CRC’s Mathematics program offers a comprehensive mathematics curriculum addressing the needs of both transfer and non-transfer students. The study of mathematics provides students with the ability to think logically and abstractly and to use problem-solving and computational skills necessary for success in any field of study.


MATHEMATICS DEPARTMENT (/ACADEMICS/MATHEMATICS)

DEAN  Ryan Cox (/about-us/contact-us/faculty-and-staff-directory/ryan-cox)  (916) 691-7537
DEPARTMENT CHAIR  Camille Moreno (/about-us/contact-us/faculty-and-staff-directory/camille-moreno)  (mailto:CoxR@crc.losrios.edu)

Associate Degrees for Transfer

A.S.-T. in Mathematics

The Associate in Science in Mathematics for Transfer degree is designed to meet common lower-division requirements for a major in mathematics at most California State University (CSU) campuses. Satisfactory completion of the CRC Associate in Science in Mathematics for Transfer (AS-T) degree provides a solid foundation and satisfies the standard prerequisites for upper division coursework for mathematics majors at most CSU and other four-year universities. However, it is highly recommended that students meet with a counselor since major and general education requirements vary for each college/university.

Catalog Date: January 1, 2020

Degree Requirements

<table>
<thead>
<tr>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 400</td>
<td>Calculus I</td>
<td>5</td>
</tr>
<tr>
<td>MATH 401</td>
<td>Calculus II</td>
<td>5</td>
</tr>
<tr>
<td>MATH 402</td>
<td>Calculus III</td>
<td>5</td>
</tr>
<tr>
<td>MATH 410</td>
<td>Introduction to Linear Algebra</td>
<td>3</td>
</tr>
<tr>
<td>MATH 420</td>
<td>Differential Equations</td>
<td>4</td>
</tr>
</tbody>
</table>
The Associate in Science in Mathematics for Transfer (AS-T) degree may be obtained by completion of 60 transferable, semester units with a minimum 2.0 GPA, including (a) the major or area of emphasis described in the Required Program, and (b) either the Intersegmental General Education Transfer Curriculum (IGETC) or the California State University General Education-Breadth Requirements.

Student Learning Outcomes

Upon completion of this program, the student will be able to:

- explain and apply basic concepts of single variable calculus including various forms of derivatives and integrals, their interconnections, and their uses in analyzing and solving real-world problems.
- explain and apply basic concepts of multivariable calculus, linear algebra, or differential equation techniques, their interconnections, and their uses in analyzing and solving real-world problems.
- prepare logical arguments and use them to prove basic mathematical theorems.
- solve real-world application problems using appropriate mathematical problem-solving skills.

Career Information

Mathematicians work as statisticians, analysts, computer programmers, actuaries, researchers, planners, and educators. NOTE TO TRANSFER STUDENTS: The Associate Degree for Transfer program is designed for students who plan to transfer to a campus of the California State University (CSU). Other than the required core, the courses you choose to complete this degree will depend to some extent on the selected CSU for transfer. In addition, some CSU-GE Breadth or IGETC requirements can also be completed using courses required for this associate degree for transfer major (known as "double-counting"). Meeting with a counselor to determine the most appropriate course choices will facilitate efficient completion of your transfer requirements. For students wishing to transfer to other universities (UC System, private, or out-of-state), the Associate Degree for Transfer may not provide adequate preparation for upper-division transfer admissions; it is critical that you meet with a CRC counselor to select and plan the courses for the major, as programs vary widely in terms of the required preparation.

Associate Degrees

A.S. in Mathematics

This degree is designed to provide a foundation in mathematics and to meet common lower-division requirements for a major in Mathematics or Statistics at many four-year institutions. It is highly recommended that students meet with a counselor because major and general education requirements vary for each college/university.
NOTE TO TRANSFER STUDENTS:
If you are interested in transferring to a four-year college or university to pursue a bachelor’s degree in Mathematics, it is critical that you meet with a CRC counselor to select and plan the courses for your major. Schools vary widely in terms of the required preparation. The courses that CRC requires for an Associate’s degree in Mathematics may be different from the courses required for the Bachelor’s degree.

Catalog Date: January 1, 2020

Degree Requirements

<table>
<thead>
<tr>
<th>COURSE CODE</th>
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<th>UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 400</td>
<td>Calculus I</td>
<td>5</td>
</tr>
<tr>
<td>MATH 401</td>
<td>Calculus II</td>
<td>5</td>
</tr>
<tr>
<td>MATH 402</td>
<td>Calculus III</td>
<td>5</td>
</tr>
<tr>
<td>MATH 420</td>
<td>Differential Equations</td>
<td>4</td>
</tr>
<tr>
<td>MATH 410</td>
<td>Introduction to Linear Algebra</td>
<td>3</td>
</tr>
</tbody>
</table>

A minimum of 4 units from the following:

<table>
<thead>
<tr>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>CISP 360</td>
<td>Introduction to Structured Programming</td>
<td>4</td>
</tr>
<tr>
<td>or CISP 370</td>
<td>Beginning Visual Basic</td>
<td></td>
</tr>
<tr>
<td>or CISP 400</td>
<td>Object Oriented Programming with C++</td>
<td>4</td>
</tr>
<tr>
<td>or CISP 401</td>
<td>Object Oriented Programming with Java</td>
<td></td>
</tr>
<tr>
<td>or STAT 300</td>
<td>Introduction to Probability and Statistics</td>
<td>4</td>
</tr>
</tbody>
</table>

Total Units: 26

The Mathematics Associate in Science (A.S.) degree may be obtained by completion of the required program, plus general education requirements, plus sufficient electives to meet a 60-unit total. See CRC graduation requirements.

Student Learning Outcomes

Upon completion of this program, the student will be able to:

- explain and apply basic concepts of single variable calculus including various forms of derivatives and integrals, their interconnections, and their uses in analyzing and solving real-world problems. (P-SLO #1)
- explain and apply basic concepts of multivariable calculus, linear algebra, or differential equation techniques, their interconnections, and their uses in analyzing and solving real-world problems. (P-SLO #2)
- prepare logical arguments and use them to prove basic mathematical theorems. (P-SLO #3)
- solve real-world application problems using appropriate mathematical problem-solving skills. (P-SLO #4)
- use mathematics in the context of computer programming or statistics. (P-SLO #5)
Career Information

Mathematicians work as statisticians, analysts, computer programmers, actuaries, researchers, planners, and educators. Most of these careers require education beyond the two-year college level.

Mathematics (MATH)

MATH 20 Arithmetic

| Units: | 5 |
| Hours: | 90 hours LEC |
| Prerequisite: | None. |
| Catalog Date: | January 1, 2020 |

This course provides instruction in the fundamentals of arithmetic with emphasis on computational skills. Topics include whole numbers, fractions, decimals, percents, ratios, proportions, problem solving, and applications.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

- **SLO (1):** CORRECTLY USE THE ORDER OF OPERATIONS TO EVALUATE EXPRESSIONS. ACCURATELY COMPUTE PROBLEMS INVOLVING THE BASIC OPERATIONS OF ARITHMETIC (ADDITION, SUBTRACTION, MULTIPLICATION, DIVISION, EXPONENTS, ORDER OF OPERATIONS) ON WHOLE NUMBERS, FRACTIONS, AND DECIMALS.

- Identify the prime numbers from 2 to 50. Use divisibility tests, factorization, and the concept of prime and composite to construct the least common multiple. Understand the process of rewriting a given number as the product of all distinct prime numbers.

- Express numeric information in one of the following three forms: fraction, percent, decimal.

- Convert numeric information into and out of scientific notation.

- Incorporate concepts of prime factorization and greatest common factor to simplify fractions.

- Evaluate problems involving ratios, proportions, and percents.

- Perform unit conversions for American measurements which involve length, capacity, weight, and times. Use the method of unit conversions to solve application problems.

- Demonstrate concepts of rounding and estimation of whole numbers and decimals to nearest place value.

- **SLO (2):** DEMONSTRATE THE ABILITY TO TRANSLATE MATHEMATICAL PROBLEMS IN WORD FORM TO AN EXPRESSION OR SINGLE VARIABLE EQUATION, AND SOLVE SINGLE VARIABLE ONE-STEP EQUATIONS.

- Translate simple English phrases and sentences into simple algebraic expressions and equations.

- Construct equations by translating information from word form to symbolic form with use of a variable.
MATH 30 Pre-Algebra Mathematics

**Units:** 5
**Hours:** 90 hours LEC
**Prerequisite:** MATH 20 with a grade of “C” or better; or equivalent skills demonstrated through the assessment process.
**Catalog Date:** January 1, 2020

This pre-algebra mathematics course emphasizes: fundamental operations on integers, fractions, and decimals; formulas involving geometric figures; measurement; and solving basic equations. Topics include: fractions; decimals; signed numbers; properties of exponents; scientific notation; conversions; metric system; square and cube roots; formula evaluation; solving equations; ratios; proportions; algebraic manipulations; descriptive statistics; the rectangular coordinate system; and elementary calculator use.

**Student Learning Outcomes**

Upon completion of this course, the student will be able to:

- SLO 1: ARTICULATE THE IMPORTANCE OF THE ORDER OF OPERATIONS AND HOW THEY RELATE TO THE REAL NUMBER SYSTEM, EXPRESSIONS, EQUATIONS AND EVALUATION OF MATHEMATICAL FORMULAS.
- Compute with accuracy problems involving the basic operations of arithmetic (addition, subtraction, multiplication, division, exponents, order of operations) on signed numbers.
- Multiply and divide numbers expressed in scientific notation.
- Simplify expressions involving variables by adding, subtracting, multiplying, dividing, or reducing.
- Use and evaluate formulas with more than one variable.
- Demonstrate accurate use of the properties of real numbers and the exponent rules in addition, subtraction, and multiplication of polynomials.
SLO 2: DEMONSTRATE THE ABILITY TO RECOGNIZE KEY WORDS OR PHRASES THAT WOULD GUIDE ONE THROUGH THE TRANSLATION OF A MATHEMATICAL PROBLEM IN WORD FORM TO AN ALGEBRAIC EXPRESSION OR EQUATION.

- Solve applied problems using signed numbers, variable expressions, scientific notation, and equations.
- Solve linear equations in one variable involving signed numbers, fractions, and decimals.
- Directly translate equations in word form to symbolic form with use of variables and solve them.

SLO 3: INVESTIGATE AND MODEL REAL LIFE PHENOMENA THROUGH THE USE OF LINEAR EQUATIONS IN TWO VARIABLES AND THEIR CORRESPONDING GRAPHS (ALGEBRAICALLY AND GEOMETRICALLY), AND THINK CRITICALLY ABOUT HOW THE MATHEMATICS IS RELEVANT TO ONE’S LIFE.

- Find solutions to linear equations in two variables and plot these points on the two-dimensional coordinate system.
- Interpret graphs of two-dimensional data, such as bar graphs, line graphs and pie charts.

SLO 4: UTILIZE AND APPLY THE METHOD OF DIMENSIONAL ANALYSIS (OR UNIT ANALYSIS) TO COMPARE AND CONVERT QUANTITIES.

- Solve applied problems using measurement conversions, proportions, and percent.
- Perform accurate computations involving measurement conversion.

SLO 5: POSSESS THE ABILITY TO RECOGNIZE PATTERNS, ORGANIZE MATHEMATICAL THOUGHTS, AND INCREASE THE LEVEL OF ABSTRACT THINKING THAT IS ESSENTIAL FOR REAL LIFE PROBLEM SOLVING.

MATH 70 Arithmetic Skills Lab

<table>
<thead>
<tr>
<th>Units:</th>
<th>0.25 - 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours:</td>
<td>13.5 - 108 hours LAB</td>
</tr>
<tr>
<td>Prerequisite:</td>
<td>None.</td>
</tr>
<tr>
<td>Corequisite:</td>
<td>MATH 20</td>
</tr>
<tr>
<td>Catalog Date:</td>
<td>January 1, 2020</td>
</tr>
</tbody>
</table>

This laboratory course provides the student with assistance in arithmetic skills via enrollment in the campus' Math Center. It is recommended for students who are encountering difficulties in the areas of math anxiety, basic skills, problem solving, and/or arithmetic concepts. Students may enter the Skills Lab course at any time during the first 12 weeks of the semester. It is recommended that the student register for 0.25 units. This recommended unit enrollment will require the student to spend a minimum of 13.5 hours throughout the semester in the Math Center studying for the relevant course. Students can take this course again in subsequent semesters until 2.0 total units have been completed. Students must be concurrently enrolled in an arithmetic-level course (MATH 20 - 29) in order to enroll in MATH 70. Placement into this Skills Lab can be made through student request, instructor recommendation, or an assessment process. This course is graded on a pass/no-pass basis.

Student Learning Outcomes

Upon completion of this course, the student will be able to:
MATH 71 Pre-Algebra Skills Lab

<table>
<thead>
<tr>
<th>Units:</th>
<th>0.25 - 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours:</td>
<td>13.5 - 108 hours LAB</td>
</tr>
<tr>
<td>Prerequisite:</td>
<td>None.</td>
</tr>
<tr>
<td>Corequisite:</td>
<td>MATH 30</td>
</tr>
<tr>
<td>Catalog Date:</td>
<td>January 1, 2020</td>
</tr>
</tbody>
</table>

This laboratory course provides the student with assistance in pre-algebra skills via enrollment in the campus' Math Center. It is recommended for students who are encountering difficulties in the areas of math anxiety, basic skills, problem solving, algebraic manipulations and/or algebra concepts. Students may enter the Skills Lab course at any time during the first 12 weeks of the semester. It is recommended that the student register for 0.25 units. This recommended unit enrollment will require the student to spend a minimum of 13.5 hours throughout the semester in the Math Center studying for the relevant course. Students can take this course again in subsequent semesters until 2.0 total units have been completed. Students must be concurrently enrolled in a pre-algebra-level course (MATH 30 - 39) in order to enroll in MATH 71. Placement into this Skills Lab can be made through student request, instructor recommendation, or an assessment process. This course is graded on a pass/no-pass basis.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

- SLO(1): BUILD STUDY SKILLS AND LEARNING STRATEGIES NEEDED FOR CONTINUED SUCCESS IN MATHEMATICS EDUCATION.
  - demonstrate improved math study skills.
  - exhibit increased confidence level in approaching mathematics.
- SLO(2): UTILIZE MATHEMATICAL SKILLS IN A VARIETY OF CONTEXTS.
  - demonstrate an improved performance at the prealgebra level.
- SLO(3): FORMULATE STRATEGIES AND CHOOSE AN APPROPRIATE COMBINATION OF TECHNIQUES FOR SOLVING APPLIED PROBLEMS.
  - employ problem solving strategies to improve specific course skills.
• employ problem solving strategies to improve specific course skills.

