

math117 Syllabus

math 117: Number Sense For PK-8 Teachers

Text: *Developing the Number Strand*, by Pat Jones ISBN: 0-9728-373-0-2

Prerequisites: Minimum ACT math score of 19, or College Algebra with a grade of C or better, or MATH 107 with a grade of C or better. Restriction: Education majors only.

Course Description:

This is a language-intensive study of the Number Strand as it develops sequentially from grades pre-K through 8. It focuses on number sense, natural connections among the big ideas in mathematics, patterns and problem solving, and the use of numbers in familiar, real situations.

This content in this course aligns with that of K-8 schools, giving prospective teachers the knowledge of mathematics that they will need to effectively teach the CCSS content. Also, an emphasis is placed on the Standards for Mathematical Practice as described in the CCSS, allowing prospective teachers to experience what their future K-8 students will experience. Prospective teachers enrolled in this course are expected to:

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriately tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

Course Outcomes:

Students will learn:

How important concepts can be developed in a smooth progression, giving special attention to significant mathematics and cognitive transitions;

How the Big Ideas are rooted and interconnected in real-world contexts, and how they can be modeled using familiar objects and situations;

How number sense, spatial sense, intuition, and problem-solving permeate everything;

That reasoning and ordinary language are essential components of concept development.

Students will have intuition, skills and deep understanding of the number sense concepts in pre-K through 8th grade.

Instructional Methods:

Visual aids such as charts and drawings are presented to help the students grasp the mathematical concepts. A wide variety of techniques, approaches, and appropriate tools will be used as students are encouraged to solve problems in different ways. Emphasis is placed on the students' ability to express "in writing" how they solve various types of problems and how they know that the answer is correct. Manipulatives will be used to model mathematical topics and arithmetic operations.

Calculator: Students are not allowed to use calculators. Students are expected to use the methods developed to do calculations mentally and well as incorporating these methods to pencil and paper work. All explanations should be clear and concise and written at an elementary level.

Sections and Topics

- Introduction to Course
- Develop the concept of place value for two-digit numerals.
- Understand the concept of addition as combining two quantities in order to find a total amount. Recognize situations in which addition is relevant.
- Understand the concepts of subtraction as the result of "removing" or of "comparing". Recognize the relevance of subtraction in both of these contexts.
- Use the phrases "same amount as", "same as", and "is" to develop the concept of equal. Use verbal number sentences with labels on all numbers. Include the words plus, minus, and equal.
- Use the word one-half orally.
- Read, write, compare, order, and use two-digit numbers in a wide variety of familiar situations.
- Recognize words that indicate opposites, in stories and ordinary situations.
- Extend the concept of place value to hundreds.
- Recognize which operation (addition or subtraction) is relevant in a particular situation.
- Learn addition and subtraction "facts" by using them every day in activities and familiar situations.
- Understand that the order in which two numbers are added doesn't affect their sum.
- Add and subtract numbers (with labels) which are written vertically, and don't require repackaging.
- Use addition and subtraction every day in activities and problems which include all the Big Ideas of mathematics.
- Understand that the order in which two numbers are added doesn't affect their sum.
- Add and subtract numbers (with labels) which are written vertically, and don't require repackaging.
- Use addition and subtraction every day in activities and problems which include all the Big Ideas of mathematics.
- Use mental strategies for adding, subtracting, and estimating whole numbers.
- Relate addition and subtraction in number sentences.
- Find sums and differences, through hundreds, with repackaging.
- Read, write, compare, add, and subtract three-digit numbers in familiar situations which involve many different Big Ideas of mathematics.
- Develop a conceptual understanding of multiplication as combining equal-numbered sets of things. Use the words times, multiply, and product, and the symbol \times .
- Understand the special roles of 0 and 1 in multiplication.
- Understand that multiplication is commutative.
- Separate a set of objects into equal shares in as many ways as possible.

