COLLEGE of the DESERT

MATH 013: LIBERAL ARTS MATH

Originator
dkleinfelter

Justification / Rationale
Prerequisite update

Effective Term
Fall 2024

Credit Status
Credit - Degree Applicable

Subject
MATH - Mathematics

Department
Math & Computer Science

School
School of Math & Sciences

Course Number
013

Full Course Title
Liberal Arts Math

Short Title
LIBERAL ARTS MATH

Discipline

Disciplines List
Mathematics

Modality
Face-to-Face
100% Online
Hybrid

Catalog Description
This course is designed for social science and liberal arts majors. It emphasizes applications of mathematics in the areas of management science, probability and statistics, social choice and decision making, game theory, and consumer finance. Topics include sets, logic & counting, probability, linear systems and linear programming, scheduling, statistics, mathematics of finance and other applications for liberal arts majors. Note: All students now can enroll in this transfer-level course without completing posted requisites. Please refer to AB 705 (under How do I enroll in courses at COD?) or see a Counselor.

Schedule Description
This course is designed for social science and liberal arts majors. It emphasizes applications of mathematics in the areas of management science, probability and statistics, social choice and decision making, graph theory, and consumer finance. Prerequisite: MATH 045 or MATH 049 or qualifying placement. Advisory: ENG 001A and Advisory Corequisite: MATH 061 or MATH 361 IGETC: 2A

Lecture Units
3

Lecture Semester Hours
54

Lab Units
1

Lab Semester Hours
54

In-class Hours
108

Out-of-class Hours
108

Total Course Units
4

Total Semester Hours
216

Class Size Maximum
30

Prerequisite Course(s)
MATH 045 or MATH 049 or qualifying placement
Advisory: ENG 001A
Advisory Corequisite: MATH 061 or MATH 361

Required Text and Other Instructional Materials

Resource Type
Book

Open Educational Resource
No

Author
Pirnot, Thomas L

Title
Mathematics All Around

Edition
7

Publisher
Pearson

Year
2021

College Level
Yes

Flesch-Kincaid Level
11.08

ISBN #
9780137383962

Resource Type
Web/Other

Open Educational Resource
No

Year
n/a

Description
Pearson MyLab and Mastering may be used with Mathematics All Around

---

Resource Type
Book

Open Educational Resource
Yes

Author
David Lippman

Title
Math in Society

Edition
2.5

Publisher
The OpenTextBookStore

Year
2021

Flesch-Kincaid Level
7.1

ISBN #
https://math.libretexts.org/Bookshelves/Applied_Mathematics/Math_in_Society_(Lippman)

Resource Type
Web/Other

Open Educational Resource
Yes

Year
n/a

Description
MyOpenMath can be used with any textbook

Entrance Skills
Use linear functions to model phenomena with constant rates of change.

Requisite Course Objectives
MATH 045-Comprehend that the key characteristic of a linear model is its constant rate of change and interpret slope as a rate of change and relate slope to topics from social sciences.
MATH 049-Comprehend that the key characteristic of a linear model is its constant rate of change. Recognize when a table, graph or equation is linear.

Entrance Skills

Graph linear equations and inequalities.

Requisite Course Objectives

MATH 045-Create a linear model in the form of a table, graph, or equation, including a line of best fit for a set of given points.
MATH 045-Graph systems of linear inequalities in two dimensions and find the coordinates of points of intersection, including application problems similar to examples from linear programming.
MATH 049-Create and comprehend a linear model in the form of a table, graph, or equation from a verbal description, using the rule of 4.
MATH 049-Graph systems of linear inequalities in two dimensions. Introduction to non-linear inequalities.

Entrance Skills

Solve 2x2 and 3x3 systems of linear equations.

Requisite Course Objectives

MATH 045-Solve 2x2 and 3x3 systems of linear equations and solve application problems from social sciences.
MATH 049-Solve 2x2 and 3x3 systems of linear equations as a lead into generalizing to nxn systems in the Linear Algebra course.