MATH 72 Elementary Algebra Skills Lab

<table>
<thead>
<tr>
<th>Units:</th>
<th>0.25 - 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours:</td>
<td>13.5 - 108 hours LAB</td>
</tr>
<tr>
<td>Prerequisite:</td>
<td>None.</td>
</tr>
<tr>
<td>Corequisite:</td>
<td>MATH 100, 101, or 102</td>
</tr>
<tr>
<td>Catalog Date:</td>
<td>January 1, 2020</td>
</tr>
</tbody>
</table>

This laboratory course provides the student with assistance in elementary algebra skills via enrollment in the campus' Math Center. It is recommended for students who are encountering difficulties in the areas of math anxiety, basic skills, problem solving, algebraic manipulations and/or algebra concepts. Students may enter the Skills Lab course at any time during the first 12 weeks of the semester. It is recommended that the student register for 0.25 units. This recommended unit enrollment will require the student to spend a minimum of 13.5 hours throughout the semester in the Math Center studying for the relevant course. Students can take this course again in subsequent semesters until 2.0 total units have been completed. Students must be concurrently enrolled in an elementary algebra-level course (MATH 100 - 109) in order to enroll in MATH 72. Placement into this Skills Lab can be made through student request, instructor recommendation, or an assessment process. This course is graded on a pass/no-pass basis.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

• SLO(1): BUILD STUDY SKILLS AND LEARNING STRATEGIES NEEDED FOR CONTINUED SUCCESS IN MATHEMATICS EDUCATION.

• demonstrate improved math study skills.

• exhibit increased confidence level in approaching mathematics.

• SLO(2): UTILIZE MATHEMATICAL SKILLS IN A VARIETY OF CONTEXTS.

• demonstrate an improved performance at the elementary algebra level.

• SLO(3): FORMULATE STRATEGIES AND CHOOSE AN APPROPRIATE COMBINATION OF TECHNIQUES FOR SOLVING APPLIED PROBLEMS.

• employ problem solving strategies to improve specific course skills.

MATH 73 Intermediate Algebra/Math Literacy Skills Lab
This laboratory course provides the student with assistance in intermediate algebra skills via enrollment in the campus’ Math Center. It is recommended for students who are encountering difficulties in the areas of math anxiety, basic skills, problem solving, algebraic manipulations and/or intermediate algebra concepts. Students may enter the Skills Lab course at any time during the first 12 weeks of the semester. It is recommended that the student register for 0.25 units. This recommended unit enrollment will require the student to spend a minimum of 13.5 hours throughout the semester in the Math Center studying for the relevant course. Students can take this course again in subsequent semesters until 2.0 total units have been completed. Students must be concurrently enrolled in an intermediate algebra-level course (MATH 120 - 129), including any mathematical literacy course (MATH 140 - 149) in order to enroll in MATH 73. Placement into this Skills Lab can be made through student request, instructor recommendation, or an assessment process. This course is graded on a pass/no-pass basis.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

- SLO(1): BUILD STUDY SKILLS AND LEARNING STRATEGIES NEEDED FOR CONTINUED SUCCESS IN MATHEMATICS EDUCATION.
- demonstrate improved math study skills.
- exhibit increased confidence level in approaching mathematics.
- SLO(2): UTILIZE MATHEMATICAL SKILLS IN A VARIETY OF CONTEXTS.
- demonstrate an improved performance at the intermediate algebra level.
- SLO(3): FORMULATE STRATEGIES AND CHOOSE AN APPROPRIATE COMBINATION OF TECHNIQUES FOR SOLVING_APPLIED_PROBLEMS.
- employ problem solving strategies to improve specific course skills.

MATH 74 Statistics/Geometry Skills Lab

<table>
<thead>
<tr>
<th>Units:</th>
<th>0.25 - 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours:</td>
<td>13.5 - 108 hours LAB</td>
</tr>
<tr>
<td>Prerequisite:</td>
<td>None.</td>
</tr>
<tr>
<td>Corequisite:</td>
<td>MATH 110 or STAT 300</td>
</tr>
<tr>
<td>Catalog Date:</td>
<td>January 1, 2020</td>
</tr>
</tbody>
</table>
This laboratory course provides the student with assistance in statistics and/or geometry skills via enrollment in the campus' Math Center. It is recommended for students who are encountering difficulties in the areas of math anxiety, basic skills, problem solving, algebraic manipulations, statistics and/or geometry concepts. Students may enter the Skills Lab course at any time during the first 12 weeks of the semester. It is recommended that the student register for 0.25 units. This recommended unit enrollment will require the student to spend a minimum of 13.5 hours throughout the semester in the Math Center studying for the relevant course. Students can take this course again in subsequent semesters until 2.0 total units have been completed. Students must be concurrently enrolled in a statistics (STAT 300) or Geometry (MATH 110) course in order to enroll in MATH 74. Placement into this Skills Lab can be made through student request, instructor recommendation, or an assessment process. This course is graded on a pass/no-pass basis.

<table>
<thead>
<tr>
<th>Student Learning Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upon completion of this course, the student will be able to:</td>
</tr>
<tr>
<td>• SLO(1): BUILD STUDY SKILLS AND LEARNING STRATEGIES NEEDED FOR CONTINUED SUCCESS IN MATHEMATICS EDUCATION.</td>
</tr>
<tr>
<td>• demonstrate improved math study skills.</td>
</tr>
<tr>
<td>• exhibit increased confidence level in approaching mathematics.</td>
</tr>
<tr>
<td>• SLO(2): UTILIZE MATHEMATICAL SKILLS IN A VARIETY OF CONTEXTS.</td>
</tr>
<tr>
<td>• demonstrate an improved performance at the statistics and/or geometry level.</td>
</tr>
<tr>
<td>• SLO(3): FORMULATE STRATEGIES AND CHOOSE AN APPROPRIATE COMBINATION OF TECHNIQUES FOR SOLVING APPLIED PROBLEMS.</td>
</tr>
<tr>
<td>• employ problem solving strategies to improve specific course skills.</td>
</tr>
</tbody>
</table>

MATH 75 Skills Lab for Miscellaneous Non-Transferable Math

| Units: | 0.25 - 2 |
| Hours: | 13.5 - 108 hours LAB |
| Prerequisite: | None. |
| Catalog Date: | January 1, 2020 |

This laboratory course provides the student with assistance in all non-transfer-level math courses via enrollment in the campus' Math Center. It is recommended for students who are encountering difficulties in the areas of math anxiety, basic skills, problem solving, algebraic manipulations, and/or algebra concepts. Students may enter the Skills Lab course at any time during the first 12 weeks of the semester. It is recommended that the student register for 0.25 units. This recommended unit enrollment will require the student to spend a minimum of 13.5 hours throughout the semester in the Math Center studying for the relevant course. Students can take this course again in subsequent semesters until 2.0 total units have been completed. Students must be concurrently enrolled in a non-transferable math course (MATH 20 – 199) in order to enroll in MATH 75. MATH 75 should only be used as a Skills Lab if there is not already a relevant Skills Lab course available that better fits the student's main math course. Placement into this Skills Lab can be made through student request, instructor recommendation, or an assessment process. This course is graded on a pass/no-pass basis.
Student Learning Outcomes

Upon completion of this course, the student will be able to:

- SLO(1): BUILD STUDY SKILLS AND LEARNING STRATEGIES NEEDED FOR CONTINUED SUCCESS IN MATHEMATICS EDUCATION.
- demonstrate improved math study skills.
- exhibit increased confidence level in approaching mathematics.

- SLO(2): UTILIZE MATHEMATICAL SKILLS IN A VARIETY OF CONTEXTS.
- demonstrate an improved performance at the non-transferable math level.

- SLO(3): FORMULATE STRATEGIES AND CHOOSE AN APPROPRIATE COMBINATION OF TECHNIQUES FOR SOLVING APPLIED PROBLEMS.
- employ problem solving strategies to improve specific course skills.

MATH 76 Trigonometry/Precalculus Skills Lab

<table>
<thead>
<tr>
<th>Units:</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Hours:</td>
<td>13.5 - 108 hours LAB</td>
</tr>
<tr>
<td>Prerequisite:</td>
<td>None.</td>
</tr>
<tr>
<td>Corequisite:</td>
<td>MATH 335 or 370</td>
</tr>
<tr>
<td>Catalog Date</td>
<td>January 1, 2020</td>
</tr>
</tbody>
</table>

This laboratory course provides the student with assistance in trigonometry and/or precalculus (including college algebra) skills via enrollment in the campus' Math Center. It is recommended for students who are encountering difficulties in the areas of math anxiety, advanced algebra skills, problem solving, trigonometric concepts, functions, graphs, etc. Students may enter the Skills Lab course at any time during the first 12 weeks of the semester. It is recommended that the student register for 0.25 units. This recommended unit enrollment will require the student to spend a minimum of 13.5 hours throughout the semester in the Math Center studying for the relevant course. Students can take this course again in subsequent semesters until 2.0 total units have been completed. Students must be concurrently enrolled in a trigonometry (MATH 335) or precalculus (MATH 370) course in order to enroll in MATH 76. Placement into this Skills Lab can be made through student request, instructor recommendation, or an assessment process. This course is graded on a pass/no-pass basis.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

- SLO(1): BUILD STUDY SKILLS AND LEARNING STRATEGIES NEEDED FOR CONTINUED SUCCESS IN MATHEMATICS EDUCATION.
- demonstrate improved math study skills.
- exhibit increased confidence level in approaching mathematics.
MATH 77 Calculus I/II Skills Lab

<table>
<thead>
<tr>
<th>Units:</th>
<th>0.25 - 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours:</td>
<td>13.5 - 108 hours LAB</td>
</tr>
<tr>
<td>Prerequisite:</td>
<td>None.</td>
</tr>
<tr>
<td>Corequisite:</td>
<td>MATH 350, 351, 400, or 401</td>
</tr>
<tr>
<td>Catalog Date:</td>
<td>January 1, 2020</td>
</tr>
</tbody>
</table>

This laboratory course provides the student with assistance in differential and/or integral calculus skills via enrollment in the campus' Math Center. It is recommended for students who are encountering difficulties in the areas of math anxiety, advanced algebra skills, problem solving, calculus concepts, etc. Students may enter the Skills Lab course at any time during the first 12 weeks of the semester. It is recommended that the student register for 0.25 units. This recommended unit enrollment will require the student to spend a minimum of 13.5 hours throughout the semester in the Math Center studying for the relevant course. Students can take this course again in subsequent semesters until 2.0 total units have been completed. Students must be concurrently enrolled in a differential or integral calculus course (MATH 350, 351, 400 or 401) in order to enroll in MATH 77. Placement into this Skills Lab can be made through student request, instructor recommendation, or an assessment process. This course is graded on a pass/no-pass basis.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

- SLO(1): BUILD STUDY SKILLS AND LEARNING STRATEGIES NEEDED FOR CONTINUED SUCCESS IN MATHEMATICS EDUCATION.
- demonstrate improved math study skills.
- exhibit increased confidence level in approaching mathematics.
- SLO(2): UTILIZE MATHEMATICAL SKILLS IN A VARIETY OF CONTEXTS.
- demonstrate an improved performance at the differential and/or integral calculus level.
- SLO(3): FORMULATE STRATEGIES AND CHOOSE AN APPROPRIATE COMBINATION OF TECHNIQUES FOR SOLVING APPLIED PROBLEMS.
- employ problem solving strategies to improve specific course skills.
MATH 78 Calculus III/DE/Linear Algebra Skills Lab

This laboratory course provides the student with assistance in multi-variable calculus, differential equations, and linear algebra skills via enrollment in the campus' Math Center. It is recommended for students who are encountering difficulties in the areas of math anxiety, advanced algebra skills, problem solving, calculus concepts, etc. Students may enter the Skills Lab course at any time during the first 12 weeks of the semester. It is recommended that the student register for 0.25 units. This recommended unit enrollment will require the student to spend a minimum of 13.5 hours throughout the semester in the Math Center studying for the relevant course. Students can take this course again in subsequent semesters until 2.0 total units have been completed. Students must be concurrently enrolled in a multi-variable calculus (MATH 402), linear algebra (MATH 410), or differential equations (MATH 420) course in order to enroll in MATH 78. Placement into this Skills Lab can be made through student request, instructor recommendation, or an assessment process. This course is graded on a pass/no-pass basis.

### Student Learning Outcomes

Upon completion of this course, the student will be able to:

- **SLO(1):** BUILD STUDY SKILLS AND LEARNING STRATEGIES NEEDED FOR CONTINUED SUCCESS IN MATHEMATICS EDUCATION.
  - demonstrate improved math study skills.
  - exhibit increased confidence level in approaching mathematics.
- **SLO(2):** UTILIZE MATHEMATICAL SKILLS IN A VARIETY OF CONTEXTS.
  - demonstrate an improved performance at the vector calculus, differential equations, and/or linear algebra level.
- **SLO(3):** FORMULATE STRATEGIES AND CHOOSE AN APPROPRIATE COMBINATION OF TECHNIQUES FOR SOLVING APPLIED PROBLEMS.
  - employ problem solving strategies to improve specific course skills.

MATH 79 Skills Lab for Miscellaneous Transferable Math

<table>
<thead>
<tr>
<th>Units:</th>
<th>0.25 - 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours:</td>
<td>13.5 - 108 hours LAB</td>
</tr>
<tr>
<td>Prerequisite:</td>
<td>None.</td>
</tr>
<tr>
<td>Catalog Date:</td>
<td>January 1, 2020</td>
</tr>
</tbody>
</table>
This laboratory course provides the student with assistance in all transfer-level math courses via enrollment in the campus' Math Center. It is recommended for students who are encountering difficulties in the areas of math anxiety, advanced algebra skills, problem solving, trigonometry, calculus, etc. Students may enter the Skills Lab course at any time during the first 12 weeks of the semester. It is recommended that the student register for 0.25 units. This recommended unit enrollment will require the student to spend a minimum of 13.5 hours throughout the semester in the Math Center studying for the relevant course. Students can take this course again in subsequent semesters until 2.0 total units have been completed. Students must be concurrently enrolled in a transfer-level math course (MATH 300 and above) in order to enroll in MATH 79. MATH 79 should only be used as a Skills Lab if there is not already a relevant Skills Lab course available that better fits the student's main math course. Placement into this Skills Lab can be made through student request, instructor recommendation, or an assessment process. This course is graded on a pass/no-pass basis.

### Student Learning Outcomes

Upon completion of this course, the student will be able to:

- **SLO(1): BUILD STUDY SKILLS AND LEARNING STRATEGIES NEEDED FOR CONTINUED SUCCESS IN MATHEMATICS EDUCATION.**
  - demonstrate improved math study skills.
  - exhibit increased confidence level in approaching mathematics.
- **SLO(2): UTILIZE MATHEMATICAL SKILLS IN A VARIETY OF CONTEXTS.**
  - demonstrate an improved performance at the transferable math level.
- **SLO(3): FORMULATE STRATEGIES AND CHOOSE AN APPROPRIATE COMBINATION OF TECHNIQUES FOR SOLVING APPLIED PROBLEMS.**
  - employ problem solving strategies to improve specific course skills.

---

**MATH 81 Academic Skills in Mathematics**

<table>
<thead>
<tr>
<th>Units:</th>
<th>0.25 - 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours:</td>
<td>13.5 - 324 hours LAB</td>
</tr>
<tr>
<td>Prerequisite:</td>
<td>None.</td>
</tr>
<tr>
<td>Catalog Date:</td>
<td>January 1, 2020</td>
</tr>
</tbody>
</table>

This course is designed for students concurrently enrolled in MATH 20, 30, 100, 101, 102, 110, 120, 125, or 144; placement can be made through student request, instructor recommendation, or an assessment process. This laboratory course provides assistance in math skills to students enrolled in a non-transferable mathematics course. Students may enter the course at any time during the first 12 weeks of the semester and earn 0.25 or 0.5 units. This course is graded on a pass/no-pass basis. MATH 81 is recommended for students who are encountering difficulties in the areas of math anxiety, basic skills, algebraic concepts or manipulation, graphing, problem solving, etc.

### Student Learning Outcomes

Upon completion of this course, the student will be able to:
MATH 82 Academic Skills in Mathematics for Transfer Level

<table>
<thead>
<tr>
<th>Units:</th>
<th>0.25 - 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours:</td>
<td>13.5 - 324 hours LAB</td>
</tr>
<tr>
<td>Prerequisite:</td>
<td>None.</td>
</tr>
<tr>
<td>Catalog Date:</td>
<td>January 1, 2020</td>
</tr>
</tbody>
</table>

This course is designed for students concurrently enrolled in MATH 300, MATH 310, MATH 315, MATH 335, MATH 341, MATH 343, MATH 344, MATH 350, MATH 351, MATH 370, MATH 400, MATH 401, MATH 402, MATH 410, MATH 420, or STAT 300. This laboratory course provides assistance in math skills to students enrolled in a transferable mathematics or statistics course. Students may enter the course at any time during the first 12 weeks of the semester and earn 0.25 or 0.5 units. This course is graded on a pass/no-pass basis. MATH 82 is recommended for students who are encountering difficulties in the areas of math anxiety, basic skills, algebraic concepts or manipulations, graphing, statistics, problem solving, etc.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

- SLO(1): BUILD STUDY SKILLS AND LEARNING STRATEGIES NEEDED FOR CONTINUED SUCCESS IN MATHEMATICS EDUCATION.
- apply problem solving strategies to improve specific skills at the appropriate course level.
- exhibit increased confidence level in approaching mathematics.
- SLO(2): UTILIZE MATHEMATICAL SKILLS IN A VARIETY OF CONTEXTS.
- demonstrate an improved performance at the appropriate course level.
- SLO(3): FORMULATE STRATEGIES AND CHOOSE AN APPROPRIATE COMBINATION OF TECHNIQUES FOR SOLVING APPLIED PROBLEMS.
- employ problem solving strategies to improve specific course skills.
MATH 83 Self Study Mathematics Modules

<table>
<thead>
<tr>
<th>Units:</th>
<th>0.25 - 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours:</td>
<td>13.5 - 54 hours LAB</td>
</tr>
<tr>
<td>Prerequisite:</td>
<td>None.</td>
</tr>
<tr>
<td>Catalog Date:</td>
<td>January 1, 2020</td>
</tr>
</tbody>
</table>

The course enables students to review specific math topics which are necessary for success in MATH 20, MATH 30, MATH 100 or any course requiring the skills taught in these classes. Learning objectives and the course of study will be designed for each individual based on the needs of the student. A partial list of modules includes fractions, decimals, signed number arithmetic, percent, simplifying algebraic expressions, factoring, and solving linear equations. Modules cannot replace any existing mathematics course, and successful completion of MATH 83 currently does not satisfy any mathematics prerequisite. MATH 83 is a credit/no-credit class and students can enroll in the class at any time during the semester.

**Student Learning Outcomes**

Upon completion of this course, the student will be able to:

- **SLO(1): UTILIZE MATHEMATICAL TERMINOLOGY AND ARTICULATE MATHEMATICAL CONCEPTS APPROPRIATE TO THE MODULE BEING STUDIED.**
  - Understand the terms and concepts covered by the module.

- **SLO(2): EMPLOY MATHEMATICAL SKILLS AT A MASTERY LEVEL.**
  - Practice using the skills covered in the module.
  - Demonstrate competency at an 80 percent level.

- **ANALYZE A MATHEMATICAL PROBLEM AND APPLY AN APPROPRIATE SET OF PROBLEM-SOLVING SKILLS.**
  - Complete a critical thinking exercise applying the skills of the module.

MATH 85 Math Study Skills

<table>
<thead>
<tr>
<th>Units:</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours:</td>
<td>18 hours LEC</td>
</tr>
<tr>
<td>Prerequisite:</td>
<td>None.</td>
</tr>
<tr>
<td>Catalog Date:</td>
<td>January 1, 2020</td>
</tr>
</tbody>
</table>
This course is designed to assist students in learning mathematics through the development of successful math study skills, specifically at the basic skills level (arithmetic, prealgebra, and beginning algebra). This course addresses topics such as learning styles, tools and techniques for reading a math textbook, using math homework as a learning tool, taking notes in a math class, preparing and taking exams/quizzes in a math class, and techniques for overcoming math anxiety. It is strongly advised that students be concurrently enrolled in a math course, as an opportunity to apply the learned material in real time. For further guidance and/or recommendations, students are advised to speak with someone in the math department.

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**Student Learning Outcomes**

Upon completion of this course, the student will be able to:

- **SLO#1: DEMONSTRATE AN UNDERSTANDING OF THE LEARNING PROCESS AS IT APPLIES TO MATHEMATICS AS SHOWN BY:**
  - Analyzing his/her current study habits and attitudes as they pertain to math courses
  - Distinguishing the differences between learning mathematics and learning other subjects
  - Classifying individual learning styles
- **SLO#2: RECOGNIZE AND APPLY VARIOUS STRATEGIES APPLICABLE TO A MATHEMATICS COURSE, SUCH AS:**
  - Listening and note-taking skills as they pertain to math courses
  - Applying study techniques, including but not limited to, how to read a math textbook and using math homework as a learning tool
  - Applying test-taking strategies and techniques as they pertain to math courses
  - Applying memorization techniques as they pertain to math courses
- **SLO#3: DEVELOP STRATEGIES TO LOWER ONE'S MATH ANXIETY LEVEL BY:**
  - Examining and assessing the sources and symptoms of math anxiety
  - Developing methods for reducing math anxiety to a productive level

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**MATH 100 Elementary Algebra**

| Units: | 5 |
| Hours: | 90 hours LEC |
| Prerequisite: | MATH 30 with a grade of “C” or better; or equivalent skills demonstrated through the assessment process. |
| Catalog Date: | January 1, 2020 |
This course includes the fundamental concepts and operations of algebra with problem solving skills emphasized throughout. Topics include: properties of real numbers, linear equations and inequalities, integer exponents, polynomials, factoring polynomials. Rational expressions and equations, radical expressions and equations, rational exponents, systems of linear equations and inequalities, the rectangular coordinate system, graphs and equations of lines, and solving quadratic equations.

<table>
<thead>
<tr>
<th>Student Learning Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Upon completion of this course, the student will be able to:</strong></td>
</tr>
<tr>
<td>• SLO#1: Use increased computational skills and number sense, recognize the order of operations and properties of real numbers; include evaluating various mathematical formulas and extending operations to variable expressions and combining like terms.</td>
</tr>
<tr>
<td>• Simplify expressions using the order of operations and basic properties of real numbers.</td>
</tr>
<tr>
<td>• Compute with accuracy problems involving the basic operations of arithmetic (addition, subtraction, multiplication, division, exponents, order of operations) on signed numbers.</td>
</tr>
<tr>
<td>• Multiply and divide numbers expressed in scientific notation.</td>
</tr>
<tr>
<td>• Use and evaluate formulas with more than one variable.</td>
</tr>
<tr>
<td>• SLO#2: Solve first degree equations, inequalities and applications.</td>
</tr>
<tr>
<td>• Identify the types of equations including conditional equations, contradiction and identity and techniques for their solution.</td>
</tr>
<tr>
<td>• Solve linear inequalities and write the solution in both set-builder and interval notation.</td>
</tr>
<tr>
<td>• Apply problem solving skills to construct equations and inequalities for application problems and solve the applications by solving the equations or inequalities and appropriately interpreting the results.</td>
</tr>
<tr>
<td>• SLO#3: Identify and analyze linear equations, and graphs of linear equations and linear inequalities.</td>
</tr>
<tr>
<td>• Interpret the slope of a line as a rate of change and graph a line.</td>
</tr>
<tr>
<td>• Generate an algebraic model for data that follows linear behavior and interpret the result of this model. Applications of linear models include linear growth, linear depreciations and rates.</td>
</tr>
<tr>
<td>• SLO#4: Apply mathematical terminology, symbols and operations to develop and extend arithmetic operations on polynomials and to evaluate polynomial expressions.</td>
</tr>
<tr>
<td>• Evaluate and expand polynomial expressions and expressions written in scientific notation.</td>
</tr>
<tr>
<td>• Apply rules of exponents (including negative exponents) to simplify algebraic expressions.</td>
</tr>
<tr>
<td>• Demonstrate proficiency in all arithmetic operations on polynomials, particularly multiplying using FOIL.</td>
</tr>
<tr>
<td>• Use operations on polynomials to solve certain polynomial equations and applications.</td>
</tr>
<tr>
<td>• SLO#5: Understand the concept of prime polynomials and factoring polynomials into primes using various techniques.</td>
</tr>
<tr>
<td>• Factor out common factors and factor by grouping.</td>
</tr>
<tr>
<td>• Factor the difference of two squares and factor trinomials including perfect square trinomials.</td>
</tr>
<tr>
<td>• Solve polynomial equations by factoring and using the zero factor property.</td>
</tr>
</tbody>
</table>
Think critically and abstractly by modeling an application problem using a polynomial equation to solve and interpret the result.

SLO#6: Simplify, combine and evaluate rational expressions using the operations of arithmetic.
Multiply and divide rational expressions and incorporate factoring to simplify to lowest terms.
Add and subtract rational expressions using the algebraic method and least common denominator.
Solve rational equations by multiplying by the least common denominator.
Use an appropriate rational equation to model an application problem to solve and interpret the results.

SLO #7: Solve systems of linear equations and systems of linear inequalities as well as their applications and effectively organize, present, and summarize the quantitative information using algebraic, numerical and graphical methods.
Calculate the solution to a 2x2 system of linear equations using the methods of graphing, substitution, and elimination, and identify the types of 2x2 systems.
Construct a system of linear equations for applications and solve the applications by solving the system and appropriately interpret the solution.
Compute the solution to a system of linear inequalities using a graph and describe the meaning of this solution.
SLO#8: Demonstrate with proficiency how to use arithmetic operations on radicals and simplify radical expressions.
Simplify different types of radicals, rationalize denominators and combine radicals when it is appropriate.
Solve radical equations and evaluate radical expressions.
Solve applied problems using radical equations and using the Pythagorean Theorem to solve triangles and applications.
Verify how to extend the definition of an exponent to a rational exponent and interpret a rational exponent as a radical.
Use radicals to solve quadratic equations by taking roots, completing the square and using the quadratic formula and employ quadratic equations in various applications.

MATH 101 Elementary Algebra - Part I

Units: 2
Hours: 36 hours LEC
Prerequisite: MATH 30 with a grade of "C" or better, or placement through the assessment process.
Catalog Date: January 1, 2020

This course presents the fundamental concepts and operations of algebra with problem solving and critical thinking skills incorporated throughout. Topics include: review of properties of real numbers and signed numbers; algebraic expressions, solving linear equations and inequalities; solving linear systems of equations; graphing, properties of exponents; operations on polynomials.
Student Learning Outcomes

Upon completion of this course, the student will be able to:

- **SLO#1**: Use increased computational skills and number sense, recognizing the order of operations and the basic operations and properties of real numbers, including evaluating various mathematical formulas and extend operations to variable expressions and combining like terms.

- Simplify expressions using the order of operations and basic properties of real numbers.

- Compute with accuracy problems involving the basic operations of arithmetic (addition, subtraction, multiplication, division, exponents, order of operations) on signed numbers.

- Multiply and divide numbers expressed in scientific notation.

- Use and evaluate formulas with more than one variable.

- **SLO#2**: Solve first degree equations and inequalities and applications.

- Identify the types of equations including consistent, contradiction and identity and demonstrate proficiency in techniques for their solution.

- Solve linear inequalities and writing the solution in both set-builder and interval notation.

- Apply problem solving skills to construct equations and inequalities for application problems and solve the application by solving the equation or inequality and appropriately interpreting the solution.

- **SLO#3**: Identify linear equations, and accurately graph linear equations using various techniques.

- Interpret the slope of a line as a rate of change and to graph a line.

- **SLO #4**: Solve systems of linear equations as well as their applications and effectively organize, present, and summarize the quantitative information using algebraic, numerical and graphical methods.

- Identify the types of 2x2 systems and calculate the solution to a 2x2 system of linear equations using the methods of graphing, substitution, and elimination.

- Construct a system of linear equations for applications and solve the applications by solving the system and appropriately interpreting the solution.

- **SLO#5**: Apply mathematical terminology, symbols and operations and develop and extend arithmetic operations to polynomials and evaluate polynomial expressions.

- Evaluate and expand polynomial expressions and expressions written in scientific notation.

- Apply rules of exponents (including negative exponents) in the simplification of algebraic expressions.

- Demonstrate proficiency in all arithmetic operations on polynomials, particularly multiplying using FOIL.

- Use operations on polynomials to solve certain polynomial equations and applications.
A continuation of MATH 101, this course presents the fundamental concepts and operations of algebra with problem solving and critical thinking skills incorporated throughout. Topics covered include: factoring and applications; operations on rational expressions and solving rational equations; rectangular coordinate systems; graphing lines and linear inequalities; equation of lines; roots and radical expressions; solving quadratic equations; complex numbers; continued study of problem solving and applications.

Upon completion of this course, the student will be able to:

- **SLO#1:** Understand the concept of prime polynomial and record the products of prime factors of polynomials using various techniques.
  - Factor out common factors and factor using grouping.
  - Factor difference of square expressions, and factoring trinomial expressions including perfect square trinomials.
  - Solve polynomial equations by factoring and using the zero factor property.
  - Think critically and abstractly by Modeling an application problem using a polynomial equation and solving and appropriately interpreting the solution.

