CUNY Common Core
Course Submission Form

Instructions: All courses submitted for the Common Core must be liberal arts courses. Courses may be submitted for only one area of the Common Core. All courses must be 3 credits/3 contact hours unless the college is seeking a waiver for another type of Math or Science course that meets major requirements. Colleges may submit courses to the Course Review Committee at any time. Courses must also receive local campus governance approval for inclusion in the Common Core.

College	Lehman College
Course Prefix and Number (e.g., ANTH 101, if number not assigned, enter XXX)	MAT 123
Course Title	Number Systems and Number Theory For Educators
Department(s)	Mathematics
Discipline	Mathematics
Credits	3
Contact Hours	3
Pre-requisites (if none, enter N/A)	Departmental permission
Co-requisites (if none, enter N/A)	n/a
Catalogue Description	Properties of counting numbers, integers, rationals and reals; elementary number theory. Operations, computations, and historical developments of these ideas also included. Note. Intended for pre-service elementary and middle school teachers.
Special Features (e.g., linked courses)	
Sample Syllabus	Syllabus must be included with submission, 5 pages max recommended

Indicate the status of this course being nominated:

☐ current course ☐ revision of current course ☒ a new course being proposed

CUNY COMMON CORE Location

Please check below the area of the Common Core for which the course is being submitted. (Select only one.)

Required	Flexible	
☐ English Composition	☐ World Cultures and Global Issues	☐ Individual and Society
☒ Mathematical and Quantitative Reasoning	☐ US Experience in its Diversity	☐ Scientific World
☐ Life and Physical Sciences	☐ Creative Expression	

Waivers for Math and Science Courses with more than 3 credits and 3 contact hours

Waivers for courses with more than 3 credits and 3 contact hours will only be accepted in the required areas of "Mathematical and Quantitative Reasoning" and "Life and Physical Sciences." Three credit/3-contact hour courses must also be available in these areas.

If you would like to request a waiver please check here:	☐ Waiver requested
If waiver requested: Please provide a brief explanation for why the course will not be 3 credits and 3 contact hours.	

If waiver requested: Please indicate whether this course will satisfy a major requirement, and if so, which major requirement(s) the course will fulfill.	

Learning Outcomes

In the left column explain the course assignments and activities that will address the learning outcomes in the right column.

B. Mathematical and Quantitative Reasoning: Three credits

A course in this area must meet all the learning outcomes in the right column. A student will:

SLO 1 is assessed through a combination of in-class activities, written assignments, quizzes, and exams throughout the semester. Across these assessments, students are required to demonstrate that they know, can describe, and can interpret various number systems and types of real numbers—including whole numbers, integers, rational numbers, irrational numbers, and decimals—using multiple quantitative representations such as symbols, diagrams, graphs, and tables. Throughout the course, students are expected not only to interpret these representations, but also to draw appropriate inferences about the meaning of quantities, including how specific symbols, diagrams, and structures (e.g., place value, base-ten structure, area models) represent numerical relationships. **Examples of Assessment Tasks:** **a) In class discussions and written assignments** Students respond to targeted tasks such as: ● Interpret the digits of 1.234 and represent them as a length; then using the base-ten structure represent this decimal as with bundled objects. (***Topic 1- Numeration Systems-Number base and place value***) ● Use the decimal representation of 1.777… to show that the square root of this number is rational. Then, sketch a picture showing the original number and its square root. (***Topic 6: Decimals, Percents, and Real Numbers- Terminating and repeating decimals***) ● Interpret an area model for a multiplication problem and explain how it illustrates the distributive property. (***Topic 2: Whole Number Operations-Properties of Whole Number Operations***) ● Interpret a graph representing a proportional relationship. (***Topic 5: Rational Numbers & Proportional Reasoning-Quantitative and Proportional Reasoning***)	**SLO 1**: Interpret and draw appropriate inferences from quantitative representations, such as formulas, graphs, or tables.

