# MATH M25B: CALCULUS WITH ANALYTIC GEOMETRY II

**Originator**
pabramoff

**Co-Contributor(s)**

| Name(s) |
| --- |
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**College**
Moorpark College

**Discipline (CB01A)**
MATH - Mathematics

**Course Number (CB01B)**
M25B

**Course Title (CB02)**
Calculus with Analytic Geometry II

**Banner/Short Title**
Calc/Analy Geometry II

**Credit Type**
Credit

**Start Term**
Fall 2023

**Catalog Course Description**
Reviews integration. Covers area, volume, arc length, surface area, centers of mass, physics applications, techniques of integration, improper integrals, sequences, series, Taylor's Theorem, parametric equations, polar coordinates, and conic sections with translations.

Course Credit Limitations:
1) Students cannot complete both the honors and regular versions of a course. Credit will be awarded only for the first course completed with a grade of "C" or better or "P". Moorpark College Honors Program requires a letter grade.
2. MATH M16B and MATH M25B or MATH M25BH combined: maximum one course.

**Taxonomy of Programs (TOP) Code (CB03)**
1701.00 - Mathematics, General

**Course Credit Status (CB04)**
D (Credit - Degree Applicable)

**Course Transfer Status (CB05) (select one only)**
A (Transferable to both UC and CSU)

**Course Basic Skills Status (CB08)**
N - The Course is Not a Basic Skills Course

**SAM Priority Code (CB09)**
E - Non-Occupational

**Course Cooperative Work Experience Education Status (CB10)**
N - Is Not Part of a Cooperative Work Experience Education Program

**Course Classification Status (CB11)**
Y - Credit Course

**Educational Assistance Class Instruction (Approved Special Class) (CB13)**
N - The Course is Not an Approved Special Class

**Course Prior to Transfer Level (CB21)**
Y - Not Applicable

**Course Noncredit Category (CB22)**
Y - Credit Course

**Funding Agency Category (CB23)**
Y - Not Applicable (Funding Not Used)

**Course Program Status (CB24)**
1 - Program Applicable

**General Education Status (CB25)**
B - Satisfies Math/Quantitative Reasoning req (CSUGE-B B4, IGETC 2, or 4-yr)

**Support Course Status (CB26)**
N - Course is not a support course

**Field trips**
Will not be required

**Grading method**
(L) Letter Graded

**Alternate grading methods**
(O) Student Option- Letter/Pass
(P) Pass/No Pass Grading

**Does this course require an instructional materials fee?**
No

**Repeatable for Credit**
No

**Is this course part of a family?**
No

## Units and Hours

**Carnegie Unit Override**
No

## In-Class

**Lecture**
**Minimum Contact/In-Class Lecture Hours**
87.5
**Maximum Contact/In-Class Lecture Hours**
87.5

**Activity**

**Laboratory**

## Total in-Class

**Total in-Class**
**Total Minimum Contact/In-Class Hours**
87.5
**Total Maximum Contact/In-Class Hours**
87.5

## Outside-of-Class

**Internship/Cooperative Work Experience**

**Paid**

**Unpaid**

## Total Outside-of-Class

**Total Outside-of-Class**
**Minimum Outside-of-Class Hours**
175
**Maximum Outside-of-Class Hours**
175

## Total Student Learning

**Total Student Learning**
**Total Minimum Student Learning Hours**
262.5
**Total Maximum Student Learning Hours**
262.5

**Minimum Units (CB07)**
5
**Maximum Units (CB06)**
5

**Prerequisites**
MATH M25A or MATH M25AH or MATH M16B or placement as determined by college's multiple measures assessment process. or placement as determined by college's multiple measures assessment process

## Entrance Skills

**Entrance Skills**
MATH M16B

**Prerequisite Course Objectives**
MATH M16B-evaluate definite and indefinite integrals using techniques including change of variables and integration by parts, or also by the integral tables. (optional)
MATH M16B-evaluate the first and second partial derivatives of functions of several variables.
MATH M16B-solve applied optimization problems for a function of several variables.
MATH M16B-find a maximum or minimum value for a function of several variables subject to a given constraint.
MATH M16B-evaluate double integrals of functions of several variables.
MATH M16B-apply double integration techniques in evaluating the volume of a solid.
MATH M16B-solve simple and separable differential equations.
MATH M16B-apply differential equations in the growth model and inhibited growth model.
MATH M16B-compute a Taylor polynomial of a given degree for a given function.
MATH M16B- determine convergence and divergence of infinite sequences and series.

