In Calculus III, the main concepts of calculus (such as derivatives and integrals) are extended to functions of two and three variables (whereas Calculus I and II dealt with functions of one variable). The tools developed in Calculus III are necessary for the study the motion of an object moving in three-dimensional space and for studying many other types of motion such as, for example, the flow of fluids. In addition, the tools we develop facilitate the study of geometrical problems such as, for instance, problems involving surface areas and volumes. Many other types of problems also require the use of functions of several variables.

Some Expected Learning Outcomes

1) The student will recognize and be able to formulate equations describing several surfaces such as planes, cones, paraboloids, and other quadric surfaces.
2) The student will be able to work with vectors and demonstrate an understanding of the algebra of vectors including dot products and cross products (and also demonstrate knowledge of the geometric interpretations of such operations).
3) The student will be able to formulate parametric descriptions of curves and surfaces.
4) The student will demonstrate understanding of the concepts of tangent vector, unit tangent vector, and normal vector to a curve at a point.
5) The student will demonstrate understanding of the concept of a tangent plane to a surface at a point and will be able to find equations for tangents planes of given surfaces.
6) The student will demonstrate understanding of the concepts of velocity, speed, and acceleration in regard to motion along a curve in three dimensional space.
7) The student will be able to solve problems involving the path of a projectile.
8) The student will be able to compute limits and partial derivatives of functions of several variables.
9) The student will be able to compute directional derivatives of functions of several variables and will understand the connections between the directional derivatives, gradient vector, and level curves of a function.
10) The student will be able to evaluate double integrals of functions of two variables and will demonstrate understanding of the geometric and applied interpretations of such integrals.
10) The student will demonstrate understanding of the concept of a conservative vector field and will be able to apply basic criteria to determine if a given vector field is conservative.

11) The student will demonstrate the ability to find potential functions for certain conservative vector fields and will be able to apply the Fundamental Theorem of Line Integrals in evaluating line integrals of such conservative vector fields.

12) The student will be able to state Green’s Theorem and will demonstrate an ability to apply this theorem.

Grading: There will be six quizzes, four one–hour exams, and a two–hour final exam. Your solutions to each quiz and exam problem will be graded according to the following scheme:

- 20 points – if your solution is correct (including a correct “final answer”) and your solution is well written. By “well-written”, I mean that I am able to easily follow your reasoning, no important details are omitted from your solution, correct notation is used, etc. Essentially, you will get 20 points if your solution is correct and I don’t have to struggle in determining that it is correct. 20 points is equivalent to a “high A”.
- 16 points – if your solution is correct (including a correct “final answer”) but I have to struggle in determining that it is correct due to unclear writing, incorrect use of notation, or for whatever reason. 16 points is equivalent to a “borderline A–B”.
- 10 points – if your solution is not completely correct, but you have made a very good start (that is well-written) and have provided the majority of a correct solution. Essentially, 10 points means high partial credit and is equivalent to a “mid-level C”.
- 4 points – if your solution is not correct, but at least the beginnings of a correct solution are discernible. Essentially, 4 points means low partial credit and is equivalent to a “borderline D–F”.
- 0 points – if partial credit is not warranted. 0 points is equivalent to a “low F”.

Please note that “correct solution” and “correct final answer” do not mean the same thing! It is absolutely essential, in writing solutions, that you provide sufficient details showing how you arrive at your final answer. I (the reader) must be able to see what your reasoning process is. Thus it is possible, for example, to write down a correct final answer and end up with 0 points (because I can’t tell how you came up with your answer). Also, keep in mind that correct statements that you write can be “cancelled” by incorrect statements that you write. For example, if you write only statement X and statement X is a correct beginning of the solution to the problem, then you might be awarded 4 points. However, if you write statements X and Y where statement X is correct and relevant but statement Y is incorrect or contradicts statement X, then you could be given 0 points.

Your grade on each exam will be calculated by averaging your scores on each question. Thus, a perfect score on any exam or quiz is 20. The average grade of the six quizzes will be considered as a single grade. Your final grade at the end of the course will be calculated according to

\[
\frac{\text{Quiz Average Score} + \text{Sum of Hour Exam Scores} + \text{Final Exam Score}}{6}
\]

However, before performing the above calculation, the lowest hour-exam (or quiz average) score will be dropped and replaced with the final exam score (if the final exam score is higher). Thus, the final exam can be used to take the place of your worst test performance (or of your quiz average).
The letter grade that you get at the end of the course will be assigned using the result of the above calculation as follows:

- A - for a score between 16 and 20.
- B - for a score between 12 and 15.9.
- C - for a score between 8 and 11.9.
- D - for a score between 4 and 7.9
- F - for a score between 0 and 3.9

This grading scale will be followed exactly with all exam scores and the final score calculation rounded to the nearest tenth. For example, suppose that your quiz average is 10.0, your scores on the first four exams are 9.9, 1.6, 14.6, and 5.6, and that your score on the final exam is 6.3. Since the final exam score is 6.3, which is higher than 1.6, the grade of 1.6 would be disregarded and the grade of 6.3 would be counted double. Thus your grade would be calculated as

$$\frac{10.0 + 9.9 + 6.3 + 14.6 + 5.6 + 6.3}{6} = 8.783$$

which rounds to 8.8. In this case your course grade would be a C.

**Important Note:** There will be no make-up exams for any reason (legitimate or not legitimate)! Occasionally, students miss exams for legitimate reasons such as illnesses and automobile mishaps. If you must miss an exam for a legitimate reason, please inform me as soon as possible. If your reason for missing the exam is legitimate, then you will be excused from it and your grade on the portion of the final exam that addresses the material of the missed exam will be used as your grade for the missed exam. In order to be excused from an exam, you must provide written documentation from a doctor (in the case of illness) or from the police (in the case of an auto accident) that states the reason why you were not able to be at KSU on the day of the exam. All such excuses will be verified by me. In some cases in which a student knows ahead of time, and informs me at least one week in advance, that he or she will not be able to be present on an exam day (for a legitimate reason), I allow the student to take the exam early (but not after the official exam day).

**Grades of “Incomplete”:** Grades of “Incomplete” (I) are given, at the instructor’s discretion, to students who have been doing satisfactory work (at least a C average) up until the last two weeks of the semester but who, for some unavoidable reason, are unable to complete the work of the last two weeks of the semester. No decisions about grades (including grades of Incomplete) will be made until the semester (including the final exam) is finished. Occasionally, students ask me if I will give them a grade of “Incomplete”. This request is usually made at some point before the last two weeks of the semester. I can’t answer such requests since I do not make any grading decisions until the semester is over. If I see that an "Incomplete" grade is warranted, then I will give that grade (without being asked). I very rarely assign grades of “Incomplete” because I have found that they are usually not warranted. All incomplete work must be made up (and the I grade changed to a regular grade, A, B, C, D, or F) as quickly as possible, typically before the start of the next semester.

**Academic Honesty:** No cheating of any kind will be tolerated. If you are caught cheating in this course (this includes things such as looking at hidden notes or books or looking at somebody else’s exam paper while taking an exam), you will be reported to the KSU Judiciary Office. In addition to your name being on record with the Judiciary, you will also get a grade of zero on the work on which you cheated and might also be given a
final grade of F for the course. At the discretion of the Judiciary, more severe penalties such as suspension or expulsion might also ensue. Please read the attached document regarding academic honesty.