

MATH M05: COLLEGE ALGEBRA FOR STEM STUDIES

Originator

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College

Moorpark College

Attach Support Documentation (as needed)

C-ID Review of MATH M05 -Jan 2022.docx

Discipline (CB01A)

MATH - Mathematics

Course Number (CB01B)

M05

Course Title (CB02)

College Algebra for STEM Studies

Banner/Short Title

College Algebra for STEM

Credit Type

Credit

Start Term

Spring 2022

Catalog Course Description

Covers quadratic equations, linear and non-linear inequalities, absolute value equations and inequalities, complex numbers, functions, polynomial functions, rational functions, exponential functions, logarithmic functions, and systems of equations. Includes the theory of polynomial equations and analytic geometry, conic sections, sequences and series.

Course Credit Limitations:

- 1) MC and CSU - completing MATH M05 and MATH M06 is equivalent to completing MATH M07. Students completing MATH M05, M06 and M07 receive a maximum credit of 7 units for MC and CSU.
- 2) UC-MATH M05 and MATH M07 combined: maximum credit one course, no more than 5 semester or 7.5 quarter units.
- 3) MATH M05 and MATH M11: maximum credit of 4 units.

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**

70

Maximum Contact/In-Class Lecture Hours

70

Activity**Laboratory****Total in-Class****Total in-Class****Total Minimum Contact/In-Class Hours**

70

Total Maximum Contact/In-Class Hours

70

Outside-of-Class**Internship/Cooperative Work Experience****Paid****Unpaid****Total Outside-of-Class****Total Outside-of-Class****Minimum Outside-of-Class Hours**

140

Maximum Outside-of-Class Hours

140

Total Student Learning**Total Student Learning****Total Minimum Student Learning Hours**

210

Total Maximum Student Learning Hours

210

Minimum Units (CB07)

4

Maximum Units (CB06)

4

Prerequisites

MATH M03 (Intermediate Algebra) or High School Algebra II or placement as determined by the college's multiple measures assessment process.

Entrance Skills**Entrance Skills**

MATH M03

Prerequisite Course Objectives

MATH M03-solve linear and literal equations for a specified variable.

MATH M03-solve absolute value equations and absolute value inequalities.

MATH M03-determine if a relation is a function using the vertical line test and identify the domain.

MATH M03-graph linear equations and test whether two lines are parallel, perpendicular, or neither.

MATH M03-write the equation of a line in point-slope form, slope-intercept form, and standard form.

MATH M03-solve a system of equations in three variables by substitution or by the elimination method and solve applications.

MATH M03-factor polynomials including the sum and difference of cubes.

MATH M03-evaluate polynomial functions and solve polynomial equations by factoring and using the zero factor property.

MATH M03-simplify rational expressions, perform operations with rational expressions, simplify complex fractions, and determine the domain of a simple rational function.

MATH M03-divide by a polynomial using long division.

MATH M03-solve equations containing rational expressions and applications.

MATH M03-simplify rational exponent expressions using the properties of exponents and convert to radical notation.

MATH M03-put radical expressions into simplest radical form, perform operations with radicals, solve equations containing radical expressions, and determine domain of a simple radical function.

MATH M03-add, subtract, multiply and divide complex numbers.

MATH M03-solve quadratic equations by each of the following methods where applicable: factoring, the square root method, completing the square, and the quadratic formula.

MATH M03-solve equations that are in quadratic form and solve quadratic equations involving radicals and substitution.

MATH M03-solve non-linear inequalities in one variable.

MATH M03-graph quadratic functions showing the vertex and intercepts.

MATH M03-find the sum, difference, product, quotient, and composition of two functions.

MATH M03-identify one-to-one functions and use the horizontal line test to determine whether or not a function is one-to-one, and find the inverse of a one-to-one function.

MATH M03-describe the relationship between the function and its inverse geometrically and algebraically.

MATH M03-graph exponential and logarithmic functions, and convert equations from exponential form to logarithmic form and vice versa.

MATH M03-use logarithmic properties to rewrite logarithmic expressions and solve logarithmic and exponential equations and related applications.

Requisite Justification

Requisite Type

Prerequisite

Requisite

Math M03

Requisite Description

Course in a sequence

Level of Scrutiny/Justification

Content review

Student Learning Outcomes (CSLOs)

Upon satisfactory completion of the course, students will be able to:

- | | |
|---|--|
| 1 | evaluate functions, equations, and inequalities related to higher level concepts in preparation for Calculus. |
| 2 | determine all real and complex roots of a polynomial of degree three or higher using synthetic division, rational root theorem, and remainder theorem. |

Course Objectives

Upon satisfactory completion of the course, students will be able to:

- | | |
|----|--|
| 1 | state and apply the definition of a function and use the vertical line test. |
| 2 | evaluate functions at both numerical and algebraic domain values. |
| 3 | determine the domain and range of a relation or function given its equation or its graph. |
| 4 | form a new function from original functions using the functional operations of addition, subtraction, multiplication, division, and composition. |
| 5 | recognize the relationship between functions and their inverses algebraically and graphically. |
| 6 | graph the functions which yield the parabola, the absolute value, the cubic, the square root, the cube root, and ones defined piecewise; solve linear and radical equations, and absolute value equalities and inequalities, and use these graphs to model real-life applications. |
| 7 | test equations of graphs for symmetries about the x-axis, the y-axis, and the origin. |
| 8 | apply transformations to the graphs of functions. |
| 9 | graph a parabola given by a quadratic function. |
| 10 | give a rough sketch of the graph of a polynomial function of degree three or larger given its factored form. |
| 11 | determine the domain and range as well as the horizontal and vertical asymptotes of a rational function and use that information to graph it; be able to solve rational equations. |

- 12 graph exponential and logarithmic functions.
- 13 convert equations back and forth from exponential to logarithmic form.
- 14 apply the rules of logarithms involving logarithms of products, quotients, powers, and change of base and solve logarithmic functions, and use logarithms to solve real-life application problems.
- 15 solve exponential equations which have the same base on both sides and ones that do not have the same base on both sides of the equation by using logarithms, and use exponents to solve real-life application problems.
- 16 use the following theorems (over the complex numbers): Remainder, Factor, Fundamental Theorem of Algebra, Rational Roots (with synthetic division), and Conjugate Roots to solve polynomial equations.
- 17 solve systems of linear equations using substitution and addition (elimination) with two and three variables and determine consistency and dependency as germane.
- 18 solve systems of nonlinear equations and linear and non-linear systems of inequalities.
- 19 identify and analyze the algebraic representations of conic sections to determine their properties and sketch their graphs, including circles, ellipses and hyperbolas.
- 20 determine and identify terms for sequences and series, and evaluate sums for both finite and infinite series.
- 21 apply rational and polynomial equations and apply functions and other algebraic techniques to model real-world STEM applications.

Course Content

Lecture/Course Content

• 20% - Relations and Functions

1. Definition of a relation and of a function
2. Function notation
3. Domain and range determined from an equation or graph
4. Combining functions: addition, subtraction, multiplication, division and composition
5. One-to-one functions
6. Inverse functions
7. Solving linear and radical equations
8. Solving absolute value equalities and inequalities.

20% - Graphing Non-linear Equations and Functions

1. Graphs of basic non-linear functions
2. Graphs of functions including intercepts and vertices
3. Piecewise defined functions and graphs
4. Graph symmetry
5. Translation and reflection of graphs, including quadratic, absolute value and radical functions.
6. Graphing parabolas
7. Graphing circles
8. Graphing polynomial functions of degree 3 or higher
9. Graphing rational functions, including transformations
10. Graphing ellipses and hyperbolas

• 20% - Exponential and Logarithmic Functions

- a. Solving exponential equations with the same base
- b. Exponential functions and graphs, including transformations
- c. The natural exponential function and e
- d. Definition of logarithms
- e. Logarithmic functions and graphs, including transformations
- f. Rules of logarithms
- g. Solving exponential equations using logarithms
- h. Solving logarithmic equations

• 20% - Theory of Equations

- a. Solving rational equations
- b. Solutions to quadratic equations, including properties of complex numbers and complex roots
- c. Synthetic division

- d. Remainder Theorem, Factor Theorem, the Fundamental Theorem of Algebra, and Conjugate Roots Theorem (over the complex numbers)
- e. Partial Fraction Decomposition
- f. Binomial Theorem
- g. Upper and Lower Bound Theorem, the Location Theorem, and Descartes' Rules of Signs (optional*)
- **15% - System of Equations**
 - a. Solving systems of linear equations and inequalities
 - b. Classifying the consistency of the systems and the dependency of the equations
 - c. Gaussian elimination and Cramer's Rule
 - d. Solving systems of nonlinear equations and inequalities
- **5% - Sequences and Series.**
 - a. Sequences
 - b. Series
- Enrichment topics related to the study of MATH M05 also may be presented by the instructor if time allows, such as (1) matrices and determinants, (2) combinatorics and probability theory. Additional optional topics can be covered if time allows, but may be omitted without loss of continuity in the mathematics program.