MATH M16B-evaluate a limit using L'Hopital's Rule.

**Entrance Skills**

MATH M25A or MATH M25AH

**Prerequisite Course Objectives**

MATH M25A-evaluate the limit of a function using numerical and algebraic techniques, the properties of limits, and analysis techniques.
MATH M25A-evaluate one-sided and two-sided limits for algebraic and trigonometric functions.
MATH M25A-determine analytically whether a limit fails to exist.
MATH M25A-determine whether a function is continuous or discontinuous at a point.
MATH M25A-apply the Intermediate Value Theorem to a continuous function on a closed interval.
MATH M25A-use the formal definition of the derivative to find the derivative of an algebraic function.
MATH M25A-apply the basic rules of differentiation to find the derivative of a function including the constant, power, sum, product, and quotient rules and The Chain Rule.
MATH M25A-find first-order and higher-order derivatives of algebraic and transcendental functions and their inverses.
MATH M25A-find the derivatives of functions and relations using implicit differentiation.
MATH M25A-solve applied problems using the derivative including rates of change, the tangent line problem, and related rates.
MATH M25A-apply the method of logarithmic differentiation for finding derivatives.
MATH M25A-demonstrate an understanding of the connection between differentiability and continuity of a function.
MATH M25A-apply Rolle's Theorem and the Mean Value Theorem to a function on a closed interval.
MATH M25A-identify indeterminate forms and use L'Hospital's Rule to evaluate limits.
MATH M25A-apply analytic techniques to a function and its derivatives to solve curve sketching problems.
MATH M25A-use differentials with linear approximation problems.
MATH M25A-solve applied optimization problems.
MATH M25A-apply the basic rules of integration for finding anti-derivatives for algebraic and transcendental functions.
MATH M25A-use summation notation with Riemann sums and upper and lower sums.
MATH M25A-use the formal definition of the definite integral to evaluate the integral of an algebraic function over a closed interval.
MATH M25A-evaluate definite integrals using the properties of integrals and the Fundamental Theorem of Calculus.
MATH M25A-integrate indefinite and definite integrals using change of variable techniques.
MATH M25A-use integration and analysis techniques to find the area of a region between two curves.
MATH M25A-solve exponential growth and decay problems (optional).

## Requisite Justification

**Requisite Type**

Prerequisite

**Requisite**

MATH M16A

**Requisite Description**

Course in a sequence

**Level of Scrutiny/Justification**

Required by 4 year institution

**Requisite Type**

Prerequisite

**Requisite**

MATH M25A or MATH M25AH

**Requisite Description**

Course in a sequence

**Level of Scrutiny/Justification**

Required by 4 year institution

**Student Learning Outcomes (CSLOs)**

| | Upon satisfactory completion of the course, students will be able to: |
|---|---|
| 1 | use series to approximate a function or an integral. |
| 2 | apply integration techniques to calculate arc length, area, and volume. |

**Course Objectives**

| | Upon satisfactory completion of the course, students will be able to: |
|---|---|
| 1 | apply the definite integral to solve problems involving area, volume, arc length, surface area, work, moments and centers of mass in the plane, fluid force, and other applications. |
| 2 | select appropriate techniques for evaluating an indefinite integral; techniques include basic integration forms, change of variables, integration by parts, trigonometric identities, trigonometric substitutions, partial fractions, and estimation techniques. |
| 3 | identify and evaluate improper integrals using correct limit notation. |
| 4 | determine the convergence or divergence of an infinite sequence using analytic techniques. |
| 5 | determine whether a sequence is bounded or is monotonic. |
| 6 | compute partial sums for infinite series. |
| 7 | recognize telescoping, geometric, and p-series. |
| 8 | determine the convergence or divergence of a geometric series and p-series. |
| 9 | compute the sum of a convergent telescoping series and geometric series. |
| 10 | apply appropriate tests which include the nth-term test, integral test, comparison tests, and ratio and root tests to determine the convergence or divergence of positive term series. |
| 11 | apply the algebraic properties of infinite series. |
| 12 | apply the alternating series test and analyze the remainder of an alternating series. |
| 13 | determine if a series converges absolutely, conditionally, or if the series diverges. |
| 14 | determine the interval of convergence for a power series using analysis techniques and the tests for convergence. |
| 15 | apply integration and differentiation techniques for finding power series of elementary functions. |
| 16 | compute Taylor and Maclaurin polynomial approximations of elementary functions with remainder. |
| 17 | compute the power series for an elementary function centered at a point. |
| 18 | sketch the graph of a parametric curve and indicate its orientation. |
| 19 | convert the equation of a curve given in parametric form to rectangular form and vice versa. |
| 20 | find the slope of the tangent line at a point on a curve given in parametric form. |
| 21 | compute the arc length of a curve and the area of a surface of revolution for curves given in parametric form. |
| 22 | sketch the graph of a polar equation. |
| 23 | convert the equation of a curve given in polar form to rectangular form and vice versa. |
| 24 | find the slope of the tangent line at a point on a curve given in polar form. |
| 25 | find the area of a region bounded by a polar equation. |
| 26 | find the arc length of a curve given in polar form. |
| 27 | compute and identify the critical information for the standard conics, such as the vertex, directrix, and axis of symmetry for a parabola; the foci and vertices of an ellipse; and the vertices, foci, and asymptotes of a hyperbola. |