Entrance Skills

Graph systems of linear inequalities in two dimensions.

Requisite Course Objectives

MATH 045-Graph systems of linear inequalities in two dimensions and find the coordinates of points of intersection, including application problems similar to examples from linear programming.
MATH 049-Graph systems of linear inequalities in two dimensions. Introduction to non-linear inequalities.

Entrance Skills

Evaluate and simplify expressions with rational exponents.

Requisite Course Objectives

MATH 045-Comprehend and manipulate rational exponents and Nth roots, including those used in financial mathematical formulas such as compound interest.
MATH 049-Comprehend and manipulate rational exponents and Nth roots, and solve radical equations.

Entrance Skills

Apply radical equations and functions.

Requisite Course Objectives

MATH 045-Apply functions to topics from social sciences and consumer mathematics, including ceiling and floor functions.
MATH 045-Evaluate root functions, including multivariate functions such as the standard deviation.
MATH 049-Comprehend and manipulate rational exponents and Nth roots, and solve radical equations.

Entrance Skills

Describe the key characteristics of functions.

Requisite Course Objectives

MATH 045-Understand the definition of a function including the use of function notation, arrow diagrams, graphs, and terminology such as domain, range, independent variables, and dependent variables.
MATH 049-Develop the language of functions: calculate and find x and y intercepts, evaluate difference quotients, and how these calculations relate to graphs in preparation for the graphing application in the College Algebra, Precalculus, and Calculus courses.

Entrance Skills

Use exponential functions to model phenomena with constant growth (or decay) factors.

Requisite Course Objectives

MATH 045-Comprehend that the key characteristic of an exponential function is its constant growth (or decay) factor and relate this to the differences between linear and exponential change with applications involving simple and compound interest.
MATH 045-Recognize when a table, graph, or equation is exponential and when a word problem can be modeled with an exponential function, including equations and graphs of functions similar to continuous probability distributions.
MATH 049-Comprehend that the key characteristic of an exponential function is its constant growth (decay) factor. Recognize when a table, graph or function is exponential.
MATH 049-Recognize when an equation is exponential and when a word problem can be modeled with an exponential function. Develop the language associated with an exponential function such as: growth or decay factor; percent increase or decrease.

Entrance Skills

ADVISORY SKILLS:
Read and comprehend word problems.

Requisite Course Objectives

ENG 001A-Read, analyze, and interpret varied texts (e.g., literary, digital, visual).
MATH 045-Investigate and practice general problem solving strategies, including Polya's problem solving techniques, pattern analysis, inductive and deductive reasoning examples, and estimation techniques for predicting feasible answers and discovering errors.

Entrance Skills

Recognize when an application requires a particular function and evaluate appropriate expressions to solve application problems.

Requisite Course Objectives

MATH 045-Apply functions to topics from social sciences and consumer mathematics, including ceiling and floor functions.
MATH 045-Evaluate multivariate formulas useful in statistics and financial mathematics such as Max, Min, Arithmetic Mean, Median, Combinations, Permutations, and simple and compound interest formulas; know the mathematical and statistical symbols used in them; and become familiar with when each formula is applicable.
MATH 045-Evaluate root functions, including multivariate functions such as the standard deviation.
MATH 045-Recognize when a table, graph, or equation is exponential and when a word problem can be modeled with an exponential function, including equations and graphs of functions similar to continuous probability distributions.
MATH 045-Evaluate expressions using summation notation, including those requiring the use of the order of operations involving sums of many values.

Entrance Skills

Investigate and practice problem-solving strategies.

Requisite Course Objectives

MATH 045-Investigate and practice general problem solving strategies, including Polya's problem solving techniques, pattern analysis, inductive and deductive reasoning examples, and estimation techniques for predicting feasible answers and discovering errors.

Entrance Skills

Diagnose one's own abilities to review necessary concepts and skills from elementary mathematics.