- Be able to read, write, add, and subtract amounts of money using \$ and decimal point.
- Use symbols to represent fractions.
- Extend understanding of place value through thousands.
- Read, write, compare, and use numbers through thousands.
- Use numbers in familiar situations which involve opposites.
- Understand the concept of division, and the language (words and symbol) associated with it.
- Write equations to describe situations that involve division.
- Learn multiplication and division "facts" by using them every day in real situations and in equations.
- Understand the inverse relation of multiplication and division.
- Use appropriate labels in multiplication and division equations.
- "See" whole numbers which end in zero, as some number of tens or hundreds.
- Use different fractions to represent the same portion of an object or set of things.
- Add and subtract fractions which have the same name (denominator).
- Compare fractions which have the same numerator by thinking of the relative "sizes" of the equal parts.
- Relate unit fractions and division. Use this relation to find fractional parts of "nice" whole numbers.
- Find a total amount when a fraction of it is known.
- Use fractions in a wide variety of real world situations.
- Understand and use order symbols ($>$ and $<$) and Use opposites in games and other real contexts
- Understand and relate the concepts of mixed numbers and improper fractions. Read, write, and use these numbers in real situations.
- Understand that a quantity may be represented by many different fractions, and that a set of equivalent fractions results from "seeing" the object or set from different points of view.
- Connect and extend the concepts of money, fractions, and place value to develop the meaning of decimals. Understand the verbal relation between fractions, or mixed numbers, and decimals. Be able to translate one representation to the
- other by recognizing their common name. Read, write, add, subtract, and compare decimals in problem contexts -- especially those which involve money and metric units of measurement.
- Understand the literal meaning of percent as "for each hundred".
- Know, and quickly recall, all the pairs of whole numbers whose product is 100. Be able to apply this in translating among fractions, terminating decimals, and percents.
- Apply the concepts of factor and multiple in real contexts. Understand and use the word multiple appropriately.
- Recognize numerals which end in zeros as some number of tens, hundreds, or thousands. Be able to mentally find products of one-digit multiples of 10, 100, and 1000.
- Have a conceptual understanding of the Distributive Property. Use parentheses to clarify the meaning of equations which apply the Distributive Property.
- Understand how to find the product of multi-digit numbers using partial sums.
- Understand that multiplication is commutative and associative.
- Understand and use some strategy for doing division in order to answer questions about real things.
- Understand, read, and write numbers through millions. Connect standard numerals, expanded notation, and names of numbers.
- Understand and use opposites in familiar contexts.

- Solve problems which include all representations of rational numbers, and which connect Big mathematical ideas in real situations.
- Understand and use the percent symbol. Translate between percents and fractions or decimals which are represented as hundredths.
- Know, and quickly recall, the percent equivalents for easy unit fractions; be able to find percents of numbers in problem contexts. Solve percent problems using proportional reasoning.
- Connect the representations of rational numbers as fractions, mixed numbers, decimals, percents, and ratios. Select the most meaningful and/or the most efficient representation in a particular context.
- "See" numbers multiplicatively. Understand what primes, factors, and multiples are. Be able to systematically list the factor pairs of a number. Be able to find common factors for a set of numbers. Apply all of this in solving problems.
- Understand what equivalent fractions are. Generate all the fractions which are equivalent to a given fraction. Apply knowledge of equivalent fractions in problems involving proportionality and addition/subtraction of fractions.
- Understand and use parentheses to clarify the meaning of equations and expressions.
- Understand and use opposites in real contexts.
- Use all forms of rational numbers in solving a wide variety of problems in real contexts.
- Extend the concepts and applications of decimals to include thousandths. Translate among fractions, terminating decimals, and mixed numbers in real contexts.
- Have a conceptual understanding of multiplication of fractions. Recognize situations in which multiplication of fractions is relevant. Know how to find the product of any two fractions.
- Relate multiplication of decimals to multiplication of fractions. Be able to find the product of two decimals, and recognize whether this product is reasonable within the given context.
- Be able to mentally divide decimals by 10 or 100.
- Understand and use fractions as quotients.
- Recognize situations in which division of fractions is relevant. Be able to follow some process for finding the quotient of two fractions.
- Be able to correctly apply a division process which involves decimal dividends and/or divisors. Recognize whether a quotient is reasonable within the given context.
- Relate infinite repeating decimals to fractions.
- Be able to solve a wide variety of problems which involve percents as they are encountered in everyday life—including "percent off", percent increase and decrease, and percents which are less than 1%.
- Understand what negative numbers are, and use them to represent opposites of real quantities. Be able to find sums, differences, products, and quotients which involve negative numbers; apply this knowledge in problