-Output Models</i>	1, 5, 17
<b>2 [P]</b>	<b>Markov Chains</b>	
2.4	<i>Markov Chains</i>	2, 3, 11, 12, Also find limiting distributions
<b>3 [F]</b>	<b>Linear Programming I</b>	
3.1	<i>Graphing Linear Inequalities</i>	21, 23, 25, 29
3.2	<i>Solving Linear Programming Problems Graphically</i>	7, 9, 13
3.3	<i>Applications of Linear Programming</i>	17, 21

<u>Chapter</u>	<u>Section &amp; Topic</u>	<u>Core Problems</u>
<b>4 [F]</b>	<b>Linear Programming II</b>	
4.1	<i>Slack Variables and the Pivot</i>	5, 7, 21
4.2	<i>Maximization Problems</i>	7, 9
4.3	<i>Minimization Problems; Duality</i>	5, 7, 13

SAMPLE EXAM QUESTIONS also form a part of the core.

The core problems indicate the kind of basic problems you will need to be able to solve by hand. They also provide a guide to the basic level of difficulty to be expected on the final exam.

Note: All sections of Math 115 have a COMMON FINAL EXAM

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