Requisite Course Objectives

MATH 061-Identify strengths and weaknesses with respect to mathematics skills and knowledge.
MATH 361-Identify strengths and weaknesses with respect to mathematics skills and knowledge.

Entrance Skills

Use technology including free applications online to model mathematical reasoning.

Requisite Course Objectives

MATH 061-Use technology tools appropriately to learn mathematics.
MATH 361-Use technology tools appropriately to learn mathematics.

Course Content

1. General Problem Solving
   a. Polya's method, mathematical principles, problem solving skills and strategies
   b. Inductive and deductive reasoning
   c. Estimation techniques
2. Sets
   a. Terminology, representing sets using well-defined properties with set-builder notation, symbols
   b. Cardinality of finite sets, finite and infinite sets, one-to-one correspondence
   c. Comparing sets
   d. Set operations
   e. Applications (e.g. survey problems)
   f. Optional: countable and uncountable infinities
3. Logic
   a. Statements, negations, conjunctions, disjunctions, conditionals
   b. Truth tables, logical equivalence
   c. Biconditionals, the contrapositive of a conditional, the converse of a conditional, and inverse of a conditional
   d. Arguments, using truth tables to show arguments are valid or invalid, using Euler diagrams to show arguments with quantified statements are valid or invalid
   e. Optional: fuzzy logic and decision tables (truth tables for decision-making)
4. Organizing, Planning and Scheduling Using Graph Theory
   a. Vertices, edges, graphs, paths, circuits
   b. Graph tracing puzzles, Euler's Theorem, Fleury's Algorithm, Eulerizing graphs, applications
   c. Using vertex coloring to color maps and make schedules or arrange locations that avoid conflicts
   d. Hamilton paths and circuits, weighted graphs, complete graphs, Traveling Salesman Problems (TSP), Brute Force for solving TSP, Nearest Neighbor and Best Edge algorithms for approximating TSP solutions
   e. Directed graphs, influence modeling, network modeling, ranking with one- and two-stage dominance
   f. Scheduling projects using PERT
   g. Optional: Modeling graphs with matrices
5. Linear Programming
   a. Linear equations in two variables, linear functions with two independent variables, linear inequalities in two variables, systems of linear equations in two variables
   b. Graphing systems of linear inequalities in two variables and solve systems of linear equations to find points of intersections of boundary lines
   c. Solving linear programming application problems by modeling constraints with inequalities, describing the objective function, graphing the region of possible solutions, finding corner points, and maximizing or minimizing the objective function
6. Consumer and Financial Mathematics
   a. Applications of percents to taxes, price mark-up/mark-down, and inflation
   b. Simple interest, add-on interest loans, credit card finance charges using average daily balance
   c. Exponential functions, logarithms, compound interest
   d. Annuities
   e. Amortized loans, amortization schedules, present value of an annuity, refinancing, using equations and tables
   f. Optional: the rule of 70 (or 72), annual percentage rate
7. Counting Principles
   a. The Fundamental Counting Principle, tree diagrams, applications
   b. Factorial notation, permutations and combinations, combining counting methods using the fundamental counting principle
   c. Applications to games of chance
8. Probability
   a. Terminology, sample spaces, events
   b. Principles of probability

c. Classical calculation of probability with equally-likely outcomes, empirical calculation of probability using data
d. Application of set theory to probability: complements of events, unions of events, principle of inclusion and exclusion, DeMorgan's laws
e. Conditional probability, intersections of events, dependent and independent events
f. Expected value, applications to games of chance, applications to insurance, other applications (e.g. guessing on multiple-choice tests, using supply and demand data for making business decisions)
g. Optional: binomial experiments, applications (e.g. drug/disease testing), probability trees, genetics, calculating odds and odds against an event

9. Statistics
   a. Population vs. sample, data, random sampling methods, inappropriate sampling methods (e.g. voluntary response surveys)
   b. Frequency tables, histograms, other display methods (e.g. stem-and-leaf plots), misleading and inappropriate graphs
   c. Mean and median for quantitative data, mode for qualitative data
   d. Five-number summary, box-and-whisker plots
   e. Range, interpretation of standard deviation, estimation of standard deviation using range, z-scores
   f. Uniform distribution, skewed distributions, normal distribution, applications of normal distributions
   g. Scatterplots, interpretation of linear correlation, lines of best fit
   h. Optional: coefficient of variation, using technology such as excel or StatCrunch, calculation of linear correlation coefficient and using tables to find critical values for the linear correlation coefficient
10. Optional topics: voting, apportionment, number systems, tessellations

Lab Content

1. Apply problem solving strategies: logic puzzles, games, experiments
2. Solve problems that can be modeled with Venn diagrams of sets and using set theory principles
3. Analyze logical statements and arguments
4. Solve problems that can be modeled with graphs using graph coloring, Euler circuits, Hamilton circuits, and/or Traveling Salesman Problem algorithms
5. Create schedules and make decisions using PERT, graph coloring, expected value, linear programming, and/or fuzzy logic
6. Use calculators to efficiently and accurately evaluate expressions.
7. Apply finance formulas including compound interest, annuities, and amortization to application problems involving money
8. Calculate measures of central tendency (mean, median, and mode) of sample data, calculate measures of dispersion (range, variance, standard deviation) of sample data, and use frequency tables and histograms to display data
9. Apply elementary counting methods to games of chance, use counting techniques to compute probabilities in games of chance

Course Objectives

	Objectives
Objective 1	Apply general problem solving strategies such as Polya's problem solving techniques, pattern analysis, and use of drawings and diagrams.
Objective 2	Differentiate between inductive and deductive reasoning, and use both to solve problems such as those requiring justification of or finding counterexamples to universal claims.
Objective 3	Demonstrate and explain estimation techniques.
Objective 4	Examine sets and their relationships, manipulate sets using set operations, describe sets in words, and apply set theory to problems involving surveys and categorizations of objects.
Objective 5	Investigate simple logical statements, compound logical statements, negations of logical statements, and general statement forms and determine when two statement forms are logically equivalent.
Objective 6	Investigate conditional and biconditional logical statements, negate quantified statements, verify arguments involving statements without quantifiers using truth tables, and verify arguments involving quantified statements using Euler diagrams.
Objective 7	Model and solve application problems using concepts from graph theory such as Euler paths, Hamilton paths, graph coloring, Traveling Salesman Problem algorithms, and influence-modeling graphs.
Objective 8	Apply list-processing & critical path algorithms to schedule a list of tasks subject to an order requirement digraph.
Objective 9	Solve optimization problems in two variables using linear programming.
Objective 10	Use a scientific calculator to perform computations effectively and accurately.
Objective 11	Identify social science & finance problems whose modeling involve exponential functions, and use exponential and logarithmic functions to model and solve them.

Objective 12	Apply formulas from the mathematics of finance including those related to compound interest, annuities, and amortization.
Objective 13	Apply elementary counting methods, including the use of the Fundamental Counting (or Multiplication) Principle, combinations and permutations formulas, and the Principle of Inclusion and Exclusion.
Objective 14	Use counting techniques to compute probabilities where outcomes are equally likely.
Objective 15	Apply basic probability theory, including conditional probability.
Objective 16	Calculate measures of central tendency (mean, median, and mode) and measures of dispersion (range, variance, standard deviation) of data sets.
Objective 17	Communicate accurately and effectively in written form using mathematical terminology and concepts.

Student Learning Outcomes

	Upon satisfactory completion of this course, students will be able to:
Outcome 1	Apply quantitative reasoning to model and solve problems from social science and financial mathematics.
Outcome 2	Formulate logical arguments and judge correctness in deductive reasoning.
Outcome 3	Interpret mathematical and statistical models and draw inferences from them.
Outcome 4	Use mathematical reasoning and concepts to make decisions.

