BOB JONES UNIVERSITY
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College of Arts and Science
Division of Mathematical Sciences

Ma 301 ~ Calculus III

Spring Semester 2020-2021

Instructor:	Dr. Melissa Gardenghi
Office:	Alumni 38
Office Hours:	Daily by appointment (see below to schedule)
Email:	mgardeng@bju.edu
Textbook:	*Calculus*, 10th edition, by Larson and Edwards. ISBN# 978-1285057095
Calculator:	TI 89, TI-Nspire-CAS
Course Website:	http://math.bju.edu/ma301/

Course Description:

Euclidean vector space, vector operations, equation of lines and planes in n-dimensional space, equations (including conversions from one coordinate space to another) and graphing in 3-dimensions in rectangular, cylindrical and spherical coordinates. Theory and applications of functions of more than one variable, partial differentiation, multiple integration, vector analysis, theorems of Green and Stokes.

Prerequisiste a C- or better in Ma 202

Course Context: This course supports the following objectives of the mathematics and actuarial program:

MM1: Progress logically from premises to valid conclusions in a variety of mathematical contexts.
MM2: Apply mathematics to model real-life situations.
MM3: Select and use technology for understanding, as well as a labor-saving or problem-solving tool.
ASM1: Solve problems using standard mathematical techniques.
ASM2: Progress logically from premises to valid conclusions in a variety of mathematical and applied contexts including analysis, statistics (both theoretical and applied), probability and finance.
ASM3: Apply mathematics to actuarial problems (such as financial math and probability modeling) in exercising the biblical mandate to have dominion over the earth.
ASM4: Use technology as a tool for understanding as well as a labor-saving or problem-solving tool.

Course Goals:

CG1: Develop mathematical maturity in the following areas:
- Two and three-dimensional vector spaces and their uses
- Three-dimensional drawings and analysis
- Problem-solving, especially the development of transferable techniques
- Applications of multi-dimensional calculus
- Extensions of other topics in mathematics such as single variate calculus, series, and linear algebra

CG2: Develop the following skills:
- Development and use of standard multi-dimensional calculus models
- Drawing and analyzing three-dimensional surfaces using calculus

Course Objectives: The student will be able to

1. Develop and use two and three dimensional vector spaces CG1,CG2 (Assessed on Ch 11 test).
2. Develop and use three-dimensional drawings. CG1, CG2 (Assessed on in-class quiz and Ch 14 take-home test on Integration)**.**
3. Develop and use multi-dimensional vectors, planes, and lines. CG1, CG2 (Assessed on Ch 12 Vector Functions Tests and Ch 15 Test on Green and Stoke's Theorem)
4. Develop and use multi-dimensional differentiation. CG1, CG2 (Assessed on Ch 13 Oral Exam)

5. Develop and use multi-dimensional integration. CG1, CG2 (Assessed on Ch 14 take-home test on Integration)
6. Develop and use multi-dimensional vector analysis. CG1, CG 2 (Assessed on in-class quizzes, Ch 15)
7. Program and use calculators for labor-savings. CG2 (Assessed on Ch 12 Programming Test)

Course Content: The course will cover the following content:

A. Vectors and vector spaces
   1. Three-dimensional vector spaces and graphing
   2. Usual definitions of limits, continuity, differentiation and integration of vector functions (NCTM A.5.1, A.5.2, A.5.4)
   3. Velocity, acceleration, etc (NCTM A.5.2, A.5.5)
   4. Elementary differential geometry concepts of moving trihedron, curvature, arc length, projectile motion, etc (NCTM A.5.1, A.5.2, A.5.4, A.5.5)

B. Vector Analysis (NCTM A.5.1, A.5.5)
   1. Line and surface integrals
   2. Work, conservative force fields, etc
   3. Green's and Stoke's theorems and their applications

C. Multidimensional functions (NCTM A.5.1, A.5.4)
   1. Usual definitions of function, limit, continuity, partials, etc
   2. Extension of Mean Value to multi-dimensions.
   3. Approximations using differentials and incremental
   4. Chain rule and implicit differentiation
   5. Tangent planes and normal lines
   6. Maximums and minimums implicitly and using Lagrange multipliers (NCTM A.5.1, A.5.4, A.5.5)

D. Multiple Integration (NCTM A.5.1, A.5.4)
   1. Definitions and approximating techniques
   2. Double and triple integration in Cartesian, cylindrical and spherical coordinates and their applications including areas, surface areas, volumes, center of mass (NCTM A.5.1, A.5.4, A.5.5)
   3. Use of Jacobeans to change variables

Daily Expectations for Effective/Efficient Study:

You may study any way you wish; however, there are certain approaches that just work better, and you too can avoid massive test studying sessions.