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
 Essay exams
 Objective exams
 Problem-solving exams
 Quizzes
 Classroom Discussion
 Projects
 Participation

Instructional Methodology

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

Class activities
 Class discussions
 Collaborative group work
 Demonstrations
 Distance Education
 Group discussions
 Instructor-guided interpretation and analysis
 Lecture

Describe specific examples of the methods the instructor will use:

1. Use of whiteboard or overhead projector to demonstrate solutions to calculations, such as identifying zeros, roots, domains and asymptotes of polynomial or rational functions.
2. Classroom discussion, with student response, such as discussing the meaning of the definition of function.
3. In-class group activities, such as guided practice on solving various types of equations such as polynomial, exponential or logarithmic equations for numerical solutions.

Representative Course Assignments

Writing Assignments

1. Stating the answer to a mathematical problem in any of various forms, such as stating the answer to an inequality in interval notation or set builder notation.
2. Writing a short answer explaining the meaning of mathematical terms, such as the difference between relation, function, and one-to-one function.
3. Writing the interpretation of an answer to a mathematical problem, such as the meaning of the solution to an exponential equation, with proper labeling of units.

Critical Thinking Assignments

1. Interpret and describe the meaning of the solution to a mathematical application problem, such as an answer representing either time, an amount of money, or an interest rate in a compound interest application problem solved by using logarithms.
2. Describe and analyze the steps in solving a problem, such as identifying and labeling the several steps in solving a linear system in three variables, using Gaussian elimination.
3. Compare and contrast methods of solving a mathematical problem, such as determining whether to factor, complete the square, or apply the quadratic formula to solve a quadratic equation.

Reading Assignments

1. Reading concepts from the textbook, such as the description of the differences between a relation, function and one-to-one function.
2. Reading instructor created materials, such as a prepared handout describing the meaning of intercepts, roots, turning points and asymptotes in the graphs of functions.
3. Reading resource materials from the library or online concerning real-life applications of exponents and logarithms in economics and the sciences.

Skills Demonstrations

1. Demonstration of computational skills such as factoring or simplifying mathematical expressions.
2. Demonstration of understanding the meaning of an answer, such as interpreting the meaning of an ordered-pair answer in an application problem.
3. Demonstration of the proper use of a calculator in finding the numerical solution to an application problem involving exponents or logarithms, and expressing the answer with proper numerical rounding and proper labeling.

Outside Assignments

Representative Outside Assignments

1. Graded assignments, such as problem sets on solving linear systems in two variables by elimination and substitution methods, or problem sets on determining all solutions to logarithmic equations and eliminating extraneous solutions.
2. Additional problem sets assigned as homework from the book, such as practice on finding roots and asymptotes of rational functions, or practice on determining all complex roots of a quadratic function.
3. Individual or group assignments, such as viewing diagrams and graphs in textbooks illustrating the various shapes of graphs, such as those of exponential, logarithmic, polynomial or rational functions.

Articulation

C-ID Descriptor Number

MATH 151

Status

Aligned

Equivalent Courses at 4 year institutions

University	Course ID	Course Title	Units
UC Santa Cruz	MATH 2	College Algebra	5
CSU San Bernardino	Math 110	College Algebra	4
CSU Fullerton	Math 115	College Algebra	4

Comparable Courses within the VCCCD

MATH V04 - College Algebra
MATH R115 - College Algebra

Equivalent Courses at other CCCs

College	Course ID	Course Title	Units
Santa Monica College	MATH 4	College Algebra for STEM	4

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:

FALL 2019

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

DescriptionYoung, Cynthia Y. *College Algebra*. 4th ed., Wiley, 2017.**Resource Type**

Textbook

DescriptionBlitzer, Robert F. *College Algebra: An Early Functions Approach*. 4th ed., Pearson, 2018.**Resource Type**

Textbook

Classic Textbook

No

DescriptionSullivan, Michael. *College Algebra*. 11th ed., Pearson, 2020.**Resource Type**

Textbook

DescriptionDugopolski, Mark. *College Algebra*. 6th ed., Pearson, 2014.**Library Resources****Assignments requiring library resources**

Use of textbooks on reserve. Use of the Library's print and online resources to supplement application problems by researching models in biology, economics, engineering, sociological studies, and other models that require use of algebraic computations such as using exponents and logarithms.

Sufficient Library Resources exist

Yes

Example of Assignments Requiring Library Resources

Using library resources to explore applications of functions and graphing, such as finding examples of structures or natural phenomena that simulate various graphs and shapes, including using measurements to compute heights, widths, areas and volumes.

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

Hybrid (51%–99% online) Modality

On campus

Primary Minimum Qualification

MATHEMATICS

Review and Approval Dates

Department Chair

01/27/2022

Dean

01/31/2022

Technical Review

02/03/2022

Curriculum Committee

02/15/2022

DTRW-I

MM/DD/YYYY

Curriculum Committee

MM/DD/YYYY

Board

MM/DD/YYYY

CCCCO

MM/DD/YYYY

Control Number

CCC000602412

DOE/accreditation approval date

MM/DD/YYYY