

# Math 221 – Calculus & Analytic Geometry III

## Summer 2012 Course Syllabus

James Jones, Professor of Mathematics  
Mathematics & Sciences Division – Richland Community College

### Meeting Information

Section 01 meets from 8:00 to 9:50 am on Monday, Tuesday, Wednesday, and Thursday in room S137.

### Instructor Information

James Jones, Professor of Mathematics.

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### Office Hours

Office hours are not required during the summer term. Please see the instructor before or after class or contact him by email if you have questions.

### Text

*Multivariable Calculus, 9<sup>th</sup> edition.* Ron Larson, Bruce Edwards. Copyright 2010, Brooks/Cole Cengage Learning. ISBN 978-0-547-20997-5 (Required)

### Student Audience

Transfer students. Students pursuing degrees in engineering, mathematics, life sciences.

### Prerequisite

Successful completion (C or better grade) of Math 122, Calculus and Analytic Geometry II.

### Course Description

#### MATH 221 - Calculus and Analytic Geometry III

Hours: 4 lecture - 0 lab - 4 credit

Mathematics 221, Calculus and Analytic Geometry III, begins with the rectangular coordinate system in three-dimensional space, vectors, and operations with vectors. Lines, planes, quadric surfaces, spherical and cylindrical coordinates, vector-valued functions, curvature, Kepler's Laws of Planetary Motion, partial derivatives, relative extrema of functions of two or more variables, centroid, Lagrange Multipliers, and multiple integrals in different coordinate systems are introduced. At the end, students will learn integrals of functions over a curve or a surface, Green's theorem, the divergence theorem, and Stoke's theorem.

Applicable toward graduation where program structure permits.

- Certificate or degree: All certificates and all degrees.
- Group requirement: Mathematics
- Area of Concentration: Not applicable.

### Illinois Articulation Initiative (IAI)

The Illinois Articulation Initiative is a statewide transfer agreement. Their website is at <http://www.itransfer.org>.

Math 221, Calculus & Analytic Geometry III, satisfies the Illinois Articulation Initiative Definition of a General Education Mathematics Course. It corresponds to M1900-3, College-level Calculus III. It also corresponds to the Baccalaureate Major's Recommendation course MTH 903: Calculus III.

When three courses are required to convey the necessary skills in calculus to mathematics majors, it is highly

advised that students complete the entire sequence at a single institution. Course content may vary widely among institutions depending on the credits assigned to each course, and completing the sequence at a single institution is the best way to assure that neither credit nor content is lost in transfer.

## General Course Objectives

While learning calculus is certainly one of the goals of this course, it is not the only objective. Upon completion of this course, the student should be able to ...

- demonstrate comprehension and understanding in the topics of the course through symbolic, numeric, graphic, and verbal methods
- demonstrate the use of proper mathematical notation
- use technology when appropriate and know the limitations of technology
- work with others towards the completion of a common goal
- use deductive reasoning and critical thinking to solve problems

## Specific Course Objectives

In all of the following objectives, the student should be able to think, show, and tell what is happening. Concentration will not be on the memorization of formulas but on the conceptual understanding of the calculus. Technology may be used to obtain the results, but the emphasis is on the fundamentals of calculus, not the technology.

Upon successful completion of this course, the student should be able to ...

- convert between rectangular, spherical, and cylindrical coordinate systems
- sketch three-dimensional surfaces
- find dot products, cross products, and projections using vectors
- form and work with parametric equations of lines
- distinguish the forms of the quadric surfaces
- differentiate and integrate vector valued functions
- find the arc length of a vector valued function
- find the unit tangent, normal, and binormal vectors
- find the curvature
- sketch the graph of multi-variable functions
- determine the limits of a multi-variable function
- find partial derivatives
- use the chain rule for derivatives with multi-variable functions
- determine directional derivatives and apply the gradient
- find the maximum and minimum of a multi-variable function, identify saddle values
- use the method of Lagrange multipliers to determine the extrema of a multi-variable function
- set up the regions and integrate double integrals in rectangular and polar coordinates
- set up and evaluate triple integrals
- use the Jacobian to change variables to ease integration
- find the divergence and curl
- evaluate line integrals
- determine whether a vector field is conservative and use Green's theorem
- find surface integrals
- apply Stoke's theorem

In addition to the objectives specific to this course, the student will also be expected to demonstrate mathematical reasoning and ability to solve problems using technology when appropriate.

A detailed topical outline of the content covered in this course is at the end of this syllabus.

## Type of Instruction

Most of the instruction through this course will occur through lecture. In addition, discussion, problem solving, activities, individual and group work, student questions, and student participation may be used.. Students are expected to have read the material before class and are strongly encouraged to come to class with a list of questions and to ask these questions.

