# *Pre Algebra*

## Number and Operations

**Enduring Understandings:**

Rational numbers can be represented in multiple ways.

Integers are useful for noting relative changes or values.

Every numerical operation has an inverse.

Mathematical properties reveal multiple appropriate methods to compute.

Solutions to problems call for estimates, approximations to an appropriate degree of precision or exact answers.

Mental computations are the basis for making reasonable estimates and sensible predictions.

**Essential Questions:**

*What does it mean to be "computationally fluent"?*

1. When does order matter and when does it not matter?
2. Can everything that has been done mathematically be undone?
3. How do you represent numbers and their relationships to each other?

**Outcomes:**

The student will:

A. Understand meanings of operations and how they relate to one another (Number Relationships).
   1. Apply order of operations when using formulas and solving equations.
   2. Apply all inverse relationships in solving multi-step equations and real-world problems.

B. Understand numbers, ways of representing numbers, relationships among numbers, and number systems (Number Sense).
   1. Understand the characteristics and properties of whole numbers, fractions, and decimals (e.g. relative magnitude, properties of zero and one, commutative and associative properties).
   2. Demonstrate the relationships among equivalent number representations (e.g. whole numbers, fractions, decimals, percents and ratios).
   3. Develop and analyze procedures (algorithms) for computing with fractions, decimals, percents and integers.

4. Compare and contrast natural, whole, and rational numbers.

C. Understand how to compute fluently and make reasonable estimates
   1. Convert among fractions, decimals and percents and use these representations for estimations and computation to solve real-world and mathematical problems.
   2. Add, subtract, multiply and divide fractions and mixed numbers. Concentrate on fraction denominations of 2, 3, 4, 5, 6, 8, 10, 12, 16, 20, 25, and 100.
   **3. Use the order of operations to simplify expressions.**
   4. Analyze and justify operations and methods used to solve a problem and evaluate the reasonableness of results.
   5. Use calculator approximations of rational and irrational numbers in multi-step real world and mathematical problems.
   6. Determine appropriateness of mental calculations, paper and pencil, and use of technology
   **7. Judge the reasonableness of numerical results**

# Algebra

**Enduring Understandings:**

Functions and patterns of change can be represented by using tables, graphs, words, and symbolic expressions.

Different forms of representations have strengths and weaknesses.

Relationships among quantities can often be expressed symbolically in more than one way.

Algebraic properties govern the fluent manipulation of symbols in expressions, and equations.

**Essential Questions:**

1. How do we deal with the unknown?
2. How do tables, graphs, words and symbolic expressions represent the same thing?
3. Is there a time when one form of representation is stronger than another?
4. How can we use representations to determine and explain the underlying patterns?

**Outcomes:**

The student will:

A. Understand the relationships between tables, graphs, words and symbolic expressions.
   1. Represent, analyze and generalize a variety of patterns with tables, graphs, words, and symbolic rules.
   2. Use patterns to solve problems.

B. Represent and analyze mathematical situations and structures using algebraic symbols.
   1. Develop the concepts, vocabulary and symbols for variable and expression, equation, equality, and ordered pairs.
   2. Recognize and generate equivalent forms for simple algebraic expressions.
   3. Use symbolic algebra to represent situations and to solve problems that involve linear relationships.

C. Understand how to use algebraic symbols to represent and analyze mathematical situations and structures
   1. **Explore the meaning of equivalent forms of expressions, equations, inequalities and relations**
   2. **Simplify expressions with single variable monomials**.
   3. Recall and use the properties of algebra
      a. **Apply the associative, commutative and distributive properties**

   b. **Apply the properties of equality**
4. **Write equivalent forms of equations, inequalities and systems of equations**
5. **Solve linear equations focusing on paper and pencil techniques**.

D. Analyze change in various contexts.
   1. **Explore relationships between symbolic equations and graphs of lines, paying particular attention to the rate of change (slope) and the meaning of the intercepts**.

# Geometry

**Enduring Understandings:**

Geometric models are useful in representing algebraic relationships.

Coordinate geometry is one way to link algebraic and geometric representations.

**Essential Questions:**

1. How are algebra and geometry related?

**Outcomes:**

The student will:

A. Understand characteristics and properties of two- and three- dimensional geometric shapes.

1. Understand how changes in dimensions affect area of rectangles

B. Understand locations and spatial relationships using coordinate geometry and other representational systems.

1. Write ordered pairs, plot ordered pairs and locate ordered pairs on a rectangular coordinate grid.

# Measurement

## Enduring Understandings:

Use of calculation and computer technologies for gathering and displaying data requires making strategic choices for selection of scale and viewing window.

Measurement is a process that assigns appropriate numerical values to spatial and physical attributes.

## Essential Questions:

1. When is it appropriate to be accurate and when is it appropriate to estimate a measurement?
2. How are accuracy and precision in measurement determined?

## Outcomes:

The student will:

A. Understand measurable attributes of objects and units, systems and processes of measurement
    1. Use appropriate units and scales when graphing on the Cartesian plane

B. Understand appropriate techniques and tools to determine measurements.
    1. Select and use appropriate estimation techniques

## Problem Solving

### Enduring Understandings:

Problem solving involves understanding what to do when confronted with unfamiliar problems.

Problem solving requires knowing problem-solving strategies and effective self-monitoring.

### Essential Questions:

*What do you do when you don't know what to do?*

1. How do you know your solution is correct?
2. How do you know you are using an efficient strategy?
3. How do you identify strategies to use when solving problems?
4. How do you know you have solved the problem?

### Outcomes:

The student will:

A. Understand that there are multiple ways to solve a problem
   1. Develop a variety of strategies to solve a problem
   2. Use a variety of strategies to solve a problem
   3. Evaluate the effectiveness of a chosen strategy
   4. Adapt a previous strategy to a new problem-solving situation

B. Understand how to monitor problem solving
   1. Predict a solution to a problem
   2. Determine if the solution is reasonable by comparing it to the prediction
   3. Recognize when a problem solving strategy is not working
   4. Compare and contrast strategy efficiency

## Reasoning and Proof

### Enduring Understandings:

Multiple methods of reasoning can be used to formulate mathematical arguments.

Informal observations lead to specific examples that are generalized and then proven.

### Essential Questions:

1. How do you construct a convincing argument?
2. When do you know you have enough evidence to convince someone that your solution is correct?
3. When can you accept something as fact?

### Outcomes:

The student will:

A. Understand the importance of reasoning
   1. Formulate possible solutions by examining patterns
   2. Explain their conclusions
   3. Explore multiple strategies for justifying one's ideas

## Communication

**Enduring Understandings:**

Communication requires expressing mathematical thinking orally and in writing.

Explanations should include mathematical arguments and rationale.

Writing is a valuable way of reflecting on and solidifying what one knows.

**Essential Questions:**

*What is the language of mathematics?*
*Why do I need to explain my thinking when I solve problems?*

1. How do you "show what you know" mathematically?
2. How do we communicate correctly using the language of mathematics?

**Outcomes:**

The student will:

A. Understand the language of mathematics
   1. Use the language of mathematics to express mathematical ideas precisely
   2. Analyze the mathematical thinking and strategies of others

B. Understand that they can communicate using their mathematical thinking
   1. Explain the strategy used to solve a problem
   2. Communicate their mathematical thinking coherently and clearly , both orally and in written form
   3. Include mathematical arguments and rationales, not just procedural descriptions or summaries, in explaining work

## Representation

**Enduring Understandings:**

Representations are flexible, appropriate and useful ways to enable communication with others about mathematical concepts and relationships.

Mathematical representations illustrate essential features of a situation and clarify mathematical relationships.

**Essential Questions:**

1. How can you model a situation?
2. How do we use mathematical representations to illustrate patterns?
3. How do you know that the model you have chosen is the most effective?

**Outcomes:**

The student will:

A. Understand that mathematical representations facilitate the communication of ideas.
   1. Create multiple representations that organize, record and communicate mathematical ideas
   2. Use pattern recognition to generalize mathematical ideas
   3. Create an appropriate representation that organizes, models, and communicates their mathematical ideas
   4. Evaluate representations thoughtfully by sharing representations with others

## Connections

**Enduring Understandings:**

Thinking mathematically involves looking for connections and making connections builds mathematical understanding.

Connections focus on the relationships and commonalties among strategies to help build new concepts or skills from familiar ideas.

**Essential Questions:**

1. When have I seen this before and when will I see it again?
2. Why does mathematics matter to society?

**Outcomes:**

The student will:

A. Understand how mathematical ideas interconnect and build on one another to produce a coherent whole
   1. Recognize connections among mathematical ideas
   2. Develop multiple approaches to the same problem leading to equivalent results
   3. Use connections among mathematical ideas to solve problem

B. Understand that mathematics exists in contexts outside of the mathematics classroom
   1. Connect mathematical ideas to real world situations
   2. Apply mathematical thinking in situations they encounter outside of the mathematics classroom.