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Prerequisites: A grade of C- or better in MAT 1236 (Calculus III). Mastery of the material from Calculus I, II, & III is essential for success in this course. Some basic familiarity with Maple will also be expected.

Course Materials:

Textbook: Calculus, 7th edition, by James Stewart. See the attached schedule for details of the material to be covered. You must also have an access code for WebAssign, which is bundled with new copies of the textbook sold at the campus bookstore. A variety of other valuable supplements for the textbook are also available for purchase, including a student solutions manual and a study guide, but they are not required.

Computer Software: The class will meet in a computer classroom equipped with one PC for every two students. We will make substantial use of Maple, a computer algebraic system. Maple is available for use on the computers in the classroom and in labs throughout the campus. You are also encouraged to consider purchasing a copy of the software for use on your own computer since many homework assignments may require the use of Maple. It will be available for purchase at a substantial discount for students using a discount code provided by your instructor.

Most of your homework for the course will also be submitted online through WebAssign, so you will need to have access to a computer with an internet connection when working on homework. Please plan accordingly.

University and Departmental Mission: Seattle Pacific University seeks to be a premier Christian university fully committed to engaging the culture and changing the world by graduating people of competence and character, becoming people of wisdom, and modeling grace-filled community. The mathematics department at Seattle Pacific University seeks to provide excellent instruction to enable our students to be competent in the mathematics required for their chosen fields, and to share our expertise with the community through service and leadership. Hence, common goals for students in mathematics courses include 1) becoming competent in the topics covered in the course, 2) demonstrating skills and attitudes which contribute to professional, ethical behavior, 3) the ability to communicate mathematically, in both written and verbal form, and 4) learning to appreciate the beauty and utility of mathematics.

Course Objectives: This course studies multivariable and vector calculus. The course covers vector-valued functions, vector fields, line integrals, and surface integrals. The primary aims of the course are to help students develop new problem solving and critical reasoning skills and to prepare them for further study in mathematics, the physical sciences, or engineering. By the end of the course, students should be able to

- recognize and apply the algebra and geometry of vector functions in two and three dimensions;
- compute derivatives and integrals of vector functions;
- determine equations of tangent planes and linearizations;
- compute directional derivatives and gradients of scalar functions and explain their meaning;
- solve multiple variable maximum and minimum value problems;
- evaluate line integrals through scalar or vector fields and explain some physical interpretations of these integrals;
- evaluate surface integrals and explain some physical interpretations of these integrals;
- compute the curl and divergence of a vector field and interpret their physical meaning;
- apply Green’s, Stokes’, and the Divergence theorems;

In addition to the specific content oriented objectives above, students should be able to

- use Maple effectively to explore and solve problems;
- analyze and solve complex problems;
- write short proofs using the ideas and techniques listed above; and
- provide clear written explanations of the ideas behind key concepts from the course.

Students should also gain an increased appreciation of mathematics as part of the language of science and as a study in itself. Finally, I hope that you will have fun accomplishing all of these objectives, even if the material is difficult and the course takes a lot of time and effort.
Grading and Course Expectations

Exams: There will be two in-class midterms and a cumulative final exam. Use of Maple may be required as a part of the exams. Tentative dates for the exams are listed in the schedule at the end of this syllabus, but the dates for the midterms are subject to change; actual dates for the exams will be announced in class about one week in advance. Most questions on the exams will be similar to exercises from the homework. You also may be expected to state some definitions, write some short proofs, and to provide written explanations of some key ideas of the course.

Homework: The only way to truly learn calculus is to work as many exercises as possible. There will be homework assignments given virtually every class period. There will be two types of homework assignments:

Online WebAssign Homework: Most of the basic computational exercises for the course will be submitted online using WebAssign. You can access WebAssign through SPU’s Blackboard system. An online assignment will be due prior to the start of almost every class period during the quarter.

