**Progressive Mathematics Initiative® (PMI®)**
**MATH6423: Learning and Teaching Pre-Algebra**

**Primary Student Contact:**   Audra Crist                audra@njctl.org

**Faculty Teams:**              Dr. Bob Goodman            bob@njctl.org
                                Audra Crist                audra@njctl.org
                                Maria Surace               maria@njctl.org
                                Katy Goodman               katy@njctl.org
                                Brian Simione              brian@njctl.org

**Course Credit:**  4.0 NJCTL credits

**Dates & Times:**
This is a 4-credit, self-paced course, covering 13 modules of content. The exact number of hours that you can expect to spend on each module will vary based upon the module coursework, as well as your study style and preferences. You should plan to spend approximately 15 hours per credit working online, and up to 30 hours per credit working offline.

**Graduate Student Handbook:** www.njctl.org/graduate-handbook/

**COURSE DESCRIPTION:**
This introductory course is for teachers to review and solidify their understanding of middle school mathematics while learning how to teach that material to students. In addition to learning how to teach this material, a key goal is to ensure that teachers have a strong foundation for subsequent, more advanced, mathematics courses. Course content is drawn from topics taught to students in grades 5 through 8, prior to the study of high school Algebra 1 and Geometry. The topics of this course are also taught in developmental college courses, to which a high percentage of entering college freshmen are assigned. As such, this course will also prepare college teachers who teach those courses. All future study of mathematics requires a full understanding of these topics, which include Numbers and Operations; Scientific Notation; Expressions; Equations; Inequalities; Ratios & Proportions; Percents; and Statistics and Probabilities.

**STUDENT LEARNING OUTCOMES:**
Upon completion of the course, the student will be able to:
1. Demonstrate an understanding of mathematics concepts of pre-algebra, including how to teach them, detailed in the module learning outcomes below.
2. Integrate PMI materials (including presentations, labs, practice problems, etc.) to support student learning and deliver effective instruction.

3.  Create a social constructivist learning environment through the use of formative assessment questions, interpreting the results of this assessment to effectively facilitate student-led discussions that support deeper understanding of the content.
4.  Integrate multiple attempts to demonstrate student mastery of content knowledge, as encouraged/fostered by the PMI pedagogy.
5.  Implement learning plans that are aligned to Common Core standards and allow for differentiation based on the needs of learners.

## TEXTS, READINGS, INSTRUCTIONAL RESOURCES:
### Required Texts:
- This course uses a free digital textbook accessible at: https://njctl.org/courses/math/pre-algebra/
- Participants will download SMART Notebook presentations, homework files, labs, and teacher resources from the PMI Pre-Algebra course

### Recommended Readings:
- Related articles within short answer prompts

## COURSE REQUIREMENTS:
In order to receive a Passing grade, the participant must complete the following course requirements:

1.  Activities: A number of different learning activities will ensure participant engagement and learning in the course. These include:
    - Engage in video module lessons which demonstrate minimized direct instruction followed by frequent formative assessment
    - Completion of formative assessments aligned to learning objectives which include detailed analysis when answered incorrectly.
    - Interaction with module discussion boards that allow conversation with peers and course instructors about the module's content, delivering that content to students. Discussion boards also serve as a place to ask and answer questions related to the module's content.
2.  Short Answer Assignment:  Each module requires one (1) original response to a given prompt. These prompts are typically based upon course lessons and require teachers to analyze, reflect, and make connections between the module's content and their own classroom practice.
3.  Mastery Exercises: For each module, these multiple-choice question quizzes assess the content knowledge gained in a module.   Participants have the opportunity to retake; random questions are pulled from a larger question bank on each attempt ensuring varied questions.
4.  Virtual Labs: In each module, a virtual lab write-up will be submitted.  Virtual labs are interactive lab simulations that promote discovery-based student learning through real-world applications and analysis.
5.  Module Exam: One is completed at the end of each module. It is a culminating exam consisting of multiple choice and free response questions aligned to the standards and objectives of the module.

6. Reflection Paper: At the end of the course, participants are required to reflect on the knowledge taught in the course, make connections, and compare/contrast their current pedagogy with new strategies gained in this assignment.
7. Final Exam: At the end of the course, a comprehensive exam consisting of Multiple Choice and Free Response questions assesses the content knowledge learned throughout the course.