## Method of Evaluation

Evaluation could include any of the following: problem solving exams, objective exams, essays, research papers, oral presentations, group projects, individual projects, classroom activities, quizzes, and homework.

## Grading Policy

Letter grades will be assigned to final adjusted scores as follows:

A: 90-100%      B: 80 - 89%      C: 70-79%      D: 60-69%      F: below 60%

Missed quizzes may not be made up.

Consideration may be given to such qualities as attendance, class participation, attentiveness, attitude in class, and cooperation to produce the maximum learning situation for everyone.

The instructor will give you a grade sheet so that you can record your scores and keep track of your progress in the course. If you are concerned about your grades, see the instructor.

Assignments are due at the beginning of the class period on the date they are due. The instructor may allow you to turn them in later that day without counting them late, but do not count on his graciousness. Late assignments lose 20% of their value per class period. The instructor reserves the right to apply this rule to missed exams as well as regular assignments. No late work will be accepted after the final.

## Attendance Policy

If you miss the first day of class or any two consecutive days after that without communicating with the instructor, you may be dropped.

Regular attendance is essential for satisfactory completion of this course. Mathematics is a cumulative subject and each day builds on the previous day's material. If you have excessive absences, you cannot develop to your fullest potential in the course.

Students who, because of excessive absences, cannot complete the course successfully, are required to be administratively dropped from the class at midterm. If a student stops attending after midterm, it is the student's responsibility to withdraw to avoid an "F". Do not stop attending and assume that you will be withdrawn from the class by the instructor.

Although dropping students for non-attendance at midterm is required, students whose attendance is occasional or sporadic may be dropped from the class at any point during the semester at the instructor's discretion. The safest way to make sure you're not dropped for non-attendance is to continue to attend classes.

The student is responsible for all assignments, changes in assignments, or other verbal information given in the class, whether in attendance or not.

If a student must miss class, a call to the instructor (RCC's phone system has an answering system) should be made or an email message sent. When a test is going to be missed, the student should contact the instructor ahead of time if at all possible. Under certain circumstances, arrangements can be made to take the test before the scheduled time. If circumstances arise where arrangements cannot be made ahead of

time, the instructor should be notified and a brief explanation of why given by either voice or email. This notification must occur before the next class period begins.

## Homework

Attempting and completing homework is vital to your success in this course. Homework is the practice that strengthens your skills and prepares you to learn the material. The worked out solutions to the odd numbered exercises are available online at [www.calcchat.com](http://www.calcchat.com). This is like having the student solutions manual for free. When you get stumped with a problem, you can go online and see how to work out the problem.

Having the solutions available fosters the temptation to use them to work the problems. This approach does not benefit the student. Instead, attempt the problem on your own first. If you get stuck with a minor algebra or trigonometry problem, then look at the online solution. If you find that your problems are more conceptual or that you keep getting stuck you need to seek additional help: read the book, look for similar examples, ask another student, go to the Academic Success Center, or ask the instructor.

As calculus students, you are some of the best and brightest mathematics students we have and you have some algebraic and trigonometric skills that most students are lacking. You should voluntarily do as much homework as you need to master the material. In this class, you will be given a list of suggested problems. If you find that you are understanding the concepts, this may be enough for you, but if you find that you still don't understand the material after working those problems, it may be necessary for you to work additional problems.

## Technology

The use of technology in this course is consistent with the Technology Statement in the [\*Illinois Mathematics & Computer Science Articulation Guide\*](#) (IMACC, 2008, p. 4). Technology is used to enhance the learning of Calculus, but it is not the focus of the instruction. There will be instances when we will use the calculator or computer to aid in our understanding or remove some of the tediousness of the calculations (especially in the area of numerical approximations). There may be some projects, homework, or portions of a test that require you to use technology to complete.

Here are some of the technology tools that we may use.

### Calculator

This class is a mathematics class and a graphing calculator is required. A scientific calculator is not sufficient. The calculator should be capable of graphing functions, finding roots, maximums, and minimums from a graph, displaying tables of values, and finding the definite integral numerically. A Texas Instruments TI-84 or TI 83 is the recommended calculator. That said, a TI-92, TI-89, or TI Nspire CAS calculator is recommended for this course if you plan on taking additional calculus or engineering courses.

### Maxima

Maxima is an open-source computer algebra system. Unlike Derive, Maxima may be downloaded from the Internet and used for free. The main page for Maxima is <http://maxima.sourceforge.net>

### WinPlot

WinPlot is a free graphing software package for Windows written by Rick Parris at Phillips Exeter Academy in NH. The software is useful for creating graphs and it is easy to copy/paste the graphs into other applications. You may download the software by right-clicking your mouse on the word "WinPlot" at the top of the page <http://math.exeter.edu/rparris/winplot.html> and choosing save.