b) Sample final exam alignment In the attached sample final exam, ● Question (1a) requires students to correctly interpret each digit in the base 10 numbers 0.0035 and 1.0405 and to explain how those digits relate to 0.0001 (one ten-thousandth). Students must accurately convert each number into an equivalent quantity measured in ten-thousandths and justify their reasoning using place value concepts. (***Topic 1- Numeration Systems- Number Base & Place Values***) ● Question 1b requires students to correctly interpret each symbol in the Roman numeral MCMXXII and determine the corresponding year in base-ten notation. Students must then describe and compare how quantity is represented in a non–place-value numeration system (Roman numerals) versus a place-value system (base 10). (***Topic 1- Numeration Systems – Ancient Numeration Systems***) Through these tasks, students demonstrate their ability to interpret symbolic quantitative representations, draw appropriate inferences about the structure and limitations of different number systems, and communicate mathematical reasoning using appropriate terminology related to numeration systems and place value.	
SLO 2 is assessed through in-class activities, homework assignments, quizzes, and exams**.** Throughout the course, students are required to select and use appropriate mathematical representations—including diagrams, drawings, graphs, equations, tables, and conceptual models—to translate, represent, and solve quantitative problems expressed in natural language**,** particularly those situated in real-world contexts. Students are expected to demonstrate flexibility in moving among representations and to justify why a chosen representation is appropriate for the problem being solved. **Examples of Assessment Tasks** **a) In-class activities, homework, and assignments** Students respond to prompts such as: ● A restaurant server received a $7.00 tip on a meal he served. If this tip represents 20% of the cost of the meal, then how much did the meal cost? Solve this problem with the aid of a drawing, and using a percent table, then represent this using an algebraic equation or proportion. (***Topic 6: Decimals, Percents, and Real Numbers – Operations on Decimals; Percents***) ● Which of the following mixtures will be saltier: 3 tablespoons of salt mixed in 4 cups of water or 4 tablespoons of salt mixed in 5 cups of water? Represent and solve the problem in at least 2 different ways. (***Topic 5: Rational Numbers & Proportional***	**SLO 2.** Represent quantitative problems expressed in natural language in a suitable mathematical format.

Reasoning- Multiplication & Division of Rational Numbers; Quantitative & Proportional Reasoning) **b) Sample final exam Alignment** ● In the attached sample final exam, this Student Learning Outcome is primarily assessed in Question 5a, where students must generate a correct numerical sequence, write an explicit algebraic rule relating the term number $n$to the term b_n, and clearly explain the underlying pattern. (***Topic 4: Operations with Integers- Addition & Subtraction of Integers; Multiplication & Division of Integers***) ● This SLO is also assessed in Questions 4a and 4b, where students translate a real-world paint-mixture scenario into appropriate mathematical forms, such as a ratio table, fraction equation, or proportional relationship, and use these representations to determine unknown quantities. (**Topic 5: Rational Numbers & Proportional Reasoning- Multiplication & Division of Rational Numbers; Quantitative & Proportional Reasoning**) .	
SLO 3 is assessed through **written assignments, quizzes, exams, and in-class group work**. Throughout the course, students are expected to **develop and apply algebraic thinking** using **variables, formulas, and relationships**, while also working within **different number system constraints**. Students must demonstrate understanding of the algebraic operations of **addition, subtraction, multiplication, and division**, and use these operations to **solve problems, model quantitative situations, and justify solution strategies** using appropriate representations and reasoning. **Examples of Assessment Tasks** **a) In-class discussions, group work, and written assignments** Students respond to prompts such as: ● A large number of gumballs are contained in a glass container shaped like a box with a square base. From the top view, approximately 50 gumballs are visible; from a side view, approximately 60 gumballs are visible; and there are about 9 gumballs along each vertical edge. Estimate the total number of gumballs in the container. Clearly state the assumptions you make, explain how those assumptions affect your estimate, and discuss how your approach would change if some gumballs were broken into pieces. (***Topic 2: Whole Number Operations- Mental Computations and Estimations***) ● Suppose that 4 painters take 20 hours to paint a house, assuming all painters work at a constant rate. Construct a table showing the relationship between the number of painters and the time required to complete the job, including	**SLO 3.** Use algebraic, numerical, graphical, or statistical methods to draw accurate conclusions and solve mathematical problems.