## Course Content

**Lecture/Course Content**

**20 % A. Applications of the Definite Integral**

1. Area
2. Volume
3. Work
4. Moments and centers of mass
5. Arc length of a curve in a plane
6. Area of surface of revolution
7. Fluid force and other applications

**25% B. Techniques of Integration**

1. Integration by parts

2. Trigonometric integrals
3. Trigonometric substitutions
4. Integrals of rational functions
5. Quadratic expressions and miscellaneous substitutions
6. Improper integrals
7. Approximation of integrals

**35% C. Infinite Series**

1. Sequences
2. Convergent or divergent series
3. Positive-term series
4. The nth-term, integral, comparison, the ratio and root tests
5. Alternating series and absolute convergence
6. Power series
7. Power series representations of functions
8. Maclaurin and Taylor series
9. Differentiation and integration of power series
10. Applications of Taylor polynomials

**20% D. Parametric Equations and Polar Coordinates**

1. Parametric equations
2. Arc length and surface areas
3. Polar coordinates
4. Integrals in polar coordinates
5. Conic sections

**Laboratory or Activity Content**

n/a

## Methods of Evaluation

**Which of these methods will students use to demonstrate proficiency in the subject matter of this course? (Check all that apply):**

Written expression
Problem solving exercises
Skills demonstrations

**Methods of Evaluation may include, but are not limited to, the following typical classroom assessment techniques/required assignments (check as many as are deemed appropriate):**

Computational homework
Individual projects
Objective exams
Problem-solving exams
Problem-solving homework
Quizzes
Other (specify)
Classroom Discussion
Projects
Participation

**Other**

Quizzes and graded work will be used to evaluate students for the critical thinking skills needed to solve math problems. Problems must require students to demonstrate analytic skills and the step-by-step details required for the solution.

## Instructional Methodology

**Specify the methods of instruction that may be employed in this course**

Class activities
Class discussions
Collaborative group work
Computer-aided presentations
Demonstrations
Distance Education
Group discussions
Instructor-guided interpretation and analysis
Instructor-guided use of technology
Lecture
Problem-solving examples

Other (specify)

**Specify other method of instruction**

All instructors will use best practices to provide an inclusive learning environment that respects all forms of racial, ethnic, age, and gender diversity, and provides for the individual needs of students of all learning styles.

**Describe specific examples of the methods the instructor will use:**

1. Lecture on the theory of the course material.
2. Have the students work in small groups to solve computationally heavy problems.
3. Class discussions on why a particular integration method or series test should be used as compared to another one for the germane problems.

## Representative Course Assignments

**Writing Assignments**

1. Homework problems selected from the calculus textbook where answers require a written explanation of the solution, such as determining the volume of a solid of revolution or the arc length along a curve.
2. Short answer problems on exams such as stating the results for an application problem, such as determining the total work to displace a body of fluid, or to indicate the center of mass for a uniform two-dimensional region.
3. Graded assignments: in-class and/or homework assignments requiring complete solutions using both written English and symbolic mathematical language, such as verifying whether an infinite series converges or diverges, with proper justification.

**Critical Thinking Assignments**

1. Apply methods of using the Taylor Series Expansion of a function to estimate the value of a definite integral and determine the accuracy of the result to a desired number of decimal places.
2. Determine the correct method to apply to finding the indefinite integral for an advanced integration technique by examining the form of the integral.
3. Apply analytic techniques for solving mathematical problems, such as determining an appropriate method for determining the convergence or divergence of an infinite series.

**Reading Assignments**

1. Read about the different techniques of integration.
2. Read about the different series tests.

**Skills Demonstrations**

1. Evaluate an indefinite integral.
2. Determine whether a series converges or diverges.

**Problem-Solving and Other Assignments (if applicable)**

1. Completing problem sets provided by the instructor, such as practice exercises on techniques of integration.
2. Practicing with polar and rectangular coordinates, such as converting the equation of a curve given in polar form to rectangular form and vice versa.