- **SLO#2:** Simplify rational expressions and apply mathematical terminology, symbols, arithmetic operations and problem-solving on rational expressions.
  - Multiply and divide rational expressions and incorporate factoring to simplify to lowest terms.
  - Add rational equations using the algebraic method and least common denominator.
  - Solve rational equations by multiplying by the least common denominator.
  - Develop an appropriate rational equation to model an application problem and use problem-solving skills to solve interpreting the results.

- **SLO#3:** Identify and analyze linear equations, linear inequalities and effectively organize, present and summarize quantitative information using symbolic, numerical and graphical methods.
  - Generate an algebraic model for data that follows linear behavior and interpret the results of this model.
  - Applications of linear models including linear growth, linear depreciations and rates.
  - Graph a linear inequality, compute and interpret the solution to a system of linear inequalities using a graph.

- **SLO#4:** Demonstrate with proficiency how to use arithmetic operations on radicals, simplify radical expressions and solve radical and quadratic equations.
  - Simplify different types of radicals, rationalizing denominators and combining radicals when it is appropriate.
  - Solve radical equations and evaluate radical expressions.
• Solve applied problems using radical equations and using the Pythagorean Theorem to solve triangles and applications.

• Verify how to extend the definition of an exponent to a rational exponent and interpret a rational exponent as a radical.

• Present solutions by radicals of quadratics by taking roots, completing the square and the quadratic formula and employ quadratics in various applications.

**MATH 110 Elementary Geometry**

**Units:** 5
**Hours:** 90 hours LEC
**Prerequisite:** MATH 100 or 102 with a grade of "C" or better, or placement through the assessment process.
**General Education:** AA/AS Area II(b)
**Catalog Date:** January 1, 2020

This course introduces Euclidean Geometry. Topics include sets, definitions, postulates, theorems, deductive and inductive reasoning, proof, parallel lines, triangles, polygons, congruence, similarity, constructions, the Pythagorean Theorem, right triangle trigonometry, circles, analytic geometry, and elementary solid geometry.

**Student Learning Outcomes**

Upon completion of this course, the student will be able to:

• **SLO #1: DEMONSTRATE UNDERSTANDING OF THE STEP-BY-STEP DEVELOPMENT OF A LOGICAL MATHEMATICAL SYSTEM**
  - Clearly state and correctly use definitions, postulates, and theorems.
  - Write 2-column direct proofs, indirect proofs, and analytic proofs using the definitions, postulates, and theorems of Euclidean geometry.

• **SLO #2: DEVELOP PROBLEM-SOLVING SKILLS USED TO SOLVE CALCULATIONS.**
  - Find missing side lengths and angle measures in a diagram using appropriate theorems.
  - Find areas of planar figures, surface area and volume of solids.
  - Analyze diagrams in the Cartesian coordinate system.
  - Develop a fundamental understanding and application of right triangle trigonometry.

• **SLO #3: CONSTRUCT PROOFS TO VERIFY GEOMETRIC RELATIONSHIPS.**
  - Write 2-column direct proofs, indirect proofs, and analytic proofs using the definitions, postulates, and theorems of Euclidean geometry.

• **SLO #4: PERFORM GEOMETRIC CONSTRUCTIONS USING A COMPASS AND STRAIGHTEDGE, AND USE A PROTRACTOR TO MEASURE ANGLES**
  - Construction of parallel lines, perpendicular lines
MATH 120 Intermediate Algebra

Units: 5
Hours: 90 hours LEC
Prerequisite: MATH 100 or 102 with a grade of "C" or better; or equivalent skills demonstrated through the assessment process.
General Education: AA/AS Area II(b)
Catalog Date: January 1, 2020

This course extends the concepts of elementary algebra with problem solving skills and applications emphasized throughout. Topics which are briefly reviewed and subsequently extended include: solving equations (quadratic, radical, rational, and systems of linear equations), graphing linear equations, simplifying expressions (polynomial, rational, radical, and those involving integer exponents), and factoring polynomials. New topics include: solving more complex equations and inequalities (exponential, logarithmic, linear and quadratic inequalities, and systems of non-linear equations), graphing more complex equations (quadratics, circles, and various functions using transformations), functions and their properties, exponential and logarithmic functions and their properties.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

- **SLO 1:** Identify and analyze linear behavior, models, and graphs of linear equations and linear inequalities. Utilize the properties of linear equations to solve linear inequalities, and solve absolute value equations and inequalities <ul><li>interpret the slope of a linear equation as a rate of change.</li><li>generate an algebraic model for data that follows linear behavior and interpret the results of this model.</li><li>sketch the graph of a linear inequality using its algebraic representation.</li></ul>

- **SLO 2:** Solve systems of linear equations and systems of linear inequalities as well as their applications graphically and algebraically <ul><li>calculate the solution to 2x2 and 3x3 systems of linear equations by using substitution, elimination, and graphs (for 2x2 systems), as well as determine whether a system is inconsistent, consistent and independent, or dependent.</li><li>construct systems of linear equations for applications and find their solution.</li><li>compute the solution to a system of linear inequalities using a graph and describe the meaning of this solution.</li></ul>

- **SLO 3:** Recognize the behavior of exponential and logarithmic functions and their graphs. Apply the properties of exponential and logarithmic expressions to simplify and solve equations involving such expressions <ul><li>evaluate algebraic expressions involving exponents and logarithms and convert between these two types of expressions.</li><li>produce the algebraic model of an exponential function using data points and use properties of exponential functions to derive conclusions.</li><li>employ the properties of exponents and logarithms to solve equations involving exponential and logarithmic expressions.</li><li>draw the graph of exponential and logarithmic functions using both point plotting and the properties of transformations.</li><li>consolidate and expand logarithmic expressions using the properties of logarithms.</li></ul>
- **SLO 4:** Identify, simplify, evaluate, and graph quadratic functions using the properties of quadratic functions and transformations. Demonstrate the properties of transformations by graphing a quadratic function, identifying the vertex and the intercepts with the axes. Choose from among factoring (and using the Zero Factor Property), extraction of roots, completing the square, or the quadratic formula to solve a quadratic equation. Apply properties of quadratic functions to create and solve quadratic models and to derive conclusions about the solutions.

- **SLO 5:** Simplify polynomial expressions, evaluate polynomial functions, and solve equations involving polynomial expressions and their applications. Investigate polynomial division by performing long division on polynomial expressions. Extend factoring techniques to include the sum and difference of cubes. Adapt factoring to include expressions that are quadratic in form. Graph a circle given its equation in standard form as well as use the distance and midpoint formulas to find the equation of a circle given conditions.

- **SLO 6:** Simplify and solve rational and radical expressions and equations (including those with higher roots). Perform arithmetic on rational and radical expressions and write results in simplified form. Simplify complex fractions. Manipulate equations involving rational or radical expressions to arrive at a non-extraneous solution. Recognize and solve applications that involve rational or radical expressions.

- **SLO 7:** Use, interpret, and simplify functions, inverse functions, and combination functions. Understand and use the definition of a function and interpret the difference between a relation and a function. Describe the domain and range of functions. Compose the graph of a function from tabular data, a word problem, or algebraic form. Perform composition of functions as well as arithmetic on combinations of functions. Find the inverse of a function algebraically and graphically. Interpret the meaning of the inverse in application problems.

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**MATH 125 Intermediate Algebra with Applications**

**Units:** 4  
**Hours:** 72 hours LEC  
**Prerequisite:** MATH 100 or 102 with a grade of "C" or better; or equivalent skills demonstrated through the assessment process.  
**General Education:** AA/AS Area II(b)  
**Catalog Date:** January 1, 2020

This course is designed for the intermediate algebra student who plans to continue only into STAT 300, PSYC 330, MATH 300, MATH 310, or MATH 315. The course topics include linear behavior, functions and graphs, exponential and logarithmic functions, systems, and polynomial, rational, exponential, logarithmic and radical expressions and equations. This course will feature discovery activities, applications to real data sets and problems which are current and relevant.

**Student Learning Outcomes**

Upon completion of this course, the student will be able to:

- **SLO 1:** ANALYZE AND FIND BEST FIT EQUATIONS FOR REAL WORLD DATA GIVEN IN MANY FORMS.
- Organize information into any/all of its four forms: words, data tables, graphs, and algebraic equations.
• Design an accurately scaled and labeled scatterplot of data, use a best fit line to examine linear trends, interpret the meaning of slope as a rate of change.

• Accurately graph and analyze functions; use linear, quadratic, and exponential functions to model real world applications and interpret real data.

• Distinguish arithmetic and geometric progressions; develop formulas for arithmetic and geometric sequences; use summation notation to calculate finite series.

• SLO 2: SOLVE EQUATIONS AND INEQUALITIES WHICH COME FROM APPLIED PROBLEMS.

• Simplify and evaluate rational and radical expressions, compositions, exponentials and logarithms; solve linear, quadratic, rational, radical, exponential, logarithmic, and literal equations.

• Accurately solve absolute value inequalities and systems of linear equations; use systems of equations to solve applied problems.

MATH 144 Math for Contemporary Careers

| Units: | 3 |
| Hours: | 54 hours LEC |
| Prerequisite: | MATH 100 or 102 with a grade of “C” or better, or placement through the assessment process. |
| General Education: | AA/AS Area II(b) |
| Catalog Date: | January 1, 2020 |

In the current information age, what mathematics should every person know? This course examines the contributions of mathematics in today's world. Students will explore mathematics' on-going role in society beginning with the need for and development of number systems, logical thinking, and current processes for coding and decoding data. A major focus of the course will be contemporary methods for analyzing data and interpreting statistics to make informed decisions. Students will conclude the course by selecting a module of mathematical interest from a list of available topics drawn from vocational programs and contemporary careers such as automotive technology, construction technology, film, digital media and broadcasting, medical records, pharmacy technology or other emerging career fields.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

• SLO 1: EXPLORE THE ORIGINS AND CULTURAL CONTRIBUTIONS OF EARLY NUMBER SYSTEMS INCLUDING WRITING AND CALCULATING IN OTHER SYSTEMS

• Translate numbers in early and modern numeration systems.

• Examine the diverse cultural history of early and modern numeration systems.

• SLO 2: ENCODE AND DECODE USING CRYPTOGRAPHY & OTHER CODING SYSTEMS

• Calculate and translate numerical information in non-decimal base systems fundamental to computer programming and other digital systems.
MATH 295 Independent Studies in Mathematics

<table>
<thead>
<tr>
<th>Units:</th>
<th>1 - 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours:</td>
<td>54 - 162 hours LAB</td>
</tr>
<tr>
<td>Prerequisite:</td>
<td>None.</td>
</tr>
<tr>
<td>Catalog Date:</td>
<td>January 1, 2020</td>
</tr>
</tbody>
</table>

An independent studies project involves an individual student or small group of students in study, research, or activities beyond the scope of regularly offered courses. See the current catalog section of “Special Studies” for full details of Independent Studies.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

- SLO #1: Actively engage in intellectual inquiry beyond that required in order to pass a course of study (College Wide Learning Outcome – Area 4).
- Discuss and outline a proposal of study (that can be accomplished within one semester term) with a supervising instructor qualified within the discipline.
- Design an independent study (to be completed individually or by collaboration of a small group) to foster special knowledge, skills, and experience that are not available in any one regularly scheduled course.
- Use information resources to gather discipline-specific information.
- SLO #2: Utilize modes of analysis and critical thinking to apply theoretical perspectives and/or concepts in the major discipline of study to significant problems and/or educational activities (College Wide Learning Outcome – Area 3).
- Analyze and apply the knowledge, skills and experience that are involved in the independent study to theoretical perspectives and/or concepts in the major discipline of study.
- Explain the importance of the major discipline of study in the broader picture of society.
- SLO #3: Communicate a complex understanding of content matter of the major discipline of study (College Wide Outcome – Area 3).
- Demonstrate competence in the skills essential to mastery of the major discipline of study that are necessary to accomplish the independent study.
- SLO #4: Identify personal goals and pursue these goals effectively (College Wide Outcome – Area 4).
- Utilize skills from the “academic tool kit” including time management, study skills, etc., to accomplish the independent study within one semester term.

### MATH 300 Introduction to Mathematical Ideas

| Units: | 3 |
| Hours: | 36 hours LEC; 54 hours LAB |
| Prerequisite: | MATH 120 or 125 with a grade of “C” or better; or equivalent skills demonstrated through the assessment process. |
| Transferable: | CSU; UC |
| General Education: | AA/AS Area II(b); CSU Area B4; IGETC Area 2 |
| Catalog Date: | January 1, 2020 |

Introduction to Mathematical Ideas allows liberal arts students to meet general education mathematics requirements while exploring concepts and objects of mathematics in a meaningful way. This course is designed to show some of the essence and quality of mathematics, and to enhance precision in the evaluation and expression of ideas, thereby developing a student’s quantitative reasoning skills. It is recommended primarily for students who do not plan to major in a math-related field, but may be of interest to others as well. Course content may include topics from numeration systems, logic, geometry, probability, statistics, algebraic modeling, number theory, consumer mathematics, graph theory, voting and apportionment, and perhaps others; concepts of contemporary mathematics may be covered. Emphasis is placed on the deductive process.

### Student Learning Outcomes

Upon completion of this course, the student will be able to:

- SLO 1: Categorize and analyze mathematical objects and apply them to real life problems
- define and setup tables, diagrams, graphs, and matrices
- SLO 2: Solve mathematical problems from different branches of mathematics
- manipulate and solve problems relating to algebra
- apply basic geometric axioms, definitions, and theorems to solve geometric problems
- recognize principles of counting techniques to determine number of ways to select members from a group for a specific task
- compute mean, median, mode, range, standard deviation, and variance of a set of data
- SLO 3: Interpretations of mathematical objects in a variety of analytical settings and performing different operations to combine these objects
- recognize different representations of sets and performing different set operations to combine sets
- apply the logic properties to assess the validity of an argument
- SLO 4: Apply the mathematical concepts or objects to assess a situation, make decisions, and solve the real life problems
- assess the risks and rewards of credit cards and investments, and select the optimal path for a delivery route
- create an efficient schedule, select a fair method for dividing valuable assets, and evaluate the efficiency of an algorithm
- SLO 5: Defend some aspects of the mathematics used in real life applications
- investigate and solve real life problems such as home mortgage loans and student loans
- pursue the meaning of mathematics through the history of different numeration system and the progression of mathematics

MATH 310 Mathematical Discovery

| Units: | 3 |
| Hours: | 54 hours LEC |
| Prerequisite: | MATH 110 or Geometry; AND MATH 120 or 125 with a grade of "C" or better; or equivalent skills demonstrated through the assessment process. |
| Transferable: | CSU |
| General Education: | AA/AS Area II(b); CSU Area B4 |
| Catalog Date: | January 1, 2020 |

This course is designed to introduce students to the spirit of mathematics by involving them in the mathematical process of exploration, conjecture, and proof. Students will explore mathematical patterns and relations, formulate conjectures, and prove their conjectures. Areas of mathematics from which content may be derived include number theory, statistics, probability, geometry, and sequences and series. This course is recommended for students interested in a career in education.

