

MATH 0019 - MATHEMATICAL CONCEPTS FOR ELEMENTARY SCHOOL TEACHERS

Catalog Description

Prerequisite: Completion of two years of high school algebra or MATH D with grade(s) of "C" or better or placement by matriculation assessment process

Hours: 54 lecture

Description: Focuses on the development of quantitative reasoning skills through in-depth, integrated explorations of topics in mathematics, including the real number system and its subsystems. The emphasis is on comprehension and analysis of mathematical concepts and applications of logical systems. (C-ID MATH 120) (CSU, UC)

Course Student Learning Outcomes

- CSLO #1: Analyze the structure and properties of rational and real number systems including their decimal representation and illustrate the use of a representation of these numbers including the number line model.
- CSLO #2: Analyze multiple approaches to solving problems from elementary to advanced levels of mathematics, using concepts and tools from sets, logic, functions, number theory and patterns.
- CSLO #3: Plan math activities for elementary aged children in line with course content and the Common Core standards.

Effective Term

Fall 2022

Course Type

Credit - Degree-applicable

Contact Hours

54

Outside of Class Hours

108

Total Student Learning Hours

162

Course Objectives

1. Perform calculations with place value systems;
2. Evaluate the equivalence of numeric algorithms and explain the advantages and disadvantages of equivalent algorithms in different circumstances;
3. Apply algorithms from number theory to determine divisibility in a variety of settings;
4. Analyze least common multiples and greatest common divisors and their role in standard algorithms;
5. Explain the concept of rational numbers, using both ratio and decimal representations; analyze the arithmetic algorithms for these two representations; and justify their equivalence;

6. Analyze the structure and properties of whole, rational, and real number systems; define the concept of rational and irrational numbers, including their decimal representation; and illustrate the use of a number line representation;
7. Develop and reinforce conceptual understanding of mathematical topics through the use of patterns, problem solving, communication, connections, modeling, reasoning, and representation; and
8. Develop activities implementing curriculum standards.

General Education Information

- Approved College Associate Degree GE Applicability
 - AA/AS - Comm & Analyt Thinking
 - AA/AS - Mathematical Skills
- CSU GE Applicability (Recommended-requires CSU approval)
 - CSUGE - B4 Math/Quantitative Reasoning
- Cal-GETC Applicability (Recommended - Requires External Approval)
- IGETC Applicability (Recommended-requires CSU/UC approval)

Articulation Information

- CSU Transferable
- UC Transferable

Methods of Evaluation

- Essay Examinations
 - Example: Essay questions will assess student understanding of the history of a variety of topics. Two examples include the history of the zero element in ancient numeration systems, and the history of the discovery (and consequent problems) of irrational numbers in ancient Greek society. The instructor will grade these exams based on a rubric relative to their clarity, correctness, and organization.
- Objective Examinations
 - Example: Objective exam questions will assess student ability to perform algorithms developed in the course. The instructor will identify if the algorithm was used correctly and that the correct solution was obtained. The Euclidean algorithm is used to find the gcd of two natural numbers, and the Division algorithm is used to rewrite an improper rational number as a mixed numeral. Both these algorithms will be presented on an objective exam.
- Problem Solving Examinations
 - Example: Exam questions will assess student ability to formulate a procedure and a solution to a given mathematical problem. The instructor will grade the response in terms of both its clarity and correctness. For example, a student will be given the distance of two individuals on the surface of this planet, one with the sun directly above. The other does not have the sun directly above, but knowing the angle that the sun makes with the second individual's shadow will allow the student to determine the circumference of the earth (this is an example of using fractions to solve a problem and is a replication of Eratosthenes findings). Another problem solving exam question will have the student use the Fibonacci sequence to build a new sequence. With this new sequence, the first entry is the ratio of the second Fibonacci number to the first. The second entry is the ratio of the third Fibonacci number to the second. Repeating this process, the student will be asked to determine the number to which the nth term of this sequence is approaching.

Repeatable

No

Methods of Instruction

- Lecture/Discussion
- Distance Learning

Lecture:

1. The instructor will provide the student with two natural numbers. Through long division or a factor tree, the student will find the prime factorization of these two natural numbers. The student will use two distinct colored circular transparent pieces of plastic, duplicating the image of a Venn diagram, and write on the appropriate parts of these plastic circle the prime factors of the given natural numbers so that the prime factors of the gcd is in the intersection and the prime factors of the lcm represent the union. In addition, the student will use the Euclidean algorithm to generate the gcd of the two given natural numbers and compare the result with the intersection of the two pieces of plastic. In addition, the student will algorithmically re-express the gcd as a linear combination of the two given natural numbers. The student will write their responses, including the algorithms, for the instructor to read and review. (Objectives 1 & 2)
2. Following an instructor lecture on fractions, the instructor will briefly partition the class into subgroups. Each group is to use fractions to identify their group. The groups will submit these descriptors to the instructor and the instructor will redistribute them to the groups. Each group will then identify which group their descriptors represents. (Objective 2)

Distance Learning

1. The instructor will provide the student with two natural numbers. Through long division or a factor tree, the student will find the prime factorization of these two natural numbers. The student will use two distinct colored circular transparent pieces of plastic, duplicating the image of a Venn diagram, and write on the appropriate parts of these plastic circle the prime factors of the given natural numbers so that the prime factors of the gcd is in the intersection and the prime factors of the lcm represent the union. In addition, the student will use the Euclidean algorithm to generate the gcd of the two given natural numbers and compare the result with the intersection of the two pieces of plastic. In addition, the student will algorithmically re-express the gcd as a linear combination of the two given natural numbers. The student will post their responses to the discussion board, including the algorithms, to be peer reviewed. (Objectives 1 & 2)
2. Following an instructor video lecture on fractions, the instructor will partition the class into virtual subgroups. Each group is to use fractions to identify their group. The groups will submit these descriptors to the instructor and the instructor will create a discussion prompt asking each group to then identify which group each descriptor represents. (Objective 2)

Typical Out of Class Assignments

Reading Assignments

1. Read the historical conflict that the ancient Greeks encountered with the irrational numbers and how this conflict shaped the direction of Greek mathematical thought towards geometry and be prepared to discuss in class. 2. Read the history of numeration systems, including the discovery

or absence of the number zero in ancient cultures, Mayan, Chinese, Egyptian, Roman, Babylonian, and Hindu-Arabic numeration systems and be prepared to discuss in class.

Writing, Problem Solving or Performance

1. Verify that a given number in decimal form that has either a finite decimal expansion or an infinite decimal expansion is indeed a rational number (i.e., it can be expressed as the ratio of two integers). 2. Generate the greatest common divisor of two natural numbers in a variety of ways, including the Euclidean Algorithm and with the use of Venn diagrams.

Other (Term projects, research papers, portfolios, etc.)

Required Materials

- Mathematics for Elementary School Teachers
 - Author: Tom Bassarear, Meg Ross
 - Publisher: Cengage
 - Publication Date: 2016
 - Text Edition: 6th
 - Classic Textbook?: No
 - OER Link:
 - OER:
- Mathematics for Elementary Teachers: A Conceptual Approach
 - Author: Albert Barnett, Ted Nelson
 - Publisher: McGraw Hill
 - Publication Date: 2016
 - Text Edition: 10th
 - Classic Textbook?: No
 - OER Link:
 - OER:
- Mathematics for Elementary Teachers
 - Author: Michelle Manes
 - Publisher: University of Hawaii OER
 - Publication Date: 2017
 - Text Edition:
 - Classic Textbook?: No
 - OER Link:
 - OER:

Other materials and-or supplies required of students that contribute to the cost of the course.