MATH 14001 (10771)
BASIC MATHEMATICAL CONCEPTS I (Plus)

Upon successful completion of this course, the student will be able to:

Number

1a. Discuss the intricacies of learning to count, including the distinction between counting as a list of numbers in order and counting to determine a number of objects, and use pairings between elements of two sets to establish equality or inequalities of cardinalities.

1b. Attend closely to units (e.g., apples, cups, inches, etc.) while solving problems and explaining solutions.

1c. Discuss how the base-ten place value system (including extending to decimals) relies on repeated bundling in groups of ten and how to use objects, drawings, layered place value cards, base-ten blocks, and numerical expressions (including integer exponents) to help reveal base-ten structure.

1d. explain the development of fractions

Start with a whole.

Understand the fraction 1/b as one piece when the whole is divided into b equal pieces.

Understand the fraction a/b as *a* pieces of size *1/b* and that the fraction a/b may be larger than one.

Understand fractions as numbers that can be represented in a variety of ways, such as with lengths (esp. number lines), areas (esp. rectangles), and sets (such as a collection of marbles).

Use the meaning of fractions to explain when two fractions are equivalent

1e. Model positive versus negative numbers on the number line and in real-world contexts.

1f. Reason about the comparison (=, <, >) of numbers across different representations (such as fractions, decimals, mixed numbers, ...).

1g. Demonstrate the skill of calculating simple arithmetic problems WITHOUT the use of a calculator.

Operations

2a. Recognize addition, subtraction, multiplication, and division as descriptions of certain types of reasoning and correctly use the language and notation of these operations.

2b. Illustrate how different problems are solved by addition, subtraction, multiplication and division and be able to explain how the operation used is connected to the solving of the problem.

2c. Recognize that addition, subtraction, multiplication, and division problem types and associated meanings for the operations (e.g., CCSS, pp. 88–89) extend from whole numbers to fractions and decimals.

2d. Employ teaching/learning paths for single-digit addition and associated subtraction and single-digit multiplication and associated division, including the use of properties of operations (i.e., the field axioms)

2e. Compare and contrast standard algorithms for operations on multi-digit whole numbers that rely on the use of place-value units (e.g., ones, tens, hundreds, etc.) with mental math methods students generate.

2f. Use math drawings and manipulative materials to reveal, discuss, and explain the rationale behind computation methods.

2g. Extend algorithms and mental math methods to decimal arithmetic.

2h. Use different representations of the same fraction (e.g., area models, tape diagrams) to explain procedures for adding, subtracting, multiplying, and dividing fractions. (This includes connections to grades 6–8 mathematics.).

2i. Explain the connection between fractions and division, $a/b = a \div b$, and how fractions, ratios, and rates are connected via unit rates. (This includes connections to grades 6–8 mathematics. See the Ratios and Proportional Relationships Progression for a discussion of unit rate.).

2j. Explain why the extensions of the operations to signed numbers make sense.

Algebraic Thinking

3a. Model and communicate their reasoning about quantities and the relationships between quantities using a variety of representations.

3b. Discuss the foundations of algebra in elementary mathematics, including understanding the equal sign as meaning “is the same [amount] as” rather than a “calculate the answer” symbol.

3c. Look for regularity in repeated reasoning, describe the regularity in words, and represent it using diagrams and symbols and communicate the connections among these.

3d. Articulate, justify, identify, and use properties of operations.

3e. Describe numerical and algebraic expressions in words, parsing them into their component parts, and interpreting the components in terms of a context.

3f. Use a variety of methods (such as guess and check, pan balances, strip diagrams, and properties of operations) to solve equations that arise in “real-world” contexts.

Number Theory

4a. Demonstrate knowledge of prime and composite numbers, divisibility rules, least common multiple, greatest common factor, and the uniqueness (up to order) of prime factorization

4b. Discuss decimal representation and recognize that there are numbers beyond integers and rational numbers.