Student Learning Outcomes

Upon completion of this course, the student will be able to:
MATH 315 Exploratory Field Experience in Mathematics

| Units: | 3 |
| Hours: | 36 hours LEC; 54 hours LAB |
| Prerequisite: | MATH 120 or 125 with a grade of “C” or better; or equivalent skills demonstrated through the assessment process. |
| Transferable: | CSU; UC |
| General Education: | AA/AS Area III(b) |
| Catalog Date: | January 1, 2020 |

This course is an education-based field experience in mathematics designed to allow students to explore learning styles, learning environments and learning methods as they apply to tutoring and teaching mathematics. While exploring teaching as a career choice, students will have the opportunity to learn and practice essential skills to motivate and assist younger students with their progress through the mathematics curriculum. Students will be assigned to area schools to observe and assist in a mathematics classroom and to work with selected students in structured one-on-one or group settings. Weekly seminars will allow students to share experiences and compare observations. Students will also have the opportunity to explore their own cognitive learning styles and consider how these learning styles relate to mathematics both as learner and as teacher. Students will have the opportunity to learn about social, cultural, and educational issues related to mathematics and the school environment. This course is recommended for students considering a major in teaching preparation who may wish to pursue either a multiple subject credential or a single subject credential in mathematics. Prior to beginning work in the schools, students may be required to be fingerprinted and pass a TB test. This course may be taken two times for credit.

Upon completion of this course, the student will be able to:
SLO 1: UNDERSTAND LEARNING
- relate the learning process and the study of mathematics as the integration of the visual, auditory, psycho-social, and cognitive functioning.
- examine various tools used to assess learning, learning styles and cognitive processes.
- evaluate learning styles and teaching methods for their positive or negative effect on learning mathematics.

SLO 2: LEARN STRATEGIES AND APPROACHES TO REACH THE MATHEMATICS LEARNER
- examine and experience alternate approaches to teaching various topics in mathematics that use multiple learning modalities and enhance the learning process.
- understand and apply questioning strategies and other techniques for assisting student learning.
- understand and apply principles of motivation, behavior modification and memory enhancement as they apply to the unmotivated and unskilled learner.
- demonstrate critical thinking, problem solving and informed decision making in analyzing areas of mathematical weakness, preparing lessons and implementing strategies to address the identified topics from the pre-algebra/algebra sequence.

SLO 3: REFLECT ON TUTORING EXPERIENCES AND CLASSROOM ENVIRONMENTS IN ORDER TO COMPARE AND EVALUATE THEIR EFFECT ON STUDENT LEARNING
- evaluate and compare individual experiences with learning styles and teaching approaches for different mathematics topics and different student learners.
- compare observations related to the social, cultural and educational environment in the mathematics classroom and examine how a student's environment can impact learning.

SLO 4: GAIN A POSITIVE EDUCATIONAL EXPERIENCE IN A MATHEMATICS CLASSROOM
- validate personal career goals related to teaching as a career.

MATH 335 Trigonometry with College Algebra

| Units: | 5 |
| Hours: | 90 hours LEC |
| Prerequisite: | MATH 110 or Geometry; AND MATH 120; both with a grade of "C" or better; or equivalent skills demonstrated through the assessment process. |
| Transferable: | CSU |
| General Education: | AA/AS Area II(b); CSU Area B4 |
| Catalog Date: | January 1, 2020 |

This is a full trigonometry course with algebra concepts reviewed, extended, and integrated when they are relevant to the trigonometric concepts. The trigonometric topics include right triangle trigonometry, unit circle trigonometry, graphs of trigonometric functions, proofs of trigonometric identities, solving trigonometric equations, applications of trigonometric functions (law of sines and cosines), and inverse trigonometric functions. The algebra topics include exponential and logarithmic functions, complex numbers, conic sections, the polar coordinate system, and solving equations, inequalities, and systems of equations.
Student Learning Outcomes

Upon completion of this course, the student will be able to:

- **SLO#1:** Cite the six fundamental trigonometric functions and be able to interpret and evaluate them
- define the trigonometric functions using right triangles and/or the unit circle
- evaluate the trigonometric functions using reference angles and special triangles
- calculate the values of the trigonometric functions using a calculator with angles in both degrees and radians

- **SLO#2:** Solve application problems by modeling them with appropriate functions
- recognize what type of function might be best to use in a given situation to model an applied problem
- distinguish between the various ways of solving application problems with trigonometric methods including the use of right triangles, oblique triangles, the law of sines, and the law of cosines
- use a polynomial, rational, exponential, logarithmic, or trigonometric function to model and solve an application
- analyze applications involving exponential and logarithmic growth and decay

- **SLO#3:** Graph a library of functions including trigonometric, polynomial, rational, absolute value, exponential, and logarithmic functions
- recognize a base graph when given the formula for a complex function
- employ the use of translations, reflections and nonrigid transformations to graph a function once the base graph is known
- express the domain and range of a function in interval notation given a formula or a graph of the function
- recognize important characteristics of graphs of functions including asymptotic behavior, periodic behavior, zeros, and end behavior patterns
- identify a function as even, odd or neither and be able to prove result
- extend quadratic functions to include methods for finding vertices, finding and interpreting intercepts, and minimizing and maximizing functions
- graph points and curves in the polar coordinate system

- **SLO#4:** Categorize types of equations, systems and inequalities and methods used to solve them
- employ algebraic and graphical methods to solve polynomial, rational, and absolute value equations, systems and inequalities
- use matrix methods to solve systems of equations including the Gauss-Jordan method
- recognize when to use logarithms to solve an equation
- integrate algebraic techniques with known identities to prove trigonometric identities
- solve trigonometric equations and be able to express solutions when restricted to an interval or when there are an infinite number of solutions
Student Learning Outcomes

Upon completion of this course, the student will be able to:

- **SLO 1: SIMPLIFY ALGEBRAIC EXPRESSIONS AND SOLVE ALGEBRAIC EQUATIONS RELATED TO BUSINESS PROBLEMS.**
- Formulate expressions and equations important in business (e.g., profit, average cost, supply and demand, etc.).
- Understand the concepts and definitions of intercepts and intersection point between two lines to find the intersection point between two lines.
- **SLO 2: EVALUATE LIMITS AND DERIVATIVES OF ALGEBRAIC, EXPONENTIAL, AND LOGARITHMIC FUNCTIONS.**
- Use the definition of the limits to calculate the limits of algebraic, exponential, and logarithmic functions.
Use graphs, tables, and a variety of algebraic skills to compute limits.

Calculate derivatives of algebraic functions using the Power, Product, Quotient, and Chain rules.

SLO 3: APPLY THE LIMITS AND DERIVATIVE TO BUSINESS APPLICATIONS.

Interpret the derivative to solve the optimization problems.

Apply the derivative to marginal cost, revenue, and profit analysis.

SLO 4: COMPARE, CONTRAST, AND COMPUTE DEFINITE AND INDEFINITE INTEGRALS; UNDERSTAND THE RELATIONSHIP BETWEEN INTEGRAL AND ANTIDERIVATIVE.

Evaluate definite integrals using the Fundamental Theorem of Calculus.

Calculate antiderivatives of various functions using substitution, integration by parts, and other methods.

Formulate solutions to applications in business such as consumer and producer surplus models that require integration.

SLO 5: STUDY MULTIVARIABLE FUNCTIONS AND ITS GRAPHS.

Analyze functions of several variables, three-dimensional coordinates and graphs, and its relevance to business.

Generate partial derivatives and then apply them to find extreme values of functions.

Apply Lagrange multipliers and Least Squares Method to predict business models.

MATH 343 Modern Business Mathematics

<table>
<thead>
<tr>
<th>Units:</th>
<th>4</th>
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<tbody>
<tr>
<td>Hours:</td>
<td>72 hours LEC</td>
</tr>
<tr>
<td>Prerequisite:</td>
<td>MATH 120 with a grade of &quot;C&quot; or better, or placement through the assessment process.</td>
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<tr>
<td>Transferable:</td>
<td>CSU</td>
</tr>
<tr>
<td>General Education:</td>
<td>AA/AS Area II(b); CSU Area B4</td>
</tr>
<tr>
<td>Catalog Date:</td>
<td>January 1, 2020</td>
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</tbody>
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This course is designed around applications of mathematics in an economic and business context. The major topics included are functions, finance (interest and exponential models), rates of change, optimization, and linear programming. The content of the course is structured to incorporate tables, graphs and data sets collected from real-world situations. This course is not recommended for mathematics or physical science majors.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

- SLO 1: Understand and apply the mathematics of finance
- Calculate and interpret simple, compound, and continuously compounded interest
- Calculate monthly payments and form an amortization schedule
MATH 350 Calculus for the Life and Social Sciences I

Units: 3
Hours: 54 hours LEC
Prerequisite: MATH 335 with a grade of "C" or better; or equivalent skills demonstrated through the assessment process.
Transferable: CSU; UC (1) MATH 341, 350, 355 and 400 combined: maximum transfer credit of one course; 2) MATH 350, 351, 355, 356, 400, 401, & 402 combined: maximum transfer credit of one series.)
General Education: AA/AS Area II(b); CSU Area B4; IGETC Area 2
Catalog Date: January 1, 2020

This course is an introduction to calculus. Topics include functions, trigonometric functions, limits, analytic geometry, and differential calculus with applications to business, social, and biological sciences. This course is intended for students majoring in social and biological sciences.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

- SLO 1: Evaluate and understand limits
- calculate limits of algebraic and trigonometric functions.
- estimate limits from tables or graphs.
- SLO 2: Derive and apply the derivative.
• formulate the derivatives of algebraic, trigonometric, exponential, and logarithmic functions using the power rule, product rule, quotient rule and chain rule.

• use the derivative to calculate rates of change and optimizations.

• SLO 3: Integrate algebraic functions.

• integrate functions using the power rule, substitution and parts.

• apply differential equations to growth and decay

• SLO 4: Investigate and model real life phenomenon using calculus.

• Apply the concepts and principles of calculus to find rates of change in populations, bacteria, blood flow, ecology, learning, drug absorption and other biological and life science situations.

MATH 351 Calculus for the Life and Social Sciences II

<table>
<thead>
<tr>
<th>Units:</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours:</td>
<td>54 hours LEC</td>
</tr>
<tr>
<td>Prerequisite:</td>
<td>MATH 350 with a grade of &quot;C&quot; or better</td>
</tr>
<tr>
<td>Transferable:</td>
<td>CSU; UC (1) MATH 351, MATH 356 and MATH 401 combined: maximum credit, 1 course; 2) MATH 350, 351, 355, 356, 400, 401, &amp; 402 combined: maximum transfer credit of one series.</td>
</tr>
<tr>
<td>General Education:</td>
<td>AA/AS Area II(b); CSU Area B4; IGETC Area 2</td>
</tr>
<tr>
<td>Catalog Date:</td>
<td>January 1, 2020</td>
</tr>
</tbody>
</table>

This course is a continuation of Math 350. Topics include: definite and indefinite integrals, power series, analytic geometry, multivariate calculus, and differential equations with applications to business, social, and biological sciences. Not open to students who have received credit for MATH 401 or higher level mathematics course. See “Cross-Listed Courses” in the catalog.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

• SLO #1: COMPARE AND CONTRAST BETWEEN THE CONCEPTS OF DERIVATIVES, ANTIDERIVATIVES, AND INTEGRALS.

• Demonstrate an understanding of the concept of an antiderivative. Apply the techniques of the basic integration formulas to perform indefinite and definite integrals.

• Apply the antiderivative and the Fundamental Theorem of Calculus to differentiate relationships between derivatives and integrals.

• SLO #2: APPROXIMATE AND INTERPRET THE INTEGRAL IN ALGEBRAIC, GRAPHICAL, AND NUMERICAL CONTEXTS TO MODEL AND SOLVE APPLICATION PROBLEMS.

• Solve and interpret applications such as areas bounded by curves, average value, or total rate of change.

• Recognize and choose the appropriate method of integrals and set up the integrals for different types of application problems.
SLO # 3: DETERMINE AN APPROPRIATE METHOD FOR INTEGRATING A FUNCTION.

Apply the methods of substitution, integration by parts, trigonometric substitution, numerical integration, integration using tables, etc. to perform the definite and indefinite integral.

Demonstrate an understanding of the concept of an improper integral. Utilize the concepts of limit and continuity to evaluate some classes of improper integrals.

SLO #4: EVALUATE DERIVATIVES AND MULTIPLE INTEGRALS.

Analyze surfaces and graph functions of two variables in the three-dimensional coordinate system.

Compute partial derivatives.

Apply partial derivatives to find a maximum and/or minimum of multivariable functions.

Use LaGrange multiplier and methods of least squares for linear regression.

Demonstrate techniques of multiple integrals and compute iterated integration over rectangular and general regions.

Apply multiple integrals in problem solving situations involving area, volume, surface area, etc.

SLO #5: CONSTRUCT A MATHEMATICAL MODEL BY GATHERING AND ANALYZING DATA, IDENTIFYING KEY VARIABLES, AND ESTABLISHING EQUATIONS RELATING THOSE VARIABLES.

Construct and solve elementary first order linear differential and separable equations.

Apply differential equations using exponential growth and decay, learning curves, and logistic growth models.

SLO #6: ESTIMATE COMPLICATED FUNCTIONS BY USING SIMILAR FUNCTIONS TO GET AN APPROXIMATION.

Define sequences and series and determine convergence or divergence of them.

Construct Taylor series to represent elementary functions.

Apply power series and Taylor polynomials to the integration of functions not integrable by conventional methods.

MATH 355 Calculus for Biology and Medicine I

| Units: | 4 |
| Hours: | 72 hours LEC |
| Prerequisite: | MATH 335 with a grade of "C" or better, or placement through the assessment process. CSU; UC (1) MATH 341, 350, 355 and 400 combined: maximum transfer credit of one course; 2) MATH 350, 351, 355, 356, 400, 401, & 402 combined: maximum transfer credit of one series. |
| Transferable: | AA/AS Area II(b); CSU Area B4; IGETC Area 2 |
| General Education: | |
| Catalog Date: | January 1, 2020 |
This course is an introduction to differential calculus and elementary differential equations via applications in biology and medicine. It covers limits, derivatives of polynomials, trigonometric and exponential functions, graphing, and applications of the derivative to biology and medicine. Topics include the Fundamental Theorem of Calculus and techniques of integration, including integral tables and numerical methods.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

- **SLO#1: EXAMINE THE GRAPHS AND LIMITS OF FUNCTIONS.**
  - Examine elementary functions and their graphs.
  - Explore discrete models of exponential growth and decay, log-log/semi-log graphing, discrete biological models, fixed points/steady states, stability, periodic solutions and chaos.
  - Evaluate and interpret limits: the definition of limits, continuity of functions, the intermediate value theorem, the bisection method, trigonometric limits, and limits at infinity.