the case of 3 painters. Describe the algebraic relationship represented in the table. (***Topic 5: Rational Numbers & Proportional Reasoning- Multiplication & Division of Rational Numbers; Quantitative & Proportional Reasoning***) ▪ Show and explain how to write the fraction $\frac{5}{8}$ as a decimal. Then rewrite the fraction as a sum of fractions whose denominators are powers of 10, and explain how this representation reflects base-ten structure. (***Topic 6: Decimals, Percents, and Real Numbers – Terminating & Repeating Decimals ; Topic 1: Numeration Systems- Number-base systems and Place Values***) b) **Sample final exam alignment** ● In the attached sample final exam, this Student Learning Outcome is primarily assessed in Questions 2a–2d**,** where students are required to perform addition, multiplication, and percent calculations without relying on standard memorized algorithms. Instead, students must demonstrate understanding by using alternative solution pathways**,** such as partial sums, expanded notation, base-ten representations, and area models or the distributive property for multiplication, and by clearly explaining their reasoning. (***Topic 2: Whole Number Operations- Multiplication and Division of Whole Numbers; Properties of Whole Number Operations)*** ● This SLO is also assessed in Question 5b**,** where students evaluate a specific term of an arithmetic sequence by substituting a given input value into an explicitly defined algebraic rule. (***Topic 4: Operations with Integers- Addition, Subtraction, Multiplication & Division of Integers)*** ● Additionally, this SLO is addressed in part in Question 5a, where students are required to write and solve an algebraic equation to represent and analyze the given quantitative situation. (**Topic 4: Operations with Integers- Addition, Subtraction, Multiplication & Division of Integers)**	

Examples of Assessment Tasks **a) In-class, group, and written exercises** Students respond to problems such as: ● Use the scaffold method to calculate 72,125 ÷ 31. Explain how other operations, including addition, subtraction, and multiplication, are used in combination to solve this problem using this method. (***Topic 2: Whole Number Operations- Multiplication & Division of Integers***) ● Write equations using numbers in expanded form to regroup 104 so that 69 can be subtracted. Explain each step and the reasoning behind it. (***Topic 2: Whole Number Operations- Addition & Subtraction***) ● Sam compares fractions by only looking at the denominator. He claims the fraction with the larger denominator is smaller because each piece is smaller. Do you agree or disagree with Sam? Explain your reasoning, referencing fraction concepts. (***Topic 5: Rational Numbers & Proportional Reasoning- The Set of Rational Numbers; Quantitative & Proportional Reasoning***) In these exercises, students are expected to justify their solution strategies, explain underlying concepts, and clearly communicate reasoning, either orally or in writing. **b) Sample final exam alignment** ● In the attached sample final exam, this Student Learning Outcome is primarily assessed in Question 1c, where students explain how ancient or historical numeration systems influenced the development of modern symbolic notations, such as the base-ten system. (***Topic 1- Numeration Systems***) ● This SLO is also addressed in part across all other exam questions, as students are required to explain their reasoning and justify their solutions to receive full credit.(***Topics 1 through 6***)	**SLO 4.** Effectively communicate quantitative analysis or solutions to mathematical problems in written or oral form.
SLO 5 is assessed through in-class and take-home assignments, including homework, quizzes, and exams. Throughout the course, students are expected to explain why standard numerical algorithms for arithmetic work, recognize situations where these algorithms may not apply, and determine an appropriate alternative solution pathway when necessary. Students are also expected to use estimation techniques to evaluate the reasonableness of results and to justify their solution strategies conceptually. **Examples of Assessment Tasks** **a) In-class, homework, and quiz exercises** Students respond to prompts such as: ● Explain in your own words why determining which of two fractions is greater can be done by giving both fractions a	**SLO 5**. Evaluate solutions to problems for reasonableness using a variety of means, including informed estimation.