Additional information about WebAssign:
- You must have an internet connection to view and submit WebAssign homework assignments. However, if you wish to work offline, you can access the assignment online and print out the questions. You can then complete your work offline and return to a computer later to submit your answers.
- The questions on the assignments are generally taken from the textbook, but some aspects of each exercise may be randomized so that each student has a slightly different version of the question. The skills required to complete the exercise will be identical, but some numerical values involved will likely be different.
- As you work on the assignments, WebAssign will give you immediate feedback as to whether or not your answers or correct. For incorrect answers, you will be allowed to rework the exercise and submit a new answer. For most exercises, you will be allowed up to FIVE submissions for each part of each question. Only your last submission will count toward your actual grade for the assignment. As a result, it will be possible for most students to get perfect scores on most online assignments.
- To discourage random guessing, some questions (particularly multiple choice) will either not permit multiple submissions at all (so only your first submission will count) or will have a reduced number of submissions. Any such restrictions will be noted in the instructions for each assignment.
- WebAssign uses Maple to check answers, so it can recognize correct answers even if they are not written in the same form as the answer key. When submitting numerical answers, use exact answers whenever possible (for example, use $\sqrt{2}$ rather than a decimal approximation like 1.41, or use 1/3 rather than 0.333). When it is necessary to submit decimal approximations, you should generally make sure that you submit at least 4 correct digits to make sure that you are within the error tolerance.
- Online assignments will generally be due 30 minutes before the start of class on the due date. Work submitted after that time will be worth NO credit. Note that the computer system will not be forgiving, even if it is one second late, so do not wait until the last minute to complete your assignment.

Written Homework Assignments: In addition to the online assignments, a written assignment will be collected approximately once a week. These written assignments will consist of exercises which involve proofs, derivations, printouts from Maple, graphs, or written explanations which cannot easily be graded by an online system. Written assignments must be turned in at the beginning of class on the day it is due (by 2:00, not 2:01); homework will not be accepted once class has started. Late written assignments will not be accepted for any reason (but in the case of an excused absence the grade for an assignment may be dropped).

Your work must be neat and easily readable or you will receive NO credit. You must show all of your work – a correct answer with no justification will also be worth NO credit (particularly for odd numbered exercises with answers in the back of the book…). Not all written homework exercises will be graded. On a typical assignment, roughly five representative exercises will be selected for grading and your grade for the assignment will be based on those five exercises only.

All assignments will be posted online; however, you are also responsible for all announcements made in class, whether or not they are posted on the web. You are strongly encouraged to come to my office to ask me questions about the homework. You are also encouraged to work with other students on the homework. However, on written assignments, you must individually write up and turn in your own solutions. You are required to list on your paper all other individuals that you worked with or that assisted you in any way with the assignment – failure to do so will be considered cheating (since you are turning in someone else’s work as your own).

In-class Activities: You may at times be asked to work in groups of 2 or 3 in class to complete practice exercises. These exercises may occasionally be collected. The collected exercises will count as a part of your homework grade.

Attendance: Attendance will be taken regularly and will count toward your homework grade. If you expect to succeed in this course, it is essential that you come to class every day. Unless you have an acceptable excuse and make
special arrangements with me before class begins, missing an exam or failing to turn in an assignment on time will result in a grade of zero. Late homework will not be accepted for any reason, but if you have an acceptable excuse and contact me before class, I will drop the homework score.

**NOTE:** Things such as oversleeping or lack of preparation are NOT acceptable excuses. Acceptable excuses include illness, a death in your immediate family, and official SPU athletic trips. If requested, you are responsible for providing me with documentation of your excuse.

**Classroom Etiquette:** During class, you are expected to actively participate in all activities and to work only on calculus – activities such as texting, emailing, tweeting, facebooking, surfing the internet, playing games, doing work for other classes, or chatting about your weekend social activities are not acceptable behaviors during class. It is expected that cell phones will be turned off and put away for the duration of the class. Computers and tablets will be used only for tasks related to the course. For the benefit of everyone’s attention, the computers are to remain off unless the professor instructs you to sign on, and then you should only use the intended resources.

**Course Grades:** Course grades will be determined by a weighted average of your scores on the homework and the three exams. Your homework average will count for 30% of the overall course grade, and your two lowest homework scores will be dropped at the end of the quarter. The two midterms will each be worth 20% of the course grade, and the final exam will be worth 30%. Course grades will be based on the following scale:

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

A grade of I (incomplete) is only given for non-academic reasons such as a severe illness that prevents you from completing the course. You must have a passing grade on the material that you have completed in order to receive an incomplete.

**Academic Dishonesty:** The current edition of the SPU Undergraduate Catalog describes the University’s commitment to academic integrity, which is breached by academic dishonesty of various kinds. Examples of academic dishonesty include copying another’s work on an exam, bringing concealed answers to an exam, turning in another person’s work as your own, committing plagiarism, assisting another student in cheating, or lying to the instructor. The minimum penalty for academic dishonesty in any form will be a zero for the assignment or exam in question; in severe cases, academic dishonesty will result in a failing grade for the course. In addition, all students have an obligation to make efforts to prevent other students from cheating and to report incidents of cheating or plagiarism.

**Office Hours:** My regular office hours will be posted on the course webpage. You are strongly encouraged to drop by my office to ask questions, discuss problems, and just to get to know me better. If you are unable to meet with me during my scheduled office hours, I am available at other times by appointment. I also maintain an “open door” policy at my office – any time that my door is open you are welcome to drop in to talk to me, even if it is not during my scheduled office hours.

**Additional Notes:**

**Calculators:** Calculators will be permitted on all exams. Any basic scientific calculator or a graphing calculator such as a TI-83 or TI-84 will be allowed. However, calculators which are capable of symbolic manipulation (such as a TI-89 or TI-92) are NOT permitted. If you have any doubt as to whether or not your calculator is acceptable, please ask me as soon as possible.

**E-mail:** All SPU students have an SPU e-mail address. I will make use of these SPU e-mail addresses to send information to all members of the class, so you should check your e-mail regularly. If you do not use your SPU e-mail account, there is a utility available in Banner to set up your SPU e-mail account to forward messages to some other e-mail address. I strongly recommend doing this so that you do not miss any important messages. Please note that while it can be a great tool for quick communication, e-mail is rarely a good substitute for face-to-face conversations and is very poorly suited for answering mathematical questions. When you come to my office to ask me questions, I engage you in a discussion about the problem, ask questions about what ideas you have for approaching the problem, explore various possible approaches (and what goes wrong with some of them), etc. In the process, I can usually find out precisely where your difficulties lie and help you to learn how to get past them. Such a conversation is impossible by e-mail. Furthermore, typing and e-mailing mathematical symbols is very time consuming, and the resulting equations in the e-mail often come out garbled (or even completely missing).

**Students with Disabilities:** In accordance with Section 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1990, students with specific disabilities that qualify for academic accommodations need to contact Disabled Student Services in the Center for Learning. Disabled Student Services in turn will send a
Disability Verification Letter to me indicating what accommodations have been approved. Once you have done this, you should also make an appointment to meet with me as early as possible in the quarter to discuss the details of how we will implement the accommodations in this course.

**Inclement Weather:** SPU maintains an Emergency Closure Hotline (206-281-2800). In the event of inclement weather or an emergency that might close the university, please call the Hotline for the most up-to-date closure information or check the SPU website. Both will be updated before 6:00 a.m.

**Emergency Procedure:** A one-page summary of SPU’s emergency procedures is attached at the end of this syllabus. Please note the emergency procedures posted in the classroom and note all emergency exits. In case of an emergency requiring evacuation of the building, the class will leave via one of the rear exits of OMH and then gather in the Alumni Center parking lot on the Nickerson Street side of Otto Miller Hall. Please try to stay together so that we can check that everyone has made it safely out of the building.

**Tentative Class Schedule**
The table below provides a tentative listing of topics that we will cover. The exact dates on which we cover material will almost certainly vary somewhat from this list. Also, topics may be added to or removed from this list at any time.

<table>
<thead>
<tr>
<th>Date</th>
<th>Section</th>
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<tbody>
<tr>
<td>3/30</td>
<td>13.1 Vector Functions and Space Curves</td>
</tr>
<tr>
<td>4/1</td>
<td>Chapter 12 Review (Vectors and Vector Operations)</td>
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<tr>
<td>4/4</td>
<td>13.2 Derivatives and Integrals of Vector Functions</td>
</tr>
<tr>
<td>4/6</td>
<td>13.3 Arc Length and Curvature</td>
</tr>
<tr>
<td>4/8</td>
<td>13.4 Motion in Space: Velocity and Acceleration</td>
</tr>
<tr>
<td>4/11</td>
<td>Review 12.5, 14.1-14.3, and 14.5 (Functions of Several Variables)</td>
</tr>
<tr>
<td>4/13</td>
<td>14.4 Tangent Planes</td>
</tr>
<tr>
<td>4/15</td>
<td>14.6 Directional Derivatives and the Gradient</td>
</tr>
<tr>
<td>4/18</td>
<td>14.7 Maximum and Minimum Values</td>
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<tr>
<td>4/20</td>
<td>14.8 Lagrange Multipliers</td>
</tr>
<tr>
<td>4/22</td>
<td>Review/Catch-up</td>
</tr>
<tr>
<td>4/25</td>
<td><strong>Exam 1</strong></td>
</tr>
<tr>
<td>4/27</td>
<td>16.1 Vector Fields</td>
</tr>
<tr>
<td>4/29</td>
<td>16.2 Line Integrals</td>
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<tr>
<td>5/2</td>
<td>More on line integrals</td>
</tr>
<tr>
<td>5/4</td>
<td>16.3 The Fundamental Theorem for Line Integrals</td>
</tr>
<tr>
<td>5/6</td>
<td>Review 15.1 through 15.4: Double Integrals</td>
</tr>
<tr>
<td>5/9</td>
<td>16.4 Green’s Theorem</td>
</tr>
<tr>
<td>5/11</td>
<td>16.5 Curl and Divergence</td>
</tr>
<tr>
<td>5/13</td>
<td>16.6 Parametric Surfaces and Their Areas</td>
</tr>
<tr>
<td>5/16</td>
<td>Review/Catch-up</td>
</tr>
<tr>
<td>5/18</td>
<td><strong>Exam 2</strong></td>
</tr>
<tr>
<td>5/20</td>
<td>16.7 Surface Integrals</td>
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<tr>
<td>5/23</td>
<td>More on Surface Integrals</td>
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<tr>
<td>5/25</td>
<td>16.8 Stokes’ Theorem</td>
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<tr>
<td>5/27</td>
<td>16.9 The Divergence Theorem</td>
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<tr>
<td>5/30</td>
<td><strong>No Class: Memorial Day</strong></td>
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<tr>
<td>6/1</td>
<td>Catch-up day</td>
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<tr>
<td>6/3</td>
<td>Review/Wrap-up</td>
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<tr>
<td>6/7</td>
<td>Final Exam 1:00-3:00</td>
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“The chief aim of all investigations of the external world should be to discover the rational order and harmony which has been imposed on it by God and which He revealed to us in the language of mathematics.”