- **SLO #2: DIFFERENTIATE POLYNOMIAL, RADICAL, TRIGONOMETRIC, LOGARITHMIC, AND EXPONENTIAL FUNCTIONS.**
  - Explore the definition of derivative, geometric interpretation of derivative, the derivative as rate of change, the differentiability of functions, and the properties of derivatives.
  - Learn and apply the basic rules for differentiation: the power rule, product rule, quotient rule and chain rule.
  - Differentiate exponential, logarithmic and trigonometric functions.
  - Extend differentiation methods to include implicit differentiation, related rates, higher-order derivatives, linear approximation and L'Hopital's Rule.

- **SLO#3: GRAPH, ANALYZE & OPTIMIZE FUNCTIONS.**
  - Calculate maxima and minima and explore monotonicity and concavity of elementary functions and other graphs including sigmoidal curves.
  - Test the stability of fixed points in differential equations and apply the Newton-Raphson method for numerical root finding.

- **SLO#4: APPLY DERIVATIVES TO APPLICATIONS IN BIOLOGY AND MEDICINE.**
  - Apply the concepts and principles of calculus to find rates of change in populations, bacteria, blood flow, ecology, learning, drug absorption and other biological and life science situations.

- **SLO#5: INTEGRATE BASIC ELEMENTARY FUNCTIONS.**
  - Apply the Fundamental Theorem of Calculus to the evaluation of definite integrals.
  - Integrate functions using the power rule, substitution, integration by parts, and partial fraction decomposition.
  - Explore numerical integration, tables of integrals and Taylor approximation.

- **SLO #6 SOLVE DIFFERENTIAL EQUATIONS.**
MATH 356 Calculus for Biology and Medicine II

4
72 hours LEC

Prerequisite: MATH 355 with a grade of "C" or better, or placement through the assessment process.

Transferable: CSU; UC (1) MATH 351, MATH 356 and MATH 401 combined: maximum credit, 1 course; 2) MATH 350, 351, 355, 356, 400, 401, & 402 combined: maximum transfer credit of one series.

General Education: AA/AS Area II(b); CSU Area B4; IGETC Area 2

January 1, 2020

This course covers matrix algebra with eigenvalues and eigenvectors, systems of linear equations, functions of several variables, partial derivatives, systems of differential equations, and applications to biology and medicine.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

- SLO #1: SOLVE SYSTEMS OF EQUATIONS.
  - Use matrices, matrix operations and determinants to solve systems of linear equations.
  - Compute eigenvalues and eigenvectors for square matrices.
  - Solve linear systems of ordinary differential equations (ODEs).
  - Apply systems of linear differential equations to problems in biology and medicine.
  - Solve nonlinear systems of ordinary differential equations and apply these methods to biological models.

- SLO #2: EXLORE FUNCTIONS OF TWO OR MORE VARIABLES.
  - Evaluate and interpret limits and continuity of multivariate functions.

- SLO #3: DIFFERENTIATE MULTIVARIATE FUNCTIONS.
  - Compute partial derivatives of functions of several variables.
  - Interpret partial derivatives as slopes and rates of change.
  - Apply the chain rules for multivariate functions and parameterized curves.
  - Implicitly differentiate multivariate functions.

- SLO #4: ANALYZE & OPTIMIZE MULTIVARIATE FUNCTIONS.
  - Graph functions of two variables and calculate equations of tangent planes to the graph.
Find extrema of multivariate functions, identify local and global extrema and solve applications involving extrema.

Optimize multivariate functions and optimize multivariate functions with constraints.

Find the gradient vector and directional derivatives and interpret directional derivatives as slopes and rates of change.

SLO #5: INTEGRATE MULTIVARIATE FUNCTIONS.

Compute and evaluate double integrals on multivariate functions.

Solve applications of double integrals.

SLO #6: COMPUTE PROBABILITIES FOR BIOLOGICAL SITUATIONS AND OTHER CHANCE OUTCOMES.

Apply counting principles, permutations, and combinations to biological situations.

Compute probabilities using basic probability rules, conditional probability, independence, Bayes’ formula, and Bayesian probability and apply these methods to biological models and events.

Explore probability distributions of discrete random variables and use discrete probability distributions to solve applications in biology and medicine.

MATH 370 Pre-Calculus Mathematics

| Units: | 5 |
| Hours: | 90 hours LEC |
| Prerequisite: | MATH 335 with a grade of "C" or better; or equivalent skills demonstrated through the assessment process. |
| Transferable: | CSU; UC |
| General Education: | AA/AS Area II(b); CSU Area B4; IGETC Area 2 |
| Catalog Date: | January 1, 2020 |

This course is designed to prepare students for the calculus sequence (MATH 400, 401, 402). Course content includes a brief review followed by an in-depth extension of the properties of polynomial, rational, exponential, logarithmic, and trigonometric functions. Additional topics include systems of linear and non-linear equations and inequalities, conic sections, sequences and series, analytic geometry, vectors, parametric, and polar equations. A graphing calculator may be required for this course.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

- SLO1: WORK WITH MATHEMATICAL EXPRESSIONS AND SOLVE MATHEMATICAL EQUATIONS.
- Evaluate, expand, and simplify algebraic, exponential, logarithmic, and trigonometric expressions.
- Expand binomial expressions by using the binomial theorem.
- SLO2: GRAPH AND ANALYZE FUNDAMENTAL MATHEMATICAL FUNCTIONS AND EQUATIONS IN BOTH RECTANGULAR AND POLAR COORDINATE SYSTEMS.
- Graph and analyze polynomial, rational, absolute value, exponential, logarithmic, trigonometric functions, and inverse trigonometric functions, as well as conic sections, involving algebraic transformations (shifts, scale factors, reflections, and absolute value) in rectangular coordinate system.

- Graph and analyze polar equations.

- Use algebraic techniques in combination with a graphing calculator to correctly analyze the graphs of functions composed of several basic functions.

- Model and solve "real world" problems using functions.

- SLO3: WORK WITH VECTORS, MATRICES, SEQUENCES, AND SERIES.
  - Demonstrate the use and properties of vectors, matrices, sequences, and series.
  - Model and solve "real world" problems using vectors, matrices, sequences, and series.

- SLO4: USE CORRECT LOGIC IN REASONINGS
  - Prove mathematical facts using algebraic manipulations, fundamental trigonometric identities, direct proof, indirect proof, and the principle of mathematical induction.
  - Identify and recognize different types of problems to be solved; select appropriate mathematical models and devise logical plans to solve the problems.

**MATH 400 Calculus I**

**Units:** 5

**Hours:** 90 hours LEC

**Prerequisite:** MATH 370 with a grade of "C" or better; or equivalent skills demonstrated through the assessment process.

**Transferable:** CSU; UC (1) MATH 341, 350, 355 and 400 combined: maximum transfer credit of one course; 2) MATH 350, 351, 355, 356, 400, 401, & 402 combined: maximum transfer credit of one series.

**General Education:** AA/AS Area II(b); CSU Area B4; IGETC Area 2

**C-ID:** MATH 210

**Catalog Date:** January 1, 2020

This course explores the basic concepts of analytic geometry, limits, derivatives, and integrals. Topics covered will include the graphs, derivatives, and integrals of algebraic, trigonometric, exponential, logarithmic, and hyperbolic functions, and indeterminate forms. Many applications will be covered, including those involving rectilinear motion, differentials, related rates, graphing, and optimization.

**Student Learning Outcomes**

Upon completion of this course, the student will be able to:

- SLO1: Evaluate limits of algebraic and transcendental functions.

- Use algebraic, graphical, and numerical approaches to evaluate limits; Use the epsilon-delta definition to prove limits
- Identify indeterminate forms and utilize L'Hospital's Rule
- SLO2: Use definition to prove a function is continuous at a real number.
- Determine whether a function is continuous at a real number from the left or from the right; Identify the interval(s) on which a function is continuous
- SLO3: Compute derivatives by using the definition of derivative and by applying differentiation rules to algebraic/transcendental and inverse functions.
- Compute derivatives by using implicit and logarithmic differentiation techniques
- SLO4: Recognize and solve real world problems that require use of limits and/or derivatives.
- Graph functions using the limits to find asymptotes, using the first derivative to find relative extreme values, using the second derivative to find concavity and inflection points, and generate equations of tangent/normal lines.
- Solve problems involving velocity, acceleration, related rates and optimization
- SLO5: Understand and apply the concept of the Riemann Sum to develop the formal definition of the definite integral and use the definition to evaluate definite integrals.
- Calculate definite integrals using the Fundamental Theorem of Calculus and appropriate substitution techniques
- Interpret definite integral as area and use it to find the area under a curve
- SLO6: Apply the definitions of limit, derivative, and integral to prove calculus theorems.
- Apply theorems such as the Intermediate Value Theorem, Rolle's Theorem, and the Mean Value Theorem to derive related theorems

**MATH 401 Calculus II**

**Units:** 5  
**Hours:** 90 hours LEC  
**Prerequisite:** MATH 400 with a grade of "C" or better  
**Transferable:** CSU; UC (1) MATH 351, MATH 356 and MATH 401 combined: maximum credit, 1 course; 2) MATH 350, 351, 355, 356, 400, 401, & 402 combined: maximum transfer credit of one series.  
**General Education:** AA/AS Area II(b); CSU Area B4; IGETC Area 2  
**C-ID:** C-ID MATH 220  
**Catalog Date:** January 1, 2020

This course is a continuation of MATH 400. Topics covered include techniques of integration, numerical integration, improper integrals, infinite series, parametric equations, polar coordinates, and conic sections. Many applications will be covered including those involving areas between plane regions, volumes of revolution, work, moments and concepts of mass, average value, arc length, and surface area.

**Student Learning Outcomes**

Upon completion of this course, the student will be able to:
- SLO#1: Understand the concept of using the limit of a Riemann sum to find areas and volumes.
- Calculate the area between two curves in a plane region
- Find the volume of a solid of revolution using the disk or washer method
- Find the volume of a solid of revolution using the cylindrical shell method
- Find the volume of a solid by using the method of slicing
- Analyze a problem to choose the best method to use to find an area or volume

- SLO#2: Understand and appropriately apply techniques of integration.
- Use the method of integration by parts
- Evaluate trigonometric integrals
- Use the method of trigonometric substitution
- Use partial fractions to integrate rational functions
- Approximate definite integrals using numerical methods including Midpoint Rule, Trapezoidal rule, and Simpson's rule
- Understand what improper integrals are and evaluate them by writing them as a limit of a proper integral
- Analyze a problem to choose the best method of integration
- Develop a strategy for integration techniques

- SLO#3: Understand other coordinate systems and how to apply calculus techniques to solve problems using them.
- Represent curves in parametric form and understand the calculus of parametric curves
- Represent curves in polar form and understand the calculus of polar curves
- Find areas, volumes, arc length, and surface area using Cartesian coordinates, polar coordinates and parametric equations

- SLO#4: Apply the techniques of integral calculus to solve applied problems.
- Apply calculus to physics and engineering problems
- Apply calculus to work and fluid force problems
- Apply calculus to find the average value of functions
- Apply calculus to solve separable differential equations and exponential growth and decay problems

- SLO#5: Understand the theory of series.
- Understand the definition of a sequence
- Understand the definition of a series
- Understand and apply both the basic comparison test and the limit comparison test
- Understand and apply the integral test
- Understand and apply the ratio and root tests
• Understand and apply the alternating series test
• Understand the difference between conditional and absolute convergence
• Develop a general strategy for testing series for convergence
• Identify power series and compute their radius and interval of convergence
• Represent functions as power series including Taylor and Maclaurin series
• Differentiate and integrate power series

MATH 402 Calculus III

5 units

50 hours LEC

Prerequisite: MATH 401 with a grade of "C" or better

Transferable: CSU; UC (MATH 350, 351, 400, 401 and 402 combined: maximum transfer credit of one series)

General Education: AA/AS Area II(b); CSU Area B4; IGETC Area 2

C-ID: MATH 230

Catalog Date: January 1, 2020

This course extends the concepts of limits, derivatives and integrals to vector-valued functions and functions of more than one variable. Topics covered will include three-dimensional analytic geometry and vectors, partial derivatives, multiple integrals, line integrals, surface integrals, and the theorems of Green, Gauss (Divergence), and Stokes. Many applications of the calculus will be included.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

• SLO 1: WORK WITH VECTORS AND GRAPHS IN BOTH TWO AND THREE DIMENSIONS.
• perform operations on vectors in R2 and R3, including the dot and cross products, limits, derivatives, and integrals.
• graph lines, planes, cylinders, and quadric surfaces in R3.
• find the equations of lines (in R3) and planes.
• find the distances between a point and a line, a point and a plane, two planes, two skew lines, etc.
• compute the curvature at any point on a space curve along with the tangential and normal components of acceleration, the arc length, and the unit tangent and unit normal vectors.

• SLO 2: EVALUATE FUNCTIONS OF MORE THAN ONE VARIABLE AS WELL AS THEIR LIMITS, CONTINUITY, AND DERIVATIVES, AND APPLY THEM TO REAL WORLD PROBLEMS.
• evaluate functions of more than one variable, find their domain and range, and sketch level curves and level surfaces.
- evaluate limits, prove limits using the epsilon-delta definition of a limit, show that limits do not exist using the "two path rule".
- examine the continuity for functions of more than one variable.
- evaluate partial derivatives and directional derivatives and find local extrema and test for saddle points.
- calculate the gradient and use it to find equations of tangent planes to surfaces in R3
- determine differentiability. calculate linearizations, differentials, and derivatives using the chain rule and apply them to real world problems.
- optimize a multivariate function on a space curve or plane region, including both local extrema and absolute extrema, the latter including the use of Lagrange multipliers to solve constraint problems.
- SLO 3 EVALUATE MULTIPLE INTEGRALS AND APPLY THEM TO REAL WORLD PROBLEMS.
- evaluate double and triple integrals using rectangular, polar, cylindrical, and spherical coordinate systems as well as change of variables using the Jacobian.
- calculate area, volume, mass, and center of mass using double and triple integrals.
- SLO 4: EVALUATE LINE INTEGRALS AND SURFACE INTEGRALS AND APPLY THEM TO THE APPROPRIATE REAL WORLD PROBLEMS.
- evaluate line integrals using parametrization, the Fundamental Theorem of Line Integrals, Green's Theorem, and Stokes' Theorem and apply them to real world problems, including work.
- evaluate surface integrals using parametrization and the Divergence Theorem and apply them to real world problems, including flux.
- Find the divergence and curl of a vector field.

