Marshall University

College of Science

Mathematics Department

MTH 229: Calculus with Analytic Geometry I (CT)

Course catalog description

An introduction to calculus and analytic geometry, emphasizing critical thinking. Limits, derivatives, and integrals of the elementary functions of one variable, including transcendental functions.

Credit hours

5 hours

Prerequisites

ACT Math 27 or equivalent, or a grade of C or higher in MTH 132

Critical thinking (CT) designator

This course carries a CT designator, and students who complete the course receive 5 hours of CT credit towards their general education requirements.

List of topics

- Brief review of basic concepts of algebra
  - Number systems. Distance formula. Slope of a line. Standard equations of lines.
- A library of functions
  - The basic equations and qualitative behavior of linear functions, power functions, polynomial functions, rational functions, exponential and logarithmic functions, and trigonometric functions.

- Limits and applications
    - The limit of a function at a point. One-sided limits. Continuity and the intermediate value theorem. Infinite limits. Limits at infinity. Applications of limits to engineering and science.
- Differentiation and applications
    - Definition of the derivative at a point and on an interval. Slope of a tangent line. Derivatives of polynomials. Derivatives of trigonometric functions. Derivatives of exponential and logarithmic functions. Rules for differentiation. Mean value theorem. Implicit differentiation. Maxima and minima. Critical points and intervals of increase and decrease. Concavity and inflection points. Newton's Method. Differentials and linear approximation. Applications of derivatives to engineering and science.
- Integration and applications
    - Area as an integral. Antiderivatives. Riemann sums. Definite integrals as limits of Riemann sums. The Fundamental Theorem of Calculus. The substitution method for integrals. Applications of integrals to engineering and science.

Learner outcomes

1. Students will be able to evaluate limits, derivatives, and integrals symbolically.
2. Students will be able to approximate limits, derivatives, and definite integrals from tabular and graphical data.
3. Students will be familiar with the definitions of limits, derivatives, and integrals; be able to apply these definitions to test properties of these concepts; and be able to produce verbal arguments and examples showing that basic properties hold or do not hold.
4. Students will be able to apply the techniques of calculus to answer questions about the analytic geometry of functions, including vertical and horizontal asymptotes, tangent lines, local extrema, and global extrema.
5. Students will be able to verbally explain the meaning of limits, derivatives, and integrals in their own words, both in general terms and in the context of specific problems.

6. Students will be able to select or construct an appropriate function to model an applied situation for which calculus is applicable, based on a verbal description of the situation.
7. Students will be able to apply techniques of calculus to solve applied problems from fields such as engineering and the sciences.
8. Students will be able to interpret symbolic and numerical results in real-world terms, and analyze the validity of their results in a real-world setting.

Course goals

- To give students an understanding of the fundamental concepts of calculus and an appreciation of its many applications.
- To develop critical thinking skills by asking students to convert real-world problems into forms suitable for calculus, and interpret the results of calculus in real-world terms.
- To provide students with a deeper understanding of the mathematics that is used in their science and engineering courses.
- To develop facility in using graphing calculators and computers to solve mathematics problems.
- To satisfy program requirements.

Technology

Students must have graphing calculators. Computer labs may be assigned at the discretion of the instructor.

Suggested textbooks

- Rogawski, *Calculus (Early Transcendentals)*, second edition.
- Stewart, *Calculus (Early Transcendentals)*, eighth edition.

Last updated

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