

MATH 013: LIBERAL ARTS MATH

Originator

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Justification / Rationale

AB 705 statement update

Effective Term

Fall 2019

Credit Status

Credit - Degree Applicable

Subject

MATH - Mathematics

Course Number

013

Full Course Title

Liberal Arts Math

Short Title

LIBERAL ARTS MATH

Discipline**Disciplines List**

Mathematics

Modality

Face-to-Face

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 prerequisites. 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 040 or MATH 045

Advisory: ENG 061 & RDG 061

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

Prerequisite Course(s)

MATH 040 or MATH 045

Advisory: ENG 061 & RDG 061

Required Text and Other Instructional Materials**Resource Type**

Book

Author

Pirnot, Thomas L

Title

Mathematics All Around

Edition

6

Publisher

Pearson

Year

2018

College Level

Yes

Flesch-Kincaid Level

11.08

ISBN #

9780134462493

Class Size Maximum

35

Entrance Skills

Recognize that the key characteristic of a linear model is its constant rate of change.

Prerequisite Course Objectives

MATH 040-Comprehend that the key characteristic of a linear model is its constant rate of change.

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.

Entrance Skills

Interpret slope as a rate of change.

Prerequisite Course Objectives

MATH 040-Interpret slope as a rate of change.

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.

Entrance Skills

Recognize when a table, graph, or equation is linear.

Prerequisite Course Objectives

MATH 040-Recognize when a table, graph, or equation is linear.

MATH 045-Recognize when a table, graph, or equation is linear and recognize when a scatterplot appears to show linear correlation and be able to describe this relationship and discuss how it does not necessarily reflect causation in written form.

MATH 045-Create, manipulate, and analyze tables and charts including an introduction to writing basic formulas in spreadsheets, describing shapes of frequency distributions, reading histograms, and the advantages/disadvantages of a variety of diagrams such as Venn and Euler diagrams, pie/circle graphs, scatterplots, bar graphs, and time series.

Entrance Skills

Create a linear model in the form of a table, graph, or equation.

Prerequisite Course Objectives

MATH 040-Create a linear model in the form of a table, graph, or equation.

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.

Entrance Skills

Find the equation of a line and apply it to solve problems with a constant of change.

Prerequisite Course Objectives

MATH 040-Find the equation of a line and apply it to solve problems with a constant of change.

MATH 045-Find the equation of a line and apply it to solve financial and social sciences problems involving constant rates of change.

Entrance Skills

Solve 2×2 and 3×3 systems of linear equations.

Prerequisite Course Objectives

MATH 040-Solve 2×2 and 3×3 systems of linear equations.

MATH 045-Solve 2×2 and 3×3 systems of linear equations and solve application problems from social sciences.

Entrance Skills

Graph systems of linear inequalities in two dimensions.

Prerequisite Course Objectives

MATH 040-Graph systems of linear inequalities in two dimensions.

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.

Entrance Skills

Understand and manipulate rational exponents and N th roots.

Prerequisite Course Objectives

MATH 040-Comprehend and manipulate rational exponents and N th roots.

MATH 045-Comprehend and manipulate rational exponents and N th roots, including those used in financial mathematical formulas such as compound interest.

Entrance Skills

Solve root equations.

Prerequisite Course Objectives

MATH 040-Solve root equations.

MATH 045-Evaluate root functions, including multivariate functions such as the standard deviation.

Entrance Skills

Understand the definition of a function including the use of function notation and appropriate terminology (e.g. domain, range, independent and dependent variables, and one-to-one).

Prerequisite Course Objectives

MATH 040-Apply the definition of a function including function notation and terminology (domain and range).

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 045-Understand the definitions one-to-one and inverse functions, including log functions, and observe them in applications from statistics and financial mathematics.

Entrance Skills

Recognize that the key characteristic of an exponential function is its constant growth (or decay) factor.

Prerequisite Course Objectives

MATH 040-Comprehend that the key characteristic of an exponential function is its constant growth (decay) factor.

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.

Entrance Skills

Recognize when a table, graph, or equation is exponential and when a word problem can be modeled with an exponential function.

Prerequisite Course Objectives

MATH 040-Recognize when a table, graph, or equation is exponential and when a word problem can be modeled with an exponential function.

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-Create, manipulate, and analyze tables and charts including an introduction to writing basic formulas in spreadsheets, describing shapes of frequency distributions, reading histograms, and the advantages/disadvantages of a variety of diagrams such as Venn and Euler diagrams, pie/circle graphs, scatterplots, bar graphs, and time series.