MATH 410 Introduction to Linear Algebra

| Units: | 3 |
| Hours: | 54 hours LEC |
| Prerequisite: | MATH 401 with a grade of "C" or better |
| Advisory: | MATH 402 |
| Transferable: | CSU; UC |
| General Education: | AA/AS Area II(b); CSU Area B4; IGETC Area 2 |
| C-ID: | C-ID MATH 250 |
| Catalog Date: | January 1, 2020 |

This course introduces linear algebra. Topics include matrices, determinants, systems of equations, vector spaces, linear transformations, eigenvectors, and applications. This course is intended for majors in mathematics, engineering, science, and related fields.

<table>
<thead>
<tr>
<th>Student Learning Outcomes</th>
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</thead>
<tbody>
<tr>
<td>Upon completion of this course, the student will be able to:</td>
</tr>
</tbody>
</table>
• SLO 1: SOLVE SYSTEMS OF LINEAR EQUATIONS
  Solve systems of homogeneous and nonhomogeneous linear equations using Gaussian elimination, Gauss-Jordan elimination, and inverse matrices (in particular, the relationship between coefficient matrix invertibility and solutions to a system of linear equations).
  
  Solve vector equations
  Examine vector algebra on R^n
  Solve matrix equations.
  Construct rigorous mathematical proofs involving linear equations, vector equations, vector algebra on R^n, and matrix equations.

• SLO 2: EXAMINE BASES
  Test for linear independence of a set of vectors.
  Test for the span of a set of vectors.
  Construct a change of basis.
  Construct rigorous mathematical proofs involving independence, span, and basis.

• SLO 3: EXAMINE MATRICES
  Calculate the inverse of a matrix.
  Construct factorizations of matrices.
  Compute determinants of matrices.
  Examine special matrices: diagonal and triangular
  Construct rigorous mathematical proofs involving matrices.

• SLO 4: EXAMINE VECTOR SPACES AND LINEAR TRANSFORMATIONS
  Test the linearity of a transformation from one vector space to another.
  Test whether a linear transformation is an isomorphism.
  Compute the Kernel and Range of a linear transformation.
  Test a subset of a vector space to determine if it is a subspace of said vector space.
  Examine the Null Space and Column Space of a matrix.
  Construct rigorous mathematical proofs involving vector spaces.

• SLO 5: EXAMINE EIGENSPACES AND ORTHOGONALITY
  Calculate dot product, norm of a vector, the angle between vectors in R^n, eigenvalues and eigenvectors and their use in applications.
  Diagonalize matrices.
  Construct orthogonal bases using the Gram-Schmidt process.
  Examine symmetric matrices and orthogonally diagonalize them.
  Construct rigorous mathematical proofs involving eigenspaces and orthogonality.
MATH 420 Differential Equations

This course will cover the theory and the applications of the solutions of ordinary differential equations and systems of ordinary differential equations. The course will introduce students to various topics useful in the solution of differential equations including power series, Laplace transforms, matrices, eigenvalues and eigenvectors, and numerical methods.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

- SLO 1: SOLVE FIRST ORDER DIFFERENTIAL EQUATIONS AND APPLY THEM TO REAL WORLD PROBLEMS.
  - Apply the theory of first order differential equations, including existence and uniqueness theorems for ordinary differential equations.
  - Solve first order differential equations using separation of variables, exactness, linearity, and substitutions (including homogeneous differential equations).
  - Apply first order differential equations to real world problems, including exponential growth and decay, Newton's Law of Cooling, and mixture problems.

- SLO 2: SOLVE HIGHER ORDER DIFFERENTIAL EQUATIONS AND APPLY THEM TO REAL WORLD PROBLEMS.
  - Examine the theory of higher order differential equations, including the fundamental set of solutions, linear independence, and the Wronskian.
  - Solve higher order homogeneous and nonhomogeneous linear differential equations with constant coefficients.
  - Solve Cauchy-Euler differential equations.
  - Solve homogeneous and nonhomogeneous linear ordinary differential equations with variable coefficients using power series solutions.
  - Apply higher order differential equations to real world problems, including spring/mass problems and circuits.

- SLO 3: SOLVE INITIAL VALUE PROBLEMS USING LAPLACE TRANSFORMS AND APPLY THEM TO REAL WORLD PROBLEMS.
  - Examine the theory of Laplace transforms.
MATH 483 Honors Seminar in Mathematics - Introduction to Mathematical Proof

<table>
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<tr>
<th>Same As:</th>
<th>HONOR 391</th>
</tr>
</thead>
<tbody>
<tr>
<td>Units:</td>
<td>1</td>
</tr>
<tr>
<td>Hours:</td>
<td>18 hours LEC</td>
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<tr>
<td>Prerequisite:</td>
<td>MATH 370 with a grade of &quot;C&quot; or better</td>
</tr>
<tr>
<td>Transferable:</td>
<td>CSU; UC (May be taken twice for credit.)</td>
</tr>
<tr>
<td>Catalog Date:</td>
<td>January 1, 2020</td>
</tr>
</tbody>
</table>

Honors Seminars in Mathematics are special one-unit intensive courses for academically accomplished students or those with the potential for high academic achievement. This particular course will study various methods of mathematical proof in a seminar setting, and will be particularly useful to students planning to study calculus, differential equations, and linear algebra. Topics include: deductive reasoning, proof by axioms, proofs of conditional and biconditional statements, proofs by contrapositive and contradiction, and proof by mathematical induction. Studies will include homework, discussions, oral presentations and lectures. Students will be expected to do independent problem solving and present their solutions to the class. Enrollment is limited to Honors Program students (see catalog). This course is the same as HONOR 391. This course, under either name, may be taken one time for credit. This course will be offered in spring semester only.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

- SLO 1: EXAMINE METHODS OF PROOF
- Prove statements using axioms
- Prove statements using deductive reasoning
- Prove conditional statements
- Prove biconditional statements
- Prove statements using the contrapositive
- Prove statements using contradiction
• Prove statements using mathematical induction

MATH 484 Honors Seminar in Mathematics - Topics in Number Theory

Honors Seminars in Mathematics are special one-unit intensive courses for academically accomplished students or those with the potential for high academic achievement. This particular course will study various topics in the field of number theory in a seminar setting. Topics include: the integers and their properties; finding integer solutions to Diophantine equations (equations with more variables than equations); and cryptography (the study of how secret codes are created and broken). Studies will include homework, discussions, oral presentations and lectures. Students will be expected to do independent problem solving and present their solutions to the class. Enrollment is limited to Honors Program students (see catalog). This course is the same as HONOR 392. This course, under either name, may be taken one time for credit. This course will be offered in spring semester only.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

• SLO 1: EXAMINE THE PROPERTIES OF THE INTEGERS
  - Examine divisibility
  - Examine prime numbers
  - Calculate the greatest common divisor
  - Examine the fundamental theorem of arithmetic
  - Prove theorems involving the integers
• SLO 2: EXAMINE DIOPHANTINE EQUATIONS
  - Examine the Euclidean algorithm
  - Solve linear Diophantine equations
  - Prove theorems involving Diophantine equations
• SLO 3: EXAMINE LINEAR CONGRUENCES
  - Examine modular arithmetic
  - Examine the properties of congruences
  - Solve congruence equations
• Prove theorems involving linear congruences
• SLO 4: EXAMINE CRYPTOLOGY
• Examine the theory of cryptology
• Examine encoding messages
• Examine decoding messages
• Prove theorems involving cryptology

MATH 495 Independent Studies in Mathematics

<table>
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<tr>
<th>Units:</th>
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<tbody>
<tr>
<td>Hours:</td>
<td>54 - 162 hours LAB</td>
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<tr>
<td>Prerequisite:</td>
<td>None.</td>
</tr>
<tr>
<td>Transferable:</td>
<td>CSU</td>
</tr>
<tr>
<td>Catalog Date:</td>
<td>January 1, 2020</td>
</tr>
</tbody>
</table>

An independent studies project involves an individual student or small group of students in study, research, or activities beyond the scope of regularly offered courses. See the current catalog section of "Special Studies" for full details of Independent Studies.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

• SLO #1: Actively engage in intellectual inquiry beyond that required in order to pass a course of study (College Wide Learning Outcome – Area 4).

• Discuss and outline a proposal of study (that can be accomplished within one semester term) with a supervising instructor qualified within the discipline.

• Design an independent study (to be completed individually or by collaboration of a small group) to foster special knowledge, skills, and experience that are not available in any one regularly scheduled course.

• Use information resources to gather discipline-specific information.

• SLO #2: Utilize modes of analysis and critical thinking to apply theoretical perspectives and/or concepts in the major discipline of study to significant problems and/or educational activities (College Wide Learning Outcome – Area 3).

• Analyze and apply the knowledge, skills and experience that are involved in the independent study to theoretical perspectives and/or concepts in the major discipline of study.

• Explain the importance of the major discipline of study in the broader picture of society.

• SLO #3: Communicate a complex understanding of content matter of the major discipline of study (College Wide Outcome – Area 3).
Demonstrate competence in the skills essential to mastery of the major discipline of study that are necessary to accomplish the independent study.

- SLO #4: Identify personal goals and pursue these goals effectively (College Wide Outcome – Area 4).
- Utilize skills from the “academic tool kit” including time management, study skills, etc., to accomplish the independent study within one semester term.

Mathematics Support (MATHS)

Statistics (STAT)

STAT 100 Pre-Statistics

| Units: | 4 |
| Hours: | 54 hours LEC; 54 hours LAB |
| Prerequisite: | MATH 30 with a grade of "C" or better, or placement through the assessment process. |
| Catalog Date: | January 1, 2020 |

This course prepares students for transfer-level Statistics. Topics include computational mathematics needed for statistics: ratios, rates, and proportional reasoning; arithmetic with fractions, decimals and percents; evaluating expressions, solving equations and inequalities, and analyzing formulas to understand statistical measures; introduction to statistical terminology and use of statistical symbols; introduction to probability, venn diagrams, set theory and two-way statistical tables; graphical and numerical descriptive statistics for quantitative and categorical data; use of linear and exponential functions to model bivariate data. Note: This course is not intended as preparation for the PreCalculus/Trigonometry courses required for students as part of their pathway to science, computer information science, engineering, or mathematics.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

- **SLO 1:** READ, EVALUATE AND CONVERSE USING BASIC STATISTICAL TERMINOLOGY.
  - Recognize a sample as a subset of a population, read and identify the description of samples and populations as presented in statistical situations.
  - Summarize and symbolize information using statistical notation.
  - Converse with classmates using statistical terminology.
- **SLO 2:** PERFORM AND INTERPRET COMPUTATIONAL MATHEMATICS USED IN STATISTICS AND PROBABILITY.
  - Use and interpret fractions, decimals and percents, including use of decimal place values and rounding.
  - Simplify linear expressions, solve linear equations and rewrite literal equations (formulas) to solve for a particular variable.
  - Translate inequality statements, solve linear inequalities and demonstrate the solution on a number line.
• Translate applied situations (english) to statistical knowns and unknowns and apply these to evaluate statistical formulas using the order of operations.

• SLO 3: CREATE AND INTERPRET STATISTICAL GRAPHS AND TABULAR DISPLAYS OF DATA.
  - Create and interpret frequency tables, relative frequency tables, bar graphs, histograms, stem and leaf displays, boxplots and scatterplots.

• SLO 4: APPLY PROBABILITY, SET THEORY AND ORGANIZATIONAL TOOLS SUCH AS VENN DIAGRAMS AND 2-WAY TABLES TO QUANTIFY THE LIKELIHOOD OF CHANCE OUTCOMES.
  - Compute and interpret relative frequency observational probability and classical sample space probabilities.
  - Compute and interpret the probabilities of an event, the complement of an event, and the union and intersection of events.
  - Use Venn Diagrams and 2-way tables to compute and interpret the probabilities of and event, the complement of an event, unions and intersections of events, and conditional probabilities.
  - Compute and interpret the area under a histogram to determine probabilities.
  - Compute and interpret the area under continuous curves using symmetry or partial sums to determine probabilities.

• SLO 5: CREATE AND INTERPRET GRAPHS OF LINEAR AND EXPONENTIAL FUNCTIONS AND USE THEM TO MODEL BIVARIATE DATA.
  - Sketch the graphs of linear and exponential functions.
  - Find the equations of linear and exponential functions given two points on the line or curve.
  - Use technology to find the equations of linear and exponential functions given a data set.
  - Interpret the parameters of the linear and exponential models and explain how these parameters describe relationships in the data.
  - Use linear and exponential models to compute predictions and make comparisons between models.

STAT 300 Introduction to Probability and Statistics

<table>
<thead>
<tr>
<th>Units:</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours:</td>
<td>54 hours LEC; 54 hours LAB</td>
</tr>
<tr>
<td>Prerequisite:</td>
<td>MATH 120 or STAT 100 with a grade of &quot;C&quot; or better, or placement through the assessment process.</td>
</tr>
<tr>
<td>Transferable:</td>
<td>CSU; UC</td>
</tr>
<tr>
<td>General Education:</td>
<td>AA/AS Area II(b); CSU Area B4; IGETC Area 2</td>
</tr>
<tr>
<td>C-ID:</td>
<td>C-ID MATH 110</td>
</tr>
<tr>
<td>Catalog Date:</td>
<td>January 1, 2020</td>
</tr>
</tbody>
</table>
This course is an introduction to probability and statistics. Topics include: elementary principles and applications of descriptive statistics, elementary probability principles, probability distributions, estimation of parameters, hypothesis testing, linear regression and correlation, and ANOVA. Scientific calculators with two-variable statistics capabilities may be required.

### Student Learning Outcomes

Upon completion of this course, the student will be able to:

- **SLO 1: ORGANIZE, DISPLAY, DESCRIBE AND COMPARE REAL DATA SETS.**
  - Recognize data types and data sources: develop basic statistical terminology including population parameters & sample statistics; identify common sampling methods used for obtaining data and identify advantages & disadvantages of each; recognize bias in sampling; compare principles of good experimental design.
  - Organize and display data appropriately by preparing tables and graphs.
  - Analyze data by computing measures of central tendency, measures of dispersion, and measures of position.
  - Analyze bivariate data for linear trends using the least-squares regression model and the correlation coefficient.

- **SLO 2: DISTINGUISH BETWEEN PROBABILITY MODELS APPROPRIATE TO DIFFERENT CHANCE EVENTS AND CALCULATE PROBABILITY ACCORDING TO THESE METHODS.**
  - Compute probabilities using sample spaces, the addition & multiplication rules, conditional probability, and complements.
  - Develop and apply probability distributions for discrete random variables; compute probabilities and expected value.
  - Analyze both discrete and continuous probability distributions by considering areas under the graph of a function or a histogram.
  - Use the normal and binomial probability distributions to compute probabilities.

