

Course Objectives
CALCULUS II
DR. M. P. M. M. M^CLOUGHLIN
SPRING 2016

Length of Course: One semester - meeting every day Monday through Friday

Pre-requisite: Completion of Math 181 with a 'C' or better.

Text (not required and rarely if ever used in class discussions or for homework):

Calculus: with Early Transcendentals Briggs, Cochran, & Gillette, Pearson. ISBN: 9780321785374

Machine (required): Whatever you use to receive e-mail. Assignments will be sent to you most every day.

Calculators are banned in this class. The computer algebra system *Maple* or *Mathematica* may be required for some take-home exercises or projects.

Handouts, Worksheets, Open Questions, etc.(required to be downloaded each class):

<http://faculty.kutztown.edu/mcloughl/Math182.html>

Texts (supplemental):

The instructor may suggest supplemental exercises or reading from a number of sources; including, but not limited to:

Calculus, Riddle (Any edition). Wadsworth.

Calculus, Hunt (Any edition). Harper-Collins.

Calculus, Grossman (Any edition). Harcourt.

Schaum Outline Series: Calculus, Mendelson & Ayres (any edition). McGraw - Hill.

Course Objective:

This course is one of a series intended for students who major in mathematics, the sciences, or engineering. The topics include the definition, properties, and applications of definite integrals, properties, derivatives, and integrals of exponential, logarithmic, trigonometric, inverse trigonometric, and hyperbolic functions with applications; techniques of integration; indeterminate forms and improper integrals; sequences, series, and convergence tests; differentiation and integration of power series; and polar coordinates and polar integrals. This course prepares students who major in mathematics, the sciences, or engineering with the mathematical background they need to address problems that arise in those majors. It could be counted in Category IV-A, IV-D, or V of General Education.

A student should have mastered and demonstrated the following skills after completing Math 182:

- the student is able to think logically
- the student is able to reason and recognise patterns and be able to make conjectures
- the student is able to use mathematical symbols
- the student understands the basic concepts of analysis; limit, continuity and the derivative
- the student is able to strike a judicious balance between theory and application, between computational skills and mathematical sophistication and between intuition and rigour.
- the student is able to do applications of derivatives.
- the student is able to explain what a proof is and discern between a valid proof and claim that a proof has been performed, but in reality has not.
- the student is able to read a proof of a statement.
- the student is able to construct a valid examples of true claims.
- the student is able to construct valid counterexamples to propositions which are false.

MATH 182 - CALCULUS II - SYLLABUS - DR. PADRAIG M^cLOUGHLIN - SPRING OF 2016

- the student is able to recognise and avoid common fallacies in arguments including begging the question, circular reasoning, affirming the conclusion, and denying the hypothesis.
- the student is able to take derivatives by the power, sum, product, quotient, or chain rule (and combinations of said).
- the student is able to take derivatives by the polynomial, trigonometric, transcendental, algebraic, logarithmic, exponential, or rational functions (and combinations of said).
- the student understands the basic concepts and application of antidifferentiation.
- the student understands the basic concepts and application of the definite integral.
- the student understands the basic concepts and application of the Fundamental Theorem of Calculus.
- Compute derivatives using logarithmic differentiation
- Compute derivatives involving the inverse trigonometric functions
- Evaluate integrals yielding trigonometric and inverse trigonometric functions
- Compute antiderivatives involving trigonometric functions
- Find antiderivatives of rational functions using partial fractions
- Find antiderivatives of functions using trigonometric substitutions
- Find integrals using miscellaneous substitutions
- Find the centroid of a region
- Solve a differential equation with the separation of variables technique
- Locate points in a plane using the polar coordinates
- Graph equations in polar coordinates
- Find area bounded by polar curves
- Obtain the graph of a parametric curve as well as tangents to the graph
- Compute arc lengths, surface areas, and centroids involving parametric curves
- Determine whether the limit of a sequence exists
- Discuss properties of bounded and monotonic sequences
- Discuss indeterminate forms
- Properly use L'Hôpital's Theorem
- Properly evaluate improper integrals
- Discuss properties of convergent and divergent series
- Discuss and use the comparison, integral, ratio, and root tests for determining convergence of series
- Determine if a convergent series is absolutely or conditionally convergent
- Determine whether an alternating series diverges, converges absolutely, or converges conditionally
- Find the interval and radius of convergence of a power series
- Discuss the properties of Taylor Polynomials, Taylor Series, and power series
- Expand functions in power series

A brief overview of some (but not all of) the Course Content:

R. A *Brief Review of Some Important Concepts From Calculus I*

1. Differentiation Rules and techniques; the meaning of the derivative.
2. Integration basics and techniques from Calculus I; the meaning of the antiderivative and definite integral.
3. Area between curves; Volume, density, and average value; Arc length and surface areas.
4. The Fundamental Theorem of Calculus (FTC), Part I & II

MATH 182 - CALCULUS II - SYLLABUS - DR. PADRAIG M^cLOUGHLIN - SPRING OF 2016

A. Principles of Integration

1. Integration by parts
2. Trigonometric integrals
3. Integration by trigonometric substitution
4. Integration of rational functions and partial fraction decomposition
5. Integration by substitution
6. Integration approximation by trapezoidal and Simpson's rules
7. Integration with *Maple* or *Mathematica*
8. Improper integrals
9. Basic indeterminate form
10. Other indeterminate forms
11. Improper integrals with infinite limits of integration
12. Improper integrals with discontinuous integrands.
13. An application: The Gamma Function

B. Brief Discussion of Differential Equations (DEs)

1. 1st order DEs
- 2.* Euler's Method
3. 1st order DE applications and models
4. 2nd order linear homogeneous DEs

C. Sequences and Series

1. Sequences: finite versus infinite
2. Sequences: convergent versus divergent
3. Series
4. Convergent versus divergent series
5. Infinite series of positive terms
6. The integral test.
7. Direct Comparison Test
8. Limit Comparison Test
9. The ratio and root tests
10. Alternating series and absolute convergence.
11. Radii or intervals of convergence
12. Power series and power series representation of functions.
13. Differentiation and integration of power series
14. Taylor and Maclaurin series
15. Taylor and Maclaurin polynomials
16. Applications of Taylor polynomials
17. The binomial series

D. Plane Curves and Polar Coordinates

1. Plane curves
2. Tangent lines and arc length
3. Polar coordinates
4. Graphs in polar coordinates
5. Conversion from polar to rectangular (and visa versa) coordinates
6. Integrals in polar coordinates

E. Conic Sections (if time)

1. Parabolas
2. Ellipses
3. Hyperbolas
4. Rotation of Axes

Outline of the Course (with suggested pace):

§	Title	Sections	Pace
I	Preliminaries & Review of Calculus I	Handouts & Worksheets	$\frac{1}{2}$ – 1 week
II	Principles of Integration	Handouts & Worksheets	$3\frac{1}{2}$ weeks
III	Differential Equations (DEs)	Handouts & Worksheets	$1\frac{1}{2}$ weeks
IV	Sequences and Series	Handouts & Worksheets	$5\frac{1}{2}$ weeks
V	Plane Curves and Polar Coordinates	Handouts & Worksheets	$3\frac{1}{2}$ weeks