Johannes Kepler (1571-1630)

**Modifications to the course requirements (such as the addition of quizzes) can be made at any time. It is your responsibility to know all course requirements as described here or announced in class.**
Emergency Preparedness Information

Report an Emergency or Suspicious Activity
Call the Office of Safety and Security to report an emergency or suspicious activity by dialing 206-281-2911 or by pressing the call button on a campus emergency phone. SPU Security Officers are trained first responders and will be dispatched to your location. If needed, the SPU Dispatcher will contact local fire/police with the exact address of the location of the emergency.

SPU-Alert System
The SPU-Alert System is SPU’s emergency notification system. It can send information via text message, email, electronic reader board, computer pop-ups (for SPU computers), loudspeaker, and recorded cell phone messages. Text messaging has generally proven to be the quickest way to receive an alert about a campus emergency. In order to receive text messages from SPU-Alert, you must provide SPU with your cell phone number through the Banner Information System on the web, https://www.spu.edu/banweb/. Select the Personal Menu then choose the Emergency Alert System tab. Contact the CIS Help Desk if you have questions about entering your personal contact information into the Banner Information System. Emergency announcements may also be made by SPU staff members serving as Building Emergency Coordinators (“BECs”).

Lockdown / Shelter in Place – General Guidance
The University will lock down in response to threats of violence such as a bank robbery or armed intruder on campus. You can assume that all remaining classes and events will be temporarily suspended until the incident is over. Lockdown notifications are sent using the SPU-Alert System.

If you are in a building at the time of a lockdown:
- Stay inside and await instruction, unless you are in immediate visible danger.
- Move to a securable area (such as an office or classroom) and lock the doors.
- Close the window coverings then move away from the windows and get low on the floor.
- Remain in your secure area until further direction or the all clear is given (this notification will be sent via the SPU-Alert System).

If you are outside at the time of a lockdown:
- Leave the area and seek safe shelter off campus. Remaining in the area of the threat may expose you to danger.
- Return to campus after the all clear is given (this notification will be sent via the SPU-Alert System).

Evacuation – General Guidance
Students should evacuate a building if the fire alarm sounds or if a faculty member, a staff member, or the SPU-Alert System instructs building occupants to evacuate. In the event of an evacuation, gather your personal belongings quickly and proceed to the nearest exit. Most classrooms contain a wall plaque or poster on or next to the classroom door showing the evacuation route and the assembly site for the building. Do not use the elevator.

Once you have evacuated the building, proceed to the nearest evacuation assembly location. The “Stop. Think. Act.” booklet posted in each classroom contains a list of assembly sites for each building. Check in with your instructor or a BEC (they will be easily recognizable by their bright orange vests). During emergencies, give each BEC your full cooperation whenever they issue directions.

Additional Information
Additional information about emergency preparedness can be found on the SPU web page at http://www.spu.edu/info/emergency/index.asp or by calling the Office of Safety and Security at 206-281-2922.