Methods of Instruction

Method	**Please provide a description or examples of how each instructional method will be used in this course.**
Lecture	Lecture will be used for introduction and explanation of course topics.
Discussion	Discussion will be used to review, explore, analyze, and evaluate various methods of solution.
Other (Specify)	Video presentations may be used to introduce and explain new topics.
Laboratory	Lab will be used, in groups or individually, for student exploration of the topics of the course.
Activity	Activities in the lab portion of the class will include practicing problem-solving skills, communicating with mathematics, performing experiments, and using various tools and technology.

Methods of Evaluation

Method	**Please provide a description or examples of how each evaluation method will be used in this course.**	**Type of Assignment**
College level or pre-collegiate essays	Students may be required to write summaries of explorations and justifications and/or analyses of mathematical concepts.	In and Out of Class
Mid-term and final evaluations	Students will be evaluated by unit examinations, including a comprehensive final exam, involving problems that require the application of studied principles and skills to new situations as well as problems that mimic those done on homework and in class. These exams may have take-home components.	In and Out of Class
Computational/problem-solving evaluations	Students will be evaluated by completing challenging problem sets requiring careful reasoning and application of a variety of course topics. These assignments will require 2-3 hours of work per week on average.	In and Out of Class
Written homework	Students will be evaluated by homework assignments requiring 4-6 hours per week.	Out of Class Only
Tests/Quizzes/Examinations	Students may be evaluated with tests or quizzes that may be required or serve as optional self-assessment tools.	In and Out of Class
Laboratory projects	Students may be evaluated by computer or hands-on lab assignments.	In and Out of Class

Student participation/contribution	Students will be evaluated by their participation in lab activities and may be required to turn in write-ups of these activities.	In and Out of Class
Laboratory projects	Students will use problem-solving skills, communicate accurately and precisely, perform experiments, and use various tools and technology. Students will be evaluated by their summary and analysis of the information gathered during explorations and experiments.	In and Out of Class

Assignments

Other In-class Assignments

1. Attend classroom lectures and take notes.
2. Participate in classroom discussions to review, analyze, interpret, explore, and evaluate various topics covered in lectures, video presentations, and homework.
3. Present material learned in lab assignments and/or independent explorations

Other Out-of-class Assignments

1. Read the textbook and supplementary material
2. Watch videos and engage in online explorations.
3. Review notes.
4. Complete lab investigations and assignments started during class.

Grade Methods

Letter Grade Only

Distance Education Checklist

Include the percentage of online and on-campus instruction you anticipate.

Online %

100

On-campus %

0

What will you be doing in the face-to-face sections of your course that necessitates a hybrid delivery vs a fully online delivery?

Although the course can be offered entirely online, it may also be offered hybrid to take advantage of collaboration activities that are more suited to in-person interaction.
Examinations can be given in a controlled location.

Lab Courses

How will the lab component of your course be differentiated from the lecture component of the course?

Lab assignments involve more active learning. They may require collaboration with classmates, Instructional Support Assistants (ISAs), or the instructor; interviewing people who are not part of the course; hands-on explorations; and open-ended discovery.

From the COR list, what activities are specified as lab, and how will those be monitored by the instructor?

Lab activities are assignments (discussions, projects, classwork, etc.) that involve solving problems or exploring concepts with other students, with people not part of the course, or under the guidance of the instructor professor or instructional support assistant. Such assignments should require between 3 and 4 hours of work per week. Such assignments that are completed in the course LMS are monitored and evaluated by the professor and/or an instructional support assistant (ISA). Such assignments that do not take place in the course LMS are evaluated by the instructor professor based on write-ups. The instructor will provide guidance and feedback via messages in the LMS, email, grading in the LMS, videoconferencing, office hours, and any other method of interacting with students used in the course. Anonymous and non-anonymous feedback opportunities will be available to students to allow the professor further monitor effectiveness and appropriateness of activities that take place somewhere other than on the course LMS.

How will you assess the online delivery of lab activities?