- **SLO 3: APPLY INFERENTIAL STATISTICAL METHODS TO MAKE PREDICTIONS, DRAW CONCLUSIONS ABOUT HYPOTHESES AND COMPARE POPULATIONS.**
  - Create and interpret confidence interval estimates for population mean and population proportion based on appropriate probability models.
  - Select the appropriate hypothesis test, perform the necessary computations and comparisons to test hypotheses about on one population mean or one population proportion and explain the conclusion of the test.
  - Create and interpret confidence interval estimates for the difference in two population means (independent & dependent sampling) or two population proportions.
  - Test significance of correlation and make predictions based on linear trends using the least-squares regression model.
STAT 480 Introduction to Probability and Statistics - Honors

This course is an introduction to probability and statistics designed for students in the honors program. Topics include elementary principles and applications of descriptive statistics, counting principles, elementary probability principles, probability distributions, estimation of parameters, hypothesis testing, linear regression and correlation, and ANOVA. Scientific calculators with two-variable statistical capabilities may be required for this class. This honors section uses an intensive instructional methodology designed to challenge motivated students. This course is the same as HONOR 393 and only one may be taken for credit.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

- SLO 1: ORGANIZE, DISPLAY, DESCRIBE AND COMPARE REAL DATA SETS.

- Recognize data types and data sources: develop basic statistical terminology including population parameters & sample statistics; identify common sampling methods used for obtaining data and identify advantages & disadvantages of each; recognize bias in sampling; compare principles of good experimental design

- Organize and display data appropriately by preparing tables and graphs.

- Analyze data by computing measures of central tendency, measures of dispersion, and measures of position.

- Analyze bivariate data for linear trends using the least-squares regression model and the correlation coefficient.

- SLO 2: DISTINGUISH BETWEEN PROBABILITY MODELS APPROPRIATE TO DIFFERENT CHANCE EVENTS AND CALCULATE PROBABILITY ACCORDING TO THESE METHODS

- Compute probabilities using sample spaces, the addition & multiplication rules, conditional probability, and complements.
Develop and apply probability distributions for discrete random variables; compute probabilities and expected value.

Analyze both discrete and continuous probability distributions by considering areas under the graph of a function or a histogram.

Use the normal and binomial probability distributions to compute probabilities.

Develop and apply sampling distributions for the sample mean and sample proportion.

SLO 3: APPLY INFERENTIAL STATISTICAL METHODS TO MAKE PREDICTIONS, DRAW CONCLUSIONS ABOUT HYPOTHESES AND COMPARE POPULATIONS.

Create and interpret confidence interval estimates for population mean and population proportion based on appropriate probability models.

Select the appropriate hypothesis test, perform the necessary computations and comparisons to test hypotheses about one population mean or one population proportion and explain the conclusion of the test.

Create and interpret confidence interval estimates for the difference in two population means (independent and dependent sampling) or two population proportions.

Select the appropriate hypothesis test, perform the necessary computations and comparisons to test hypotheses about two population means (independent & dependent sampling), more than two population means (ANOVA), and two or more population proportions (Chi-Sq. tests) and explain the conclusion of the test.

Test significance of correlation and make predictions based on linear trends using the least-squares regression model.

SLO 4: USE TECHNOLOGY TO PERFORM STATISTICAL COMPUTATIONS, PREDICTIONS AND HYPOTHESIS TESTS.

SLO 5: USE APPROPRIATE STATISTICAL TECHNIQUES TO ANALYZE AND INTERPRET APPLICATIONS OF DATA including all of the following: business, economics, social sciences, psychology, life science, health science and education.

SLO 6 (HONORS PROGRAM SLO 1): EXPRESSION OF IDEAS: EXPRESS IDEAS CLEARLY IN WELL-ORGANIZED WRITTEN MESSAGES (SLO #1, College Wide SLO – Area 1, and General Education SLO C5a – English Composition).

Express ideas clearly and completely in a variety of written formats.

Utilize correct and appropriate conventions of mechanics, usage, and style in written communication.

Comprehend main ideas and reasonably interpret written information.

Compose and apply properly documented sources of information.

SLO 7 (HONORS PROGRAM SLO 2): ANALYSIS AND CRITICAL THINKING: UTILIZE MODES OF ANALYSIS AND CRITICAL THINKING IN A DISCIPLINE OF STUDY AS APPLIED TO SIGNIFICANT ISSUES AND/OR PROBLEMS (SLO #2; College Wide SLO Area 3).

Analyze reasoning processes to evaluate issues, value judgments or conclusions that determine the quality, validity, and/or reliability of information.

Construct an accurate and/or logical interpretation of reasoning while applying a framework of analytic concepts.
- Communicate a complex understanding of content matter of a major discipline of study.
- Explain the importance of the major discipline of study in the broader picture of society.
- SLO 8 (HONORS PROGRAM SLO 3): INTELLECTUAL INQUIRY: ACTIVELY ENGAGE IN INTELLECTUAL INQUIRY BEYOND THAT REQUIRED IN ORDER TO PASS A COURSE OF STUDY (SLO #3, College Wide SLO – Area 4).
- Apply information and resources necessary to develop academically and personally.
- Utilize skills from one’s “academic tool kit” including time management, study skills, etc.
- SLO 9 (HONORS PROGRAM SLO 4): ETHICAL REASONING: RECOGNIZE THE ETHICAL DIMENSIONS OF DECISIONS AND ACTIONS (SLO #4, College Wide SLO – Area 5).
- Demonstrate the ability to engage in ethical reasoning necessary to exercise responsibility as an ethical individual, professional, local and global citizen.
- SLO 10 (HONORS PROGRAM SLO 5): ARTICULATE AN AWARENESS OF A VARIETY OF PERSPECTIVES WITHIN A DISCIPLINE AND THE RELEVANCE OF THESE PERSPECTIVES TO ONE’S OWN LIFE (SLO #5, College Wide SLO – Area 2).

### STAT 495 Independent Studies in Statistics

| Units:     | 1 - 3     |
|Hours:      | 54 - 162 hours LAB |
|Prerequisite: | None.     |
|Transferable: | CSU     |
|Catalog Date: | January 1, 2020 |

An independent studies project involves an individual student or small group of students in study, research, or activities beyond the scope of regularly offered courses. See the current catalog section of “Special Studies” for full details of Independent Studies.

### Student Learning Outcomes

Upon completion of this course, the student will be able to:

- SLO #1: Actively engage in intellectual inquiry beyond that required in order to pass a course of study (College Wide Learning Outcome – Area 4).
- Discuss and outline a proposal of study (that can be accomplished within one semester term) with a supervising instructor qualified within the discipline.
- Design an independent study (to be completed individually or by collaboration of a small group) to foster special knowledge, skills, and experience that are not available in any one regularly scheduled course.
- Use information resources to gather discipline-specific information.
- SLO #2: Utilize modes of analysis and critical thinking to apply theoretical perspectives and/or concepts in the major discipline of study to significant problems and/or educational activities (College Wide Learning Outcome – Area 3).

- Analyze and apply the knowledge, skills and experience that are involved in the independent study to theoretical perspectives and/or concepts in the major discipline of study.

- Explain the importance of the major discipline of study in the broader picture of society.

- SLO #3: Communicate a complex understanding of content matter of the major discipline of study (College Wide Outcome – Area 3).

- Demonstrate competence in the skills essential to mastery of the major discipline of study that are necessary to accomplish the independent study.

- SLO #4: Identify personal goals and pursue these goals effectively (College Wide Outcome – Area 4).

- Utilize skills from the “academic tool kit” including time management, study skills, etc., to accomplish the independent study within one semester term.

Jorge Baca  
Mathematics Professor  
Office: CRC Main, LRC, 152  
Email: bacaj@crc.losrios.edu  
Phone: (916) 691-7590  
Web: Jorge Baca's Profile Page (/about-us/contact-us/faculty-and-staff-directory/jorge-baca)  

Tom Blankenship  
Mathematics Professor  
Office: CRC Main, SCI, 501  
Email: Thomas.Blankenship@crc.losrios.edu  
Phone: (916) 691-7204  
Web: Tom Blankenship's Profile Page (/about-us/contact-us/faculty-and-staff-directory/tom-blankenship)  

Ron Breitenbach  
Mathematics Professor  

Jim Brooks  
Adjunct Mathematics Professor
Bao (Amy) Guan
Adjunct Mathematics
Professor
Office: CRC Main, RHS, 165
Email: GuanB@crc.losrios.edu
Phone: (916) 691-7204
Web: Bao (Amy) Guan's Profile Page
(mailto:GuanB@crc.losrios.edu)

Benjamin Hee
Adjunct Mathematics
Professor
Office: CRC Main, SCI, 501
Email: heeb@crc.losrios.edu
Phone: (916) 691-7204
Web: Benjamin Hee's Profile Page
(mailto:heeb@crc.losrios.edu)

Linda Hoang
Mathematics Professor
Office: CRC Main, LRC, 140
Email: hoangl@crc.losrios.edu
Phone: (916) 691-7007
Web: Linda Hoang's Profile Page
(mailto:hoangl@crc.losrios.edu)

Wyatt Howard
Mathematics Professor
Office: CRC Main, LRC, 135
Email: HowardW@crc.losrios.edu
Phone: (916) 691-7070
Web: Wyatt Howard's Profile Page
(mailto:HowardW@crc.losrios.edu)

Beven Kair
Adjunct Statistics Professor
Office: CRC Main, SCI, 501
Email: KairB@crc.losrios.edu
Phone: (916) 691-7204
Web: Beven Kair's Profile Page
(mailto:KairB@crc.losrios.edu)

Nam Lam
Mathematics Professor
Office: CRC Main, LRC, 138
Email: lamn@crc.losrios.edu
Phone: (916) 691-7043
Web: Nam Lam's Profile Page
(mailto:lamn@crc.losrios.edu)
Lawrence Larsen
Adjunct Mathematics Professor

Office: CRC Main, SCI, 501
Email: LarsenL@crc.losrios.edu
(mailto:LarsenL@crc.losrios.edu)
Phone: (916) 691-7204
Web: Lawrence Larsen's Profile Page (/about-us/contact-us/faculty-and-staff-directory/lawrence-larsen)

Xiaozhu Li
Adjunct Mathematics Professor

Office: CRC Main, SCI, 501
Email: LiX@crc.losrios.edu
(mailto:LiX@crc.losrios.edu)
Phone: (916) 691-7204
Web: Xiaozhu Li's Profile Page (/about-us/contact-us/faculty-and-staff-directory/xiaozhu-li)

Phuong Le
Mathematics Professor

Office: CRC Main, L, 156
Email: lep2@crc.losrios.edu
(mailto:lep2@crc.losrios.edu)
Phone: (916) 691-7285
Web: Phuong Le's Profile Page (/about-us/contact-us/faculty-and-staff-directory/phuong-le)

Lap Ly
Mathematics Professor

Office: CRC Main, LRC, 155
Email: lyl@crc.losrios.edu
(mailto:lyl@crc.losrios.edu)
Phone: (916) 691-7606
Web: Lap Ly's Profile Page (/about-us/contact-us/faculty-and-staff-directory/lap-ly)

PiYali Markalanda
Mathematics Professor

Office: CRC Main, LRC, 134
Email: markalP@crc.losrios.edu
(mailto:markalP@crc.losrios.edu)
Phone: (916) 691-7104
Web: PiYali Markalanda's Profile Page (/about-us/contact-us/faculty-and-staff-directory/piyali-markalanda)

Mary Martin
Mathematics Professor

Office: CRC Main, LRC, 160
Email: martinms@crc.losrios.edu
(mailto:martinms@crc.losrios.edu)
Phone: (916) 691-7217
Web: Mary Martin's Profile Page (/about-us/contact-us/faculty-and-staff-directory/mary-martin)

Camille Moreno
Mathematics Professor

Brandon Muranaka
Mathematics Professor
Camille Moreno
Mathematics Professor
CRC Main, LRC, 149
morenoc@crc.losrios.edu
mailto:morenoc@crc.losrios.edu
(916) 691-7541
Camille Moreno's Profile Page
/about-us/contact-us/faculty-and-staff-directory/camille-moreno

Brandon Muranaka
Adjunct Mathematics Professor
CRC Main, LRC, 141
muranab@crc.losrios.edu
mailto:muranab@crc.losrios.edu
(916) 691-7081
Brandon Muranaka's Profile Page
/about-us/contact-us/faculty-and-staff-directory/brandon-muranaka

Maha Myren
Mathematics Professor
CRC Main, LRC, 159
myrenm@crc.losrios.edu
mailto:myrenm@crc.losrios.edu
(916) 691-7544
Maha Myren's Profile Page
/about-us/contact-us/faculty-and-staff-directory/maha-myren

Murray Navarro
Adjunct Mathematics Professor
CRC Main, SCI, 501
NavarrM@crc.losrios.edu
mailto:NavarrM@crc.losrios.edu
(916) 691-7204
Murray Navarro's Profile Page
/about-us/contact-us/faculty-and-staff-directory/murray-navarro

Matthew Nelsenador
Adjunct Mathematics Professor
CRC Main, SCI, 501
NelsenM@crc.losrios.edu
mailto:NelsenM@crc.losrios.edu
(916) 691-7204
https://web.crc.losrios.edu/nelsenm/
https://web.crc.losrios.edu/nelsenm/

Nhat (Natalie) Nguyen
Mathematics Professor
CRC Main, LRC, 146
nguyenn4@crc.losrios.edu
mailto:nguyenn4@crc.losrios.edu
(916) 691-7041
Nhat (Natalie) Nguyen's Profile Page
/about-us/contact-us/faculty-and-staff-directory/nhat-(natalie)-nguyen

Loi Nguyen-Vo
Mathematics Professor
CRC Main, SCI, 501
nguyenn4@crc.losrios.edu
mailto:nguyenn4@crc.losrios.edu
(916) 691-7041
Loi Nguyen-Vo's Profile Page

Luke Parker
Adjunct Mathematics Professor
Loi Nguyen-Vo's Profile Page (/about-us/contact-us/faculty-and-staff-directory/loi-nguyen-vo)


Matt Rodrigues's Profile Page (/about-us/contact-us/faculty-and-staff-directory/matt-rodrigues)

Bill Schult's Profile Page (/about-us/contact-us/faculty-and-staff-directory/bill-schult)

Sangchin Sertich's Profile Page (/about-us/contact-us/faculty-and-staff-directory/sangchin-sertich)

Roy Simpson's Profile Page (/about-us/contact-us/faculty-and-staff-directory/roy-simpson)