## Outside Assignments

**Representative Outside Assignments**

1. Completing written and/or graded homework assignments practicing advanced integration techniques, determining convergence or divergence of infinite series, demonstrating the computation of a Taylor Series Expansion, or computing the volumes of solids of revolution using both the washer method and the shell method.
2. Observing visual diagrams in the calculus textbook, such as images of rotated solids, diagrams of tanks and containers whereby amount of work is computed to move fluid, diagrams of uniform lamina for computing center of mass, or graphs of various functions illustrated in polar or parametric form.
3. Reading assigned material from the calculus textbook, such as identifying the various forms of infinite series and their necessary conditions for convergence or divergence.

## Articulation

**C-ID Descriptor Number**
MATH 220

**Status**
Approved

**Additional C-ID Descriptor(s)**

| C-ID Descriptor(s) | Status |
|---|---|
| MATH 900S (with MATH M25A/H and M25B) | Approved |

**Equivalent Courses at 4 year institutions**

| University | Course ID | Course Title | Units |
|---|---|---|---|
| CSU Northridge | MATH 150B | Calculus II | 5 |
| CSU Fresno | MATH 76 | Calculus II | 4 |
| UC Berkeley | MATH 1B | Calculus | 4 |

**Comparable Courses within the VCCCD**
MATH R121 - Calculus with Analytic Geometry II
MATH V21B - Calculus with Analytic Geometry II
MATH M25BH - Honors: Calculus with Analytic Geometry II

**Equivalent Courses at other CCCs**

| College | Course ID | Course Title | Units |
|---|---|---|---|
| Orange Coast College | MATH A185 | Calculus 2 | 4 |
| Sacramento City College | MATH 401 | Calculus II | 5 |
| Lake Tahoe Community College | MAT 106 | Calculus and Analytic Geometry (Part II) | 5 |

## District General Education

## A. Natural Sciences

## B. Social and Behavioral Sciences

## C. Humanities

## D. Language and Rationality

**D2. Communication/Analytical Thinking**
Approved

## E. Health and Physical Education/Kinesiology

## F. Ethnic Studies/Gender Studies

**Course is CSU transferable**
Yes

**CSU Baccalaureate List effective term:**
F1995

## CSU GE-Breadth

### Area A: English Language Communication and Critical Thinking

### Area B: Scientific Inquiry and Quantitative Reasoning

**B4 Mathematical/Quantitative Reasoning**
Approved

### Area C: Arts and Humanities

### Area D: Social Sciences

### Area E: Lifelong Learning and Self-Development

### Area F: Ethnic Studies

### CSU Graduation Requirement in U.S. History, Constitution and American Ideals:

## UC TCA

**UC TCA**
Approved

## IGETC

### Area 1: English Communication

### Area 2A: Mathematical Concepts & Quantitative Reasoning

**Area 2A: Mathematical Concepts & Quantitative Reasoning**
Approved

### Area 3: Arts and Humanities

### Area 4: Social and Behavioral Sciences

### Area 5: Physical and Biological Sciences

### Area 6: Languages Other than English (LOTE)

## Textbooks and Lab Manuals

**Resource Type**
Textbook

**Classic Textbook**
No

**Description**
Hass, Joel R., et al. *Thomas' Calculus: Early Transcendentals.* 15th ed., Pearson, 2023.

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**Resource Type**
Textbook

**Classic Textbook**
No

**Description**

Larson, Ron, and Bruce H. Edwards. *Calculus: Early Transcendental Functions.* 8th ed., Cengage, 2021.

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**Resource Type**

Textbook

**Classic Textbook**

No

**Description**

Stewart, James. *Calculus: Early Transcendentals.* 9th ed., Cengage, 2023.

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**Resource Type**

Textbook

**Description**

Strang, Gilbert, and Edwin Herman. *Calculus Volume 2.* E-book, Open Stax, 2020, https://openstax.org/details/books/calculus-volume-2. Accessed 20 Oct 2022.

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## Library Resources

**Assignments requiring library resources**

Projects involving use of library resources to investigate applications of integrals, Taylor Series, parametric and polar equations as they relate to the sciences, engineering or other related fields. Use of textbooks on reserve at Circulation Desk.

**Sufficient Library Resources exist**

Yes

**Example of Assignments Requiring Library Resources**

Using Library's print and online resources to supplement application problems relating to sciences, technology and engineering, such as researching scientific formulas for related rates problems or architectural structures that simulate volume of solids or work or fluid force.

## Distance Education Addendum

## Definitions

**Distance Education Modalities**

Hybrid (1%–50% online)
Hybrid (51%–99% online)
100% online

## Faculty Certifications

**Faculty assigned to teach Hybrid or Fully Online sections of this course will receive training in how to satisfy the Federal and state regulations governing regular effective/substantive contact for distance education. The training will include common elements in the district-supported learning management system (LMS), online teaching methods, regular effective/substantive contact, and best practices.**

Yes

**Faculty assigned to teach Hybrid or Fully Online sections of this course will meet with the EAC Alternate Media Specialist to ensure that the course content meets the required Federal and state accessibility standards for access by students with disabilities. Common areas for discussion include accessibility of PDF files, images, captioning of videos, Power Point presentations, math and scientific notation, and ensuring the use of style mark-up in Word documents.**

Yes

## Regular Effective/Substantive Contact

**Hybrid (1%–50% online) Modality:**

| Method of Instruction | Document typical activities or assignments for each method of instruction |
|---|---|
| Asynchronous Dialog (e.g., discussion board) | Use of student discussion boards to discuss concepts from the material, solutions to homework problems, general discussion of techniques in solving problems, study skills, or arranging study groups. |
| E-mail | Responding to student queries about material, grade information, course policies and procedures, scheduling and due dates, submitting homework assignments, or making general announcements to the class. |
| Face to Face (by student request; cannot be required) | Students requesting to speak to instructor in person for personal help on material, grade information, or discussion of policies and procedures. |
| Other DE (e.g., recorded lectures) | Posting of recorded lectures either by the instructor, recorded lessons available through campus resources, or use of public online resources available on the internet |
| Synchronous Dialog (e.g., online chat) | Active live discussion with the instructor on material concepts, techniques for problem solving, feedback on solutions to problems, general chat on study skills, or answers to homework problems, quizzes or tests. |

**Hybrid (51%–99% online) Modality:**

| Method of Instruction | Document typical activities or assignments for each method of instruction |
|---|---|
| Asynchronous Dialog (e.g., discussion board) | Use of student discussion boards to discuss concepts from the material, solutions to homework problems, general discussion of techniques in solving problems, study skills, or arranging study groups. |
| E-mail | Responding to student queries about material, grade information, course policies and procedures, scheduling and due dates, submitting homework assignments, or making general announcements to the class. |
| Face to Face (by student request; cannot be required) | Students requesting to speak to instructor in person for personal help on material, grade information, or discussion of policies and procedures. |
| Other DE (e.g., recorded lectures) | Posting of recorded lectures either by the instructor, recorded lessons available through campus resources, or use of public online resources available on the internet. |
| Synchronous Dialog (e.g., online chat) | Active live discussion with the instructor on material concepts, techniques for problem solving, feedback on solutions to problems, general chat on study skills, or answers to homework problems, quizzes or tests. |

**100% online Modality:**

| Method of Instruction | Document typical activities or assignments for each method of instruction |
|---|---|
| Asynchronous Dialog (e.g., discussion board) | Use of student discussion boards to discuss concepts from the material, solutions to homework problems, general discussion of techniques in solving problems, study skills, or arranging study groups. |
| E-mail | Responding to student queries about material, grade information, course policies and procedures, scheduling and due dates, submitting homework assignments, or making general announcements to the class. |
| Other DE (e.g., recorded lectures) | Posting of recorded lectures either by the instructor, recorded lessons available through campus resources, or use of public online resources available on the internet. |
| Synchronous Dialog (e.g., online chat) | Active live discussion with the instructor on material concepts, techniques for problem solving, feedback on solutions to problems, general chat on study skills, or answers to homework problems, quizzes or tests. |

## Examinations

**Hybrid (1%–50% online) Modality**
On campus
Online

**Hybrid (51%–99% online) Modality**
On campus
Online

**Primary Minimum Qualification**
MATHEMATICS

## Review and Approval Dates

**Department Chair**
10/12/2022

**Dean**
10/17/2022

**Technical Review**
10/20/2022

**Curriculum Committee**
11/01/2022

**DTRW-I**
MM/DD/YYYY

**Curriculum Committee**
MM/DD/YYYY

**Board**
MM/DD/YYYY

**CCCCO**
MM/DD/YYYY

**Control Number**
CCC000434818

**DOE/accreditation approval date**
MM/DD/YYYY