Reports and other forms of write-ups will be submitted on the course LMS for evaluation and feedback. Students may give presentations.

Instructional Materials and Resources

If you use any other technologies in addition to the college LMS, what other technologies will you use and how are you ensuring student data security?

Depending on the textbook used, the professor may choose to use Pearson MyLab and Mastering or MyOpenMath. Both of these are considered to be safe for use in education for both faculty and students. Both can also be integrated with the college LMS (Canvas), which decreases the amount of times students will need to sign-in-and-out of accounts and open them up to data breaches.

If used, explain how specific materials and resources outside the LMS will be used to enhance student learning.

Professors who choose to use Pearson MyLab and Mastering or MyOpenMath do so in order to assign pre-written or instructor-created problems that are more complicated than those that can be created in Canvas while still receiving instantaneous feedback.

Effective Student/Faculty Contact

Which of the following methods of regular, timely, and effective student/faculty contact will be used in this course?

Within Course Management System:

Discussion forums with substantive instructor participation
Online quizzes and examinations
Private messages
Regular virtual office hours
Timely feedback and return of student work as specified in the syllabus
Weekly announcements

External to Course Management System:

Direct e-mail
Posted audio/video (including YouTube, 3cmediasolutions, etc.)
Synchronous audio/video
Telephone contact/voicemail

For hybrid courses:

Scheduled Face-to-Face group or individual meetings

Briefly discuss how the selected strategies above will be used to maintain Regular Effective Contact in the course.

Faculty will regularly contact students individually and as a group through Canvas messages and/or COD email. Students will also receive regular announcements with information about the course, COD as a whole, or other relevant information.
In discussions and through other lab assignments, students will communicate with each other and their professor regularly and frequently.

If interacting with students outside the LMS, explain how additional interactions with students outside the LMS will enhance student learning.

Students may prefer to contact their professor via email or on the phone, which allows for an improved experience for those who communicate better in those contexts. The professor may direct students to access free supplemental resources as well.

Other Information

Comparable Transfer Course Information

University System

CSU

Campus

CSU San Bernardino

Course Number

MATH 1101

Course Title

Mathematics and Society

Catalog Year

2021-2022

Rationale

Similar course content. Currently aligned.

COD GE
C4.B - Language and Rationality - Communication and Analytical Thinking

CSU GE
B4 - Mathematics

IGETC GE
2A - Mathematical Concepts & Quantitative Reasoning

MIS Course Data

CIP Code
27.0101 - Mathematics, General.

TOP Code
170100 - Mathematics, General

SAM Code
E - Non-Occupational

Basic Skills Status
Not Basic Skills

Prior College Level
Not applicable

Cooperative Work Experience
Not a Coop Course

Course Classification Status
Credit Course

Approved Special Class
Not special class

Noncredit Category
Not Applicable, Credit Course

Funding Agency Category
Not Applicable

Program Status
Program Applicable

Transfer Status
Transferable to both UC and CSU

General Education Status
B = Mathematics/Quantitative Reasoning/Analytical Thinking

Support Course Status
N = Course is not a support course

Allow Audit
Yes

Repeatability
No

Materials Fee
No

Additional Fees?
No

Approvals

Curriculum Committee Approval Date
10/19/2023

Academic Senate Approval Date
10/26/2023

Board of Trustees Approval Date
11/09/2023

Chancellor's Office Approval Date
01/19/2023

Course Control Number
CCC000642332

Programs referencing this course
Liberal Arts: Math and Science AA Degree (http://catalog.collegeofthedesert.eduundefined/?key=29)
UC 7 Course Transfer Pattern (http://catalog.collegeofthedesert.eduundefined/?key=404)
CSU Golden 4 Transfer Certificate (http://catalog.collegeofthedesert.eduundefined/?key=405)
Intersegmental General Education Transfer Curriculum (IGETC) for STEM (http://catalog.collegeofthedesert.eduundefined/?key=407)