### DPGraph

DPGraph is a 3D graphing package that will be useful for visualizing the graphs of multi-variable functions. The software is not free, but Richland has a site license that allows students to download and use it without additional charge. You may download it from <http://www.dpgraph.com/graphing-users.html> (be sure to find the entry for Richland Community College)

## **Additional Supplies**

The student should have a pencil, red pen, ruler, graph paper, stapler, and paper punch. The student is expected to bring calculators and supplies as needed to class. The calculator should be brought daily. There will be a paper punch and stapler in the classroom.

## **Additional Help**

The student is encouraged to seek additional help when the material is not comprehended. Mathematics is a cumulative subject; therefore, getting behind is a very difficult situation for the student. There are several places where you can seek additional help in your classes.

You may use a recording device to record the lectures. Feel free to use a camera or cell phone to take pictures of the boards if you have trouble getting all of the information into your notes.

### ***CalcChat.com***

The textbook has an affiliated website called [www.calcchat.com](http://www.calcchat.com) that provides free solutions to all of the odd numbered problems in the textbook.

### ***Instructor***

I try to make myself as available to the students as I can. My office hours are listed at the beginning of this syllabus, but those are just the times I'm scheduled to be in my office. Grab me and ask me questions if you see me in the hallway. Ask questions before or after class. If I'm in my office and it's not my scheduled office hours, go ahead and stop in.

The instructor should be considered the authoritative source for material related to this class. If a tutor or other student says something that disagrees with the instructor, believe the instructor.

### ***Study Groups***

Probably the best thing you can do for outside help is to form a study group with other students in your class. Work with those students and hold them accountable. You will understand things much better if you explain it to someone else and study groups will also keep you focused, involved, and current in the course.

### ***Academic Success Center***

The Academic Success Center consolidates several student services into one area. It is located in the south wing of the first floor next to the Kitty Lindsay Learning Resources Center (library).

### **Testing**

The testing center is located in room S116. You must provide a photo identification and know the name of your instructor to use this service.

### **Tutoring**

The tutoring center provides tutoring on a walk-in or appointment basis in room S118. They also have computers with the mathematical software loaded on it.

Quality tutors for the upper level mathematics are difficult to find. Please consider forming a study group among your classmates.

### **Accommodations**

There are accommodations available for students who need extended time on tests, note takers, readers, adaptive computer equipment, braille, enlarged print, accessible seating, sign language interpreters, books on tape, taped classroom lectures, writers, or tutoring. If you need one of these services, then you should see Learning Accommodation Services in room C148. If you request an accommodation, you will be required to provide documentation that you need that accommodation.

## **Academic Dishonesty**

Each student is expected to be honest in his/her class work or in the submission of information to the College. Richland regards dishonesty in classroom and laboratories, on assignments and examinations, and the submission of false and misleading information to the College as a serious offense.

A student who cheats, plagiarizes, or furnishes false, misleading information to the College is subject to disciplinary action up to and including failure of a class or suspension/expulsion from the College.

## **Non-Discrimination Policy**

Richland Community College policy prohibits discrimination on the basis of race, color, religion, sex, marital or parental status, national origin or ancestry, age, mental or physical disability (except where it is a bonafide occupational qualification), sexual orientation, military status, status as a disabled or Vietnam-era veteran.

## **Electronic Communication Devices**

The Mathematics and Sciences Division prohibits the use of cell phones, pagers, and other non-learning electronic communication equipment within the classroom. All equipment must be turned off to avoid disturbances to the learning environment. If a student uses these devices during an examination, quiz, or any graded activity, the instructor reserves the right to issue no credit for these assignments. The instructor needs to approve any exceptions to this policy.

## **Topical Outline**

### ***Vectors and geometry of space – 13 hours***

- Vectors in 2D and 3D space
- Dot products, cross products, projections
- Lines and planes
- Surfaces
- Cylindrical and spherical coordinates

### ***Vector valued functions – 11 hours***

- Vector valued functions
- Differentiation and integration
- Velocity and acceleration
- Arc length and change of parameters
- Unit tangent, normal, and binormal vectors
- Curvature, motion along a curve

### ***Multivariable functions – 15 hours***

- Multivariable graphs, contour plots
- Limits and continuity
- Partial derivatives, differentials
- The chain rule
- Directional derivatives and gradients
- Tangent planes and normal vectors
- Maxima and minima, Lagrange multipliers

### ***Multiple Integration – 13 hours***

- Iterated integrals and area
- Double integrals in rectangular and polar coordinates
- Center of mass and moments of inertia
- Parametric surfaces and surface area
- Triple integrals in rectangular, spherical, and cylindrical coordinates
- Jacobians and change of variables

### ***Topics from Vector Calculus – 13 hours***

- Vector fields, divergence, and curl
- Line integrals
- Independence of path, conservative vector fields, and Green's theorem
- Parametric surfaces
- Surface integrals, flux, divergence theorem
- Stoke's theorem