common denominator. What is the conceptual rationale behind this method? What does it mean mathematically to give fractions the same denominator? (***Topic 5: Rational Numbers & Proportional Reasoning - The Set of Rational Numbers)*** ● Leah is working on the multiplication problem 2.43 × 0.148. Ignoring the decimals, she calculates 243 × 148 = 35,964. Explain how Leah can reason about the sizes of the numbers to determine the correct placement of the decimal point in her final answer. (***Topic 6: Decimals, Percents, and Real Number-Operations on Decimals***) ● Estimate the product of 498 × 62 before calculating the exact answer. Explain how your estimation strategy helps you determine whether your calculated result is reasonable or unreasonable. (***Topic 2: Whole Number Operations-Multiplication & Division)*** In all tasks, students are expected to conceptually explain the mathematical process, demonstrate estimation strategies, and justify their reasoning. **b) Sample final exam alignment** ● In the attached sample final exam, this Student Learning Outcome is primarily assessed in Question 2d, where students are asked to describe how estimation is used to evaluate the reasonableness of their results. (***Topic 2: Whole Number Operations-Multiplication & Division***) ● It is also assessed in Question 8a, where students apply estimation techniques to solve a percent problem, rounding either the price or percent, and justify why their solution is reasonable. (***Topic 5: Rational Numbers & Proportional Reasoning- Properties of, Estimations and Error Patterns with Rational Numbers***) ● Additionally, Question 1a addresses this SLO in part, as students must justify their reasoning using estimation when interpreting place value and quantitative relationships. (***Topic 1: Numeration System- Number-base systems and Place Values***)	
This Student Learning Outcome is assessed through homework assignments, quizzes, and exams. Throughout the course, students are expected to apply properties of various number systems and arithmetic operations to solve problems in a wide range of real-world contexts, including basic number theory, history and archaeology, biology, finance, manufacturing, construction and architecture, visual arts and design, computer science, and everyday life. Students are required to select and justify appropriate mathematical approaches, translate contextual problems into mathematical representations, and solve them using logical reasoning and proportional reasoning where applicable. **Examples of Assessment Tasks** **a) Real-world applications by context** 1) Architecture and Construction	**SLO 6**: Apply mathematical methods to problems in other fields of study.

● Keiko has a rectangular piece of fabric that is 48 inches wide and 72 inches long. She wants to cut her fabric into identical square pieces, leaving no fabric remaining, with all side lengths as whole numbers. What are her options? (***Topic 2: Whole Number Operations- Multiplication & Division***) ● If 10 workers take 8 hours to sew a store's order of pants, how long would it take 15 workers to complete the same order? Use proportional reasoning to solve. (***Topic 5: Rational Numbers & Proportional Reasoning- Proportional Reasoning)*** 2) Finance ● Last year's profits were $16 million, and this year's profits are $6 million. By what percent did profits decrease from last year to this year? Represent your solution using both a percent table and a proportional equation. (***Topic 6: Decimals, Percents, and Real Number – Operations on Decimals; Percents)*** 3) Computer Science and Measurement ● Explain how the binary numeration system supports data representation and computation in modern computer systems. Why is base-2 more efficient for electronic hardware than base-10? (***Topic 1: Numeration System-Number base Systems & Place Values***) ● Write a word problem in Finance, Construction, Science, or Measurement that represents 8.3 × 4.15, and solve it using at least two different representations (e.g., diagrams, equations, or tables). (***Topic 6: Decimals, Percents, and Real Numbers- Operations on Decimals***) **b) Sample final exam alignment** ● In the attached sample final exam, this Student Learning Outcome is fully addressed in Questions 4a and 4b, which involve real-life applications in Construction & Architecture and Visual Arts & Design. Students apply proportional reasoning to determine how much of each type of paint must be mixed with another color to produce a desired shade. (***Topic 5: Rational Numbers & Proportional Reasoning***) ● This SLO is also fully addressed in Questions 8b and 8c, which focus on Financial Math applications. Students are required to represent and solve percent problems using the percent table method and then represent the same problem as a proportion or algebraic equation, justifying their reasoning. (***Topic 6: Decimals, Percents, and Real Numbers -Quantitative & Proportional Reasoning)***	