Entrance Skills

ADVISORY SKILLS:

Read and comprehend word problems.

Prerequisite Course Objectives

ENG 061-Demonstrate the ability to think critically and express ideas using various patterns of development.

ENG 061-Demonstrate the ability to read and respond in writing beyond the literal interpretation of the text.

RDG 061-Read a variety of texts fluently.

RDG 061-Write organized summaries/reactions that capture main idea and supporting details.

Entrance Skills

Evaluate expressions and functions and recognize when an application requires a particular function.

Prerequisite Course Objectives

MATH 040-Comprehend that the key characteristic of an exponential function is its constant growth (decay) factor.

MATH 040-Apply the definition of a function including function notation and terminology (domain and range).

MATH 040-Recognize when a table, graph, or equation is linear.

MATH 040-Apply the definition of a function including function notation and terminology (domain and range).

MATH 040-Recognize when a table, graph, or equation is exponential and when a word problem can be modeled with an exponential function.

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 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

Demonstrate the order of operations when evaluating functions and expressions and manipulate expressions using properties of operations on real numbers and functions.

Prerequisite Course Objectives

MATH 040-Apply the definition of a function including function notation and terminology (domain and range).

MATH 040-Apply the definition of a function including function notation and terminology (domain and range).

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 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 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.

Prerequisite Course Objectives

ENG 061-Demonstrate the ability to think critically and express ideas using various patterns of development.

MATH 040-Recognize when a table, graph, or equation is exponential and when a word problem can be modeled with an exponential function.

MATH 040-Recognize when a table, graph, or equation is linear.

MATH 040-Recognize when a table, graph, or equation is quadratic.

MATH 045-Recognize when a table, graph, or equation is linear and recognize when a scatterplot appears to show linear correlation and be able to describe this relationship and discuss how it does not necessarily reflect causation in written form.

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-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.

MATH 045-Create, manipulate, and analyze tables and charts including an introduction to writing basic formulas in spreadsheets, describing shapes of frequency distributions, reading histograms, and the advantages/disadvantages of a variety of diagrams such as Venn and Euler diagrams, pie/circle graphs, scatterplots, bar graphs, and time series.

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

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, using Polya's problem solving techniques, analyze patterns, draw and use diagrams, find counterexamples, and justify universal statements.
Objective 2	Differentiate between inductive and deductive reasoning, and use both to solve problems.
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 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.
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 elementary mathematics of finance formulas including 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).
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 evaluated by writing summaries, explorations, justifications, and analyses of mathematical concepts.	In and Out of Class
Mid-term and final evaluations	Students will be evaluated by examinations 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.	In Class Only
Computational/problem-solving evaluations	Students will be evaluated by completing challenging problem sets requiring careful reasoning and application of a variety of course topics.	In and Out of Class
Written homework	Students will be evaluated by homework assignments requiring at least six hours per week.	Out of Class Only
Other	Students may be evaluated with chapter tests and/or section quizzes, with free-response, multiple choice, and/or True/False problems.	In Class Only
Mid-term and final evaluations	Students will be evaluated by a comprehensive two-hour final exam.	In Class Only
Laboratory projects	Students may be evaluated by computer 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. Complete examinations involving problems that require the application of studied principles and skills to new situations as well as problems that mirror those done on homework and in class.

Other Out-of-class Assignments

1. Read textbook.
2. Read supplementary material.
3. Review notes.
4. Complete assigned homework, including exercises designed to improve problem solving, computational skills and mathematical understanding.
5. Complete lab investigations and assignments started during class.
6. Complete homework and lab assignments that involve writing summaries and/or interpreting mathematical concepts.

Grade Methods

Letter Grade Only

Comparable Transfer Course Information
University System

CSU

Campus

CSU San Bernardino

Course Number

MATH 115

Course Title

The Ideas of Mathematics

Catalog Year

2017-2018

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

Allow Audit

No

Repeatability

No

Materials Fee

No

Additional Fees?

No

Approvals**Curriculum Committee Approval Date**

02/05/2019

Academic Senate Approval Date

02/14/2019

Board of Trustees Approval Date

03/15/2019

Course Control Number

CCC000250892

Programs referencing this courseLiberal Arts: Math and Science AA Degree (<http://catalog.collegeofthedesert.eduundefined?key=29>)