## GRADE DISTRIBUTION AND SCALE:

### Grade Distribution:

| | |
|---|---|
| Module Exams | 70% |
| Final Exam | 10% |
| Labs | 6% |
| Short Answer Assignments | 6% |
| Mastery Exercises | 6% |
| Reflection Paper | 2% |

### Grade Scale:

| | |
|---|---|
| A | 93 – 100 |
| A- | 90 – 92 |
| B+ | 86 – 89 |
| B | 83 – 86 |
| B- | 80 – 82 |
| C+ | 77 – 79 |
| C | 73 – 76 |
| C- | 70 – 72 |
| D | 60.0 – 69.9 |
| F | 59.9 or below |

### GRADING RUBRIC:
The following rubric is used to score:
- Short Answer Assignment – 6% of grade
- Reflection Paper – 2% of grade

The minimum possible score for this rubric is 4 points, and the score will be converted to the minimum grade available in this module (which is zero unless the scale is used). The maximum score of 25 points will be converted to the maximum grade.

Intermediate scores will be converted respectively and rounded to the nearest available grade. If a scale is used instead of a grade, the score will be converted to the scale elements as if they were consecutive integers.

|  | Meets Expectation | Approaches Expectation | Below Expectation | Limited Evidence |
|---|---|---|---|---|
|  | *7 points* | *5 points* | *3 points* | *1 point* |
| **Content** | • Demonstrates excellent knowledge of concepts, skills, and theories relevant to topic. | • Demonstrates fair knowledge of concepts, skills, and theories. | • Demonstrates incomplete or insubstantial knowledge of concepts, skills, and theories. | • Demonstrates little or no knowledge of concepts, skills, and theories. |
| **Depth of Reflection** | • Content is well supported and addresses all required components of the assignment. | • Content is partially supported; addresses most of the required components of the assignment. | • Content contains major deficiencies; addresses some of the required components of the assignment. | • Content is not supported and/or includes few of the required components of the assignment. |
| **Evidence and Practice** | • Response shows strong evidence of synthesis of ideas presented and insights gained throughout the entire course. The implications of these insights for the respondent's overall teaching practice are thoroughly detailed, as applicable. | • Writing is mostly clear, concise, and well organized with good sentence/paragraph construction. Thoughts are expressed in a coherent and logical manner. There are no more than five spelling, grammar, or syntax errors per page of writing. | • Response is missing some components and/or does not fully meet the requirements indicated in the instructions. Some questions or parts of the assignment are not addressed. Some attachments and additional documents, if required, are missing or unsuitable for the purpose of the assignment. | • Response excludes essential components and/or does not address the requirements indicated in the instructions. Many parts of the assignment are addressed minimally, inadequately, and/or not at all. |
|  | *4 points* | *3 points* | *2 points* | *1 point* |
| **Writing Quality** | • Writing is well-organized, clear, concise, and focused; no errors. | • Some minor errors or omissions in writing organization, focus, and clarity. | • Some significant errors or omissions in writing organization, focus, and clarity. | • Numerous errors in writing organization, focus, and/or clarity. |

The following rubric is used to score:
- Labs – 6% of grade

The minimum possible score for this rubric is 2 points, and the score will be converted to the minimum grade available in this module (which is zero unless the scale is used). The maximum score of 14 points will be converted to the maximum grade.

Intermediate scores will be converted respectively and rounded to the nearest available grade. If a scale is used instead of a grade, the score will be converted to the scale elements as if they were consecutive integers.

|  | Meets Expectation | Approaches Expectation | Below Expectation | Limited Evidence |
|---|---|---|---|---|
|  | *7 points* | *5 points* | *3 points* | *1 point* |
| **Completeness** | • Lab write-up is complete with no missing fields. | • Lab write-up has 1-2 missing fields. | • Lab write-up has 3-5 missing fields. | • There are more than 5 missing fields on the lab write-up. |
| **Calculations** | • All answers are calculated correctly. | • Most answers are calculated correctly, but there are 1-2 minor calculation errors. | • Most answers are calculated correctly, but there are multiple minor calculation errors, or 1-2 gross miscalculations. | • There are calculation errors throughout the lab. |

The remaining types of assignments are not scored using a rubric. These assignments are scored using percentage correct to assign a letter grade. The assignments in this manner are as follows:
- Mastery Exercises – 6% of grade
- Module Exams – 70% of grade
- Final Exam – 10% of grade

Mastery Exercises can be retaken as many times as desired to ensure a high score. Due to the nature of these assignments, each time they are taken, they will be composed of unique questions pulled randomly from a larger question bank.