1. Before considering any homework problems, take 5-10 minutes to add the ideas from today's lecture to your "map" of the content. Don't use paragraphs or even complete sentences. Do NOT just copy words from the lecture or book. Rewrite the ideas in your own (maybe awkward) words.
2. Take 10-20 minutes and consider all the theory discussed that day. Answer the following questions:
   a. How will you learn this theory without resorting to memorization (this will NOT work)?
   b. What general tools were used (that might be reused again)?
   c. How can I tell when I should use this "general" tool?
3. Consider your calculator as a computational tool (not a replacement for understanding). Make sure any new programs that are needed/useful are running properly.
   a. Find a problem that the program addresses and work it by hand.
   b. Then run your program, checking each computation as you go to ensure that it too is working properly.
4. As you consider the assigned homework, answer the following questions:
   a. Where does this problem fit into my "map"?
   b. What technique/process did I use to solve this problem?
   c. What about the problem made me use that technique? Aka how will I recognize this question on the test when it looks different?
   d. Can I explain in a step-by-step format how to solve all problems of that form (in my own words, no "math" language, just "English")? Add these instructions to a study sheet
5. Prior to the next class period, take 5 minutes to look over whatever we are covering next.

   a. Identify the big idea of that section (and maybe take note of any new vocab that we'll see)
   b. Try and anticipate how this idea will fit into the new material.
6. Each week dedicate 30-60 minutes to reviewing the following:
   a. The theory covered that week (and previously).
   b. The processes you developed to solve the problems discussed that week (and previously).
7. Take notes that are not destined for the landfill. What do you need to write down so that your future (forgetful) self will immediately understand what you are understanding as you write it down?

Help Policies: Come early and often, there is little help that can be provided right before a test. Prepare questions beforehand and try things before asking for help on them (then bring what you've tried).

Course Requirements and Evaluation: The course grade will consist of

1. Approximately three unit in-class tests (chs 11,12 and 15), an oral exam (ch 13), and a take-home test (ch 14) as announced in class. Each test will be worth approximately 150 points, but may be given over several days.**

   Tentative Test Dates: Dates may shift depending on when material is finished in class. To better anticipate test dates, note the number of sections remaining in the chapter. See Canvas for current schedule.

   Ch 11 January 27
   Ch 12 February 10/16
   Ch 13 Oral Exam as scheduled (around March 24)
   Ch 14 April 13
   Ch 15 April 23/28
2. Weekly homework rubrics – 7 points each, for 15 weeks. Recommended problems are posted on the course webpage. There will be a weekly progress/homework report submitted (in Canvas – due by end of day on Saturday of each week). Homework problems themselves will NOT be collected.
3. A cumulative final exam, worth 250 points.

** Point assignments are subject to change.

Grading Scale: Standard 10 point scale

Office Hour Appointments:

Office hour appointments can be made using the Calendly site.

Instructions for using the site: https://math.bju.edu/media/bju-math-division/bju-math-department/melissa-gardenghi/Office-Hours-Procedure.pdf.

A direct link to Calendly for making appointments with Dr. Gardenghi: https://calendly.com/mgardeng/20min

General Policies:

1. Compliance with student handbook policies is expected during class. The classroom is to be a professional environment. That means your attention is expected to be on course related material, and you are expected to positively contribute to the class.
2. Homework will be assessed by online quizzes due each Saturday at 11:59pm. Additional assignments may be given in class. Late assignments and homework quizzes will be assessed a 25% per calendar day penalty.
3. University attendance policy is in effect (see https://home.bju.edu/bju-policies/ for details).

   Scheduled tests/quizzes should be taken before your *planned absence*; please contact your professor to make arrangements for doing so. You are personally responsible to get notes from your classmates and discuss the missed material with them. You should not expect your professor to privately re-teach you the material you missed. If an unannounced quiz/assessment is taken during the class that you miss, you will NOT be allowed to make it up, and you WILL receive a zero on the assignment. Work may always be completed early (see your professor if you wish to take a test early).

Missing a test because you feel you are not prepared to take it is **not** acceptable. Work missed for this reason will not made up and you will receive a zero on the assignment.

For *absences due to incapacitating illness or emergency*, you should contact the instructor as soon as you realize you will not be in class to make arrangements for making up any missed work. Tests will be made up without penalty for the first occurrence. Each subsequent time a test is missed because of incapacitating illness or emergency, an additional 10 percent grade penalty for that test will be incurred.

4. University academic integrity policy is in effect (see https://home.bju.edu/bju-policies/ for details).

   Cheating is defined as any use of unauthorized helps, and plagiarism is defined as taking someone else's words and/or ideas and claiming them as your own.

   Doing your own work brings glory to God. The claiming of someone else's work as your own is cheating and is a sin. All work done for this class needs to be your own. If information is taken from other sources (which is at times appropriate), it always needs to be referenced and credit given where it is due. Use standard referencing techniques as taught in En 102. Solutions found on the internet are not to be copied.

   Tests (in class or takehome): In today's age of technology, cheating includes getting unapproved help from a source on the internet or another person and/or using any resource to provide you with additional information during a test. The presence of any unauthorized material on your desk or in your calculator while taking a test, will be construed as cheating and will be dealt with as such. Cheating on a test will result in a zero on the test plus any penalties imposed by the Academic Integrity Committee.

   If you have a question about any source you are considering using, please gain your professor's approval before using it. You are always permitted to ask your professor for help. Any help they choose to provide is acceptable.