JOLIET JUNIOR COLLEGE 1901
DEPARTMENT OF MATHEMATICS

Math 172
Calculus with Analytic Geometry III

Course Description
This is the third course in calculus and analytic geometry. The course explores multivariable calculus. It includes vectors, partial derivatives, multiple integrals, parametric curves and surfaces, vector fields, line integrals, and applications of all of these.

Illinois Articulation Initiative (IAI) number: M1 900-3; MTH 903

Credit and Contact Hours:

Lecture	**4**
Lab	**0**
Credit Hours	**4**

Prerequisites: Minimum grade "C" in MATH 171 or equivalent.

Books, Supplies, and Supplementary Materials

A. **Required Textbooks**

Cengage Unlimited Subscription. WebAssign will be used for online coursework (homework, quizzes, tests, etc.) and can be accessed by logging into iCampus/Canvas and selecting this course. If you are comfortable reading the textbook on the computer, you may use the eText alone. **There is no need to purchase a physical textbook for this course; the Cengage Unlimited Subscription for the eText and WebAssign was included in your course fees. Registration instructions are posted in our iCampus/Canvas site.**

B. **Other Required Materials**

Graphing calculator required; TI-83+ or TI-84+ graphing calculator is recommended.

C. **Methods of Instruction:**

Lecture, Hybrid, or Online

General Education Student Learning Outcome

1. Quantitative Literacy: Students possess the ability to reason and solve quantitative problems from an array of contexts.

Course Learning Outcomes (CLOs)

1. Explore multivariable functions using limit techniques.
2. Explore multivariable functions using differentiation techniques.
3. Explore multivariable functions using integration techniques.
4. Explore vector functions using multivariable calculus techniques.

Lesson Learning Outcomes (LLOs)

1. Represent and interpret a function of two variables graphically, numerically, and analytically.

2. Analyze the behavior of functions using cross sections of their graphs and level curves in their contour diagrams.
3. Represent functions of three variables using level surfaces.
4. Interpret and apply vector operations geometrically (sum, difference, scalar product, dot product, cross product).
5. Approximate partial derivatives of a function of two variables using tables, graphs, and contour diagrams.
6. Compute partial derivatives algebraically.
7. Determine an equation of the plane tangent to the graph of a function of two variables at a point.
8. Use the local linearity of a differentiable function of two variables to approximate it near a point.
9. Calculate and interpret directional derivatives numerically, graphically, and algebraically.
10. Calculate a gradient vector and recognize it's meaning with respect to direction and magnitude of most rapid rate of change.
11. Calculate partial derivatives algebraically using the chain rule for composite functions.
12. Calculate second order partial derivatives and interpret their geometric meaning on contour diagrams.
13. Determine local and global extrema and saddle points from graphs, contour diagrams, gradient fields, and tables.
14. Determine local extrema and saddle points using the second derivative test.
15. Recognize whether a region in the plane is closed or bounded, and apply these concepts in conjunction with the Extreme Value Theorem.
16. Solve applied optimization problems using functions of two variables.
17. Solve constrained optimization problems using Lagrange Multipliers.
18. Approximate double integrals using Riemann sums numerically, graphically (from graphs and contour diagrams), and analytically.
19. Evaluate double integrals over a region by iteration.
20. Change the order of integration in evaluating a double integral.
21. Evaluate triple integrals and describe the region of integration.
22. Determine the region of integration for a double integral in polar coordinates, change the order of integration, and evaluate.
23. Determine regions of integration in cylindrical and spherical coordinates, and evaluate triple integrals in these systems.
24. Interpret motion described parametrically in graphical or algebraic form.
25. Write and interpret various parameterizations of a given curve.
26. Given parametric equations for a curve, determine associated velocity and acceleration vectors, and arc lengths.
27. Given a space curve, compute its curvature.
28. Given a space curve, compute the unit tangent vector, unit normal vector, and unit binomial vector.
29. Given a space curve, reparameterize it with respect to arc length.
30. Parametrize a surface.
31. Interpret vector fields graphically and analytically.
32. Interpret the flow of a vector field graphically and analytically.
33. Interpret a line integral in a vector field graphically.
34. Calculate line integrals analytically.
35. Determine whether a given vector field is a gradient field and whether it is conservative.
36. Find potential functions for conservative vector fields.
37. Use Green's Theorem to evaluate line integrals.
38. Interpret curl and divergence of a vector field both geometrically and analytically.
39. Compute surface integrals.
40. Interpret the flux of a vector field across a surface both geometrically and analytically.
41. Understand when Stokes' Theorem applies and use Stokes' Theorem to calculate the circulation of a vector field around the boundary of an oriented surface.
42. Understand when the Divergence Theorem applies and use the Divergence Theorem to compute the outward flux of a simple solid region.

Final Course Grading Scale

Grade	Percentage
A	90-100%
B	80-89%
C	70-79%
D	60-69%
F	lower than 60%

Faculty Commitment

Faculty members are committed to providing a quality learning experience through thoughtful planning, implementation, and assessment of course activities. They are also committed to being readily available to students throughout the semester by returning e-mails and phone calls within 48 hours and to returning graded course work within a week. Furthermore, they are committed to selecting appropriate course materials and making them available in an organized and timely manner.

Student Commitment

For every credit hour a student is enrolled in, they should expect to spend at least 2 hours outside of class studying, working on assignments, and preparing for class each week of the fifteen-week semester. For example, for this four credit-hour class, students can expect to spend four hours per week in class actively engaged in learning the material by participating in face-to-face classes or viewing lectures and instructional material online. In addition, students should expect to spend another eight hours per week outside of class completing homework and assignments, posting to discussion boards online, or studying for quizzes and tests. This means students should spend a minimum of 12 hours per week engaged in achieving the learning outcomes for this course. If you are not achieving your desired results in this class, you should consider increasing your prep time outside of class, in addition to using available resources such as instructor office hours and tutoring services.

By registering for this course, you commit yourself to active participation in course activities as well as the submission of all assignments and exams on time. Furthermore, you commit to accessing the course site and checking your JJC e-mail several times a week.