Module and Final Exams are scored using a curve, which allows us to keep content exams rigorous. Module Exams can be retaken one time. Final Exams cannot be retaken.

## ACADEMIC STANDING:
NJCTL has established standards for academic good standing within a student's academic program. Students enrolled in any NJCTL online course must receive an 80 or higher to successfully complete a course and receive credit for that course. An 80 is equivalent to a GPA of 2.7 or B-. Additionally, students in an endorsement program must receive a cumulative GPA of 3.0 for all courses combined in order to successfully complete the program.

## ACADEMIC INTEGRITY:
Students must assume responsibility for maintaining honesty in all work submitted for credit and in any other work designated by the instructor of the course. Academic dishonesty includes cheating, fabrication, facilitating academic dishonesty, plagiarism, reusing /repurposing your own work, unauthorized possession of academic materials, and unauthorized collaboration.

## CITING SOURCES WITH APA STYLE:
All students are expected to follow proper writing and APA requirements when citing in APA (based on the APA Style Manual, 6th edition) for all assignments.

## DISABILITY SERVICES STATEMENT:
We are committed to providing reasonable accommodations for all persons with disabilities. Any student with a documented disability requesting academic accommodations should contact the Dean of Students, Melissa Axelsson, for additional information to coordinate reasonable accommodations for students with documented disabilities (melissa@njctl.org).

## NETIQUETTE:
Respect the diversity of opinions among the instructor and classmates and engage with them in a courteous, respectful, and professional manner. All posts and classroom communication must be conducted in accordance with the student code of conduct. Think before you push the Send button. Did you say just what you meant? How will the person on the other end read the words?

Maintain an environment free of harassment, stalking, threats, abuse, insults or humiliation toward the instructor and classmates. This includes, but is not limited to, demeaning written or oral comments of an ethnic, religious, age, disability, sexist (or sexual orientation), or racist nature; and the unwanted sexual advances or intimidations by email, or on discussion boards and other postings within or connected to the online classroom.

If you have concerns about something that has been said, please let your instructor know.

## CLASS SCHEDULE:

| Module | Module Learning Outcomes | Assignments |
|---|---|---|
| 1 – Numbers & Operations, Pt. 1 | <ul><li>Understand the concepts of opposite numbers, negative numbers, and absolute value.</li><li>Compare and order integers and rational numbers.</li><li>Apply prior knowledge of the number system to problems involving integers.</li><li>Add, subtract, multiply and divide integers.</li></ul> | <ul><li>Short Answer</li><li>Lab</li><li>Mastery Exercises</li><li>Module Exam</li></ul> |

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| **2 - Numbers & Operations, Pt. 2** | <ul><li>Identify even and odd numbers.</li><li>Review divisibility rules.</li><li>Use factors and multiples to find both GCFs and LCMs.</li></ul> | <ul><li>Short Answer</li><li>Lab</li><li>Mastery Exercises</li><li>Module Exam</li></ul> |
| **3 – Numbers & Operations, Pt. 3** | <ul><li>Understand that a fraction is another representation of a division problem.</li><li>Calculate the sum and difference of fractions with unlike denominators, including mixed numbers.</li><li>Develop an understanding for multiplication of whole numbers by fractions as well as fractions by fractions.</li><li>Develop an understanding of the division of a fraction by a unit fraction and a fraction by a unit fraction by using a concrete model.</li><li>Calculate the product and quotient of two fractions.</li><li>Model and solve multiple step word problems using operations with fractions.</li></ul> | <ul><li>Short Answer</li><li>Lab</li><li>Mastery Exercises</li><li>Module Exam</li></ul> |
| **4 – Numbers & Operations, Pt. 4** | <ul><li>Review long division.</li><li>Practice the standard algorithms for decimal computation.</li><li>Solve real world application problems that involve the addition, subtraction, multiplication and division of decimals.</li><li>Add, subtract, multiply and divide rational numbers.</li><li>Transform rational numbers into decimals.</li></ul> | <ul><li>Short Answer</li><li>Lab</li><li>Mastery Exercises</li><li>Module Exam</li></ul> |
| **5 – Scientific Notation** | <ul><li>Express numbers using scientific notation.</li><li>Recognize the difference between scientific notation and standard form.</li><li>Calculate the sum, difference, product and quotient of numbers written in scientific notation.</li><li>Solve real world application problems that involve the addition, subtraction, multiplication and division of numbers in scientific notation.</li></ul> | <ul><li>Short Answer</li><li>Lab</li><li>Mastery Exercises</li><li>Module Exam</li></ul> |
| **6 – Expressions** | <ul><li>Students will be able to identify constants, coefficients, and variables in an algebraic expression.</li><li>Students will be able to evaluate a numerical expression using the correct order of operations.</li><li>Students will be able to use the distributive property to simplify algebraic expressions.</li><li>Students will be able to simplify algebraic expressions by combining like terms.</li><li>Students will be able to translate verbal phrases into mathematical and algebraic expressions.</li><li>Students will be able to evaluate algebraic expressions when each variable is assigned a value using substitution and the order of operations.</li></ul> | <ul><li>Short Answer</li><li>Lab</li><li>Mastery Exercises</li><li>Module Exam</li></ul> |

