

Calculus 1

Course Outcome Summary

WTCS - Wisconsin Technical College System

Information

Course Number	10-804-198
Credits	4
Contact Hours	72
Instructional Area	General Studies
Instructional Level	Associate Degree
Organization	WTCS - Wisconsin Technical College System
Division	Mathematics
Developer(s)	WTCS Statewide Team

Types of Instruction

Type of Instruction	Contact Hours	Outside Hours	Credits
Classroom Presentation	72	144	4
Totals	72		4

Description

Analyze and graph algebraic expressions, especially conic sections. Develop an intuitive understanding of limits, derivatives and integrals. Apply the derivative and the integral to certain physical problems.

Goal

1. This course outcome summary includes the competencies and criteria for Calculus 1. This course is part of the General Studies Core offered throughout the Wisconsin Technical College System (WTCS). The course competencies are consistent among the colleges and are at baccalaureate level to accommodate student success in transfer to four-year colleges.

Prerequisite

1. College Technical Mathematics 1 and 2 or equivalent

Textbooks

1. Larson, Hostetler, and Edwards. *Calculus*. Publisher: Houghton Mifflin
2. Larson Edwards. *Brief Calculus - An Applied Worktext*. Publisher: Houghton Mifflin

3. Smith and Minton. *Calculus*
4. George Thomas and Ross Finney. *Calculus*

Competencies and Performance Standards

1. Find limits and continuity of functions

Performance Standards

Competence will be demonstrated:

- 1.a. written exam and/or quizzes
- 1.b. homework assignments

Performance will be successful when:

- 1.a. you correctly evaluate limits of various functions for values in the domain.
- 1.b. you identify discontinuities in a function and correctly evaluate left and right limits about the discontinuity.
- 1.c. you distinguish between various types of discontinuities within a function
- 1.d. you distinguish between various right and left limits
- 1.e. you analyze limits involving infinity

2. Calculate derivatives for algebraic functions

Performance Standards

Competence will be demonstrated:

- 2.a. written exam and/or quizzes
- 2.b. homework assignments

Performance will be successful when:

- 2.a. you correctly use the formal definition of the derivative for finding derivatives of polynomial functions
- 2.b. you differentiate between continuous and discontinuous functions
- 2.c. you effectively use proper symbols and terminology to communicate relevant concepts
- 2.d. you correctly use the formal definition of the derivative for finding derivatives of rational functions
- 2.e. you evaluate derivatives at specific values within the domain of differentiable functions
- 2.f. you differentiate functions using the product, quotient, chain, and generalized power rules
- 2.g. you differentiate functions implicitly
- 2.h. you calculate higher order derivatives
- 2.i. you use the Mean Value Theorem for derivatives

3. Calculate derivatives of trigonometric functions

Performance Standards

Competence will be demonstrated:

- 3.a. written exam and/or quizzes
- 3.b. homework assignments

Performance will be successful when:

- 3.a. you effectively use proper symbols and terminology to communicate relevant concepts
- 3.b. you evaluate derivatives at specific values within the domain of differentiable functions
- 3.c. you differentiate functions using the product, quotient, chain, and generalized power rules
- 3.d. you calculate higher order derivatives

4. Calculate derivatives of exponential and logarithmic functions

Performance Standards

Competence will be demonstrated:

- 4.a. written exam and/or quizzes
- 4.b. homework assignments

Performance will be successful when:

- 4.a. you effectively use proper symbols and terminology to communicate relevant concepts
- 4.b. you differentiate exponential and logarithmic functions with different bases
- 4.c. you evaluate derivatives at specific values within the domain of differentiable functions
- 4.d. you differentiate functions using the product, quotient, chain, and generalized power rules
- 4.e. you calculate higher order derivatives

5. Use derivatives to solve applied problems.

Performance Standards

Competence will be demonstrated:

- 5.a. written exam and/or quizzes
- 5.b. homework assignments

Performance will be successful when:

- 5.a. you effectively use proper symbols and terminology to communicate relevant concepts
- 5.b. you apply derivative tests to solve applied geometric problems of maximization and

minimization

- 5.c. you determine the rate-of-change of one variable while knowing the rate-of-change of remaining variables in a related-rate equation
- 5.d. you determine equation of a tangent line through a given point on a curve
- 5.e. you determine equation of a normal line through a given point on a curve
- 5.f. you determine rate-of-change for a single variable in geometric related rate problems.
- 5.g. you use derivatives to establish relationships between position, velocity, and acceleration
- 5.h. you use Newton's method to find roots of equations
- 5.i. you calculate a differential and use it to calculate absolute error

6. Graph and analyze functions using derivative tests

Performance Standards

Competence will be demonstrated:

- 6.a. written exam and/or quizzes
- 6.b. homework assignments

Performance will be successful when:

- 6.a. you use first derivative test to find critical points along the curve of a function
- 6.b. you determine maxima and minima along a function curve
- 6.c. you use first derivative test to find intervals over which a function is increasing or decreasing
- 6.d. you use second derivative test to determine concavity at a point along a function curve
- 6.e. you find inflection points along a function curve
- 6.f. you use derivative tests and asymptotes to aid in curve sketching

7. Find integrals of algebraic functions

Performance Standards

Competence will be demonstrated:

- 7.a. written exam and/or quizzes
- 7.b. homework assignments

Performance will be successful when:

- 7.a. you find antiderivatives of algebraic functions
- 7.b. you integrate an algebraic function and find its constant of integration
- 7.c. you use Riemann sums to find the area under a function curve by integrating horizontally and vertically
- 7.d. you evaluate integrals of polynomial functions using limits

- 7.e. you use the fundamental theorem of calculus to evaluate an integral
- 7.f. you set up and evaluate an integral to calculate the area under a curve
- 7.g. you communicate integral concepts using standard written notation
- 7.h. you find definite and indefinite integrals using u substitution
- 7.i. you use integrals to find the area between two curves by integrating horizontally and vertically

8. Approximate integrals with numerical methods

Performance Standards

Competence will be demonstrated:

- 8.a. written exam and/or quizzes
- 8.b. homework assignments

Performance will be successful when:

- 8.a. you approximate the value of an integral using left and right end point
- 8.b. you approximate the value of an integral using midpoint method
- 8.c. you approximate the value of an integral using trapezoidal rule
- 8.d. you approximate the value of an integral using Simpson's rule

9. Find volume of solids of revolution

Performance Standards

Competence will be demonstrated:

- 9.a. written exam and/or quizzes
- 9.b. homework assignments

Performance will be successful when:

- 9.a. you calculate the volume of a vertical solid of revolution using the disk method when appropriate
- 9.b. you calculate the volume of a vertical solid of revolution using the washer method when appropriate.
- 9.c. you calculate the volume of a horizontal solid of revolution using the disk method when appropriate.
- 9.d. you calculate the volume of a horizontal solid of revolution using the washer method when appropriate.
- 9.e. you calculate the volume of a vertical solid of revolution using the shell method when appropriate.
- 9.f. you calculate the volume of a horizontal solid of revolution using the shell method when appropriate.

10. Apply integrals to solve problems involving centroids, moments of inertia, work, and pressure

Performance Standards

Competence will be demonstrated:

- 10.a. written exam and/or quizzes
- 10.b. homework assignments

Performance will be successful when:

- 10.a. you determine the centroid of a polygonal plate of uniform density.
- 10.b. you determine the centroid of a shape defined by functions in the cartesian plane.
- 10.c. you calculate the centroid of any solid of revolution.
- 10.d. you calculate the moment of inertia and radius of gyration for shapes bound by functions in the plane
- 10.e. you calculate the moment of inertia for solids of revolution.
- 10.f. you apply the integral to applications involving varying fluid pressure over a submerged surface
- 10.g. you apply the integral to application involving work done in various physical systems such as stretching/compressing a spring, pumping water out of a tank, winding rope with known density
- 10.h. you use integrals to calculate average values