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| **7 – Equations** | • Examine commutative and associative properties of different equations.<br>• Identify and manipulate inverse equations using different operations.<br>• Solve one-step addition, subtraction, multiplication, and division equations using inverse operations.<br>• Solve two-step equations using inverse operations.<br>• Combine like terms within an equation and use the distributive property to solve equations.<br>• Solve multi-step equations involving different techniques.<br>• Solve equations that contain fractions.<br>• Solve equations that contain the same variable on both sides of the equation.<br>• Simplify and compare algebraic expressions that contain the same variable.<br>• Solve equations that contain perfect square and cube roots.<br>• Solve literal equations for the desired variable.<br>• Translate word problems into equations and solve them. | • Short Answer<br>• Lab<br>• Mastery Exercises<br>• Module Exam |
| **8 - Intro. To Inequalities & Graphing** | • Write simple inequalities.<br>• Graph solution sets to simple inequalities.<br>• Solve and graph one-step inequalities involving addition, subtraction, multiplication, and division. | • Short Answer Assignment<br>• Lab<br>• Mastery Exercises<br>• Module Exam |
| **9 – Ratios & Proportions** | • Write ratios for various situations.<br>• Determine if ratios are equivalent as well as how to determine an unknown in an equivalent ratio.<br>• Calculate unit rates to solve word problems.<br>• Use ratios to describe proportional situations.<br>• Make conversions between different measurements and unit ratios.<br>• Use proportions to solve problems.<br>• Use proportions to solve problems involving scale drawings and similar figures. | • Short Answer<br>• Lab<br>• Mastery Exercises<br>• Module Exam |
| **10 – Percents** | • Represent percents with concrete models, fractions, and decimals.<br>• Relate fractions, decimals, and percents to each other.<br>• Apply their knowledge of rations and proportions to percent problems.<br>• Solve problems involving percents.<br>• Represent percent equations in an algebraic context.<br>• Apply percent of increase and percent of decrease when solving problems.<br>• Use knowledge of percents to help them solve real world problems. | • Short Answer<br>• Lab<br>• Mastery Exercises<br>• Module Exam |

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| **11 – Real Numbers** | <ul><li>Convert repeating decimals into their equivalent fractions.</li><li>Evaluate square and cube roots of perfect square and cubes to solve equations.</li><li>Use the properties of exponents to solve equations with perfect square and cube roots.</li><li>Find the squares and square roots of both rational and irrational numbers.</li><li>Know the perfect squares. They will also be able to simplify perfect square radical expressions.</li><li>Use the perfect squares to approximate square roots.</li></ul> | <ul><li>Short Answer</li><li>Lab</li><li>Mastery Exercises</li><li>Module Exam</li></ul> |
| **12 – Statistics & Probability** | <ul><li>Understand the concept of sampling.</li><li>Draw inferences about a population based on a sample.</li><li>Compare two populations and solve real world application problems with them.</li><li>Calculate the measures of center and use them to solve application problems.</li><li>Calculate the measures of variability and use them to solve application problems.</li><li>Compare and contrast the measures of center and variability between two data sets.</li><li>Understand that the probability of a chance event is a number between 0 and 1 that expresses the likelihood of the event occurring.</li><li>Use experimental and theoretical probability to determine the likelihood of an event occurring.</li><li>Calculate the probabilities of compound events using organized lists, tables, tree diagrams, simulation, and arithmetic operations.</li></ul> | <ul><li>Short Answer</li><li>Lab</li><li>Mastery Exercises</li><li>Module Exam</li></ul> |
| **13 – Reflection & Final Exam** | <ul><li>Review topics from the course</li><li>Zoom call with course instructor, as needed</li></ul> | <ul><li>Reflection Paper</li><li>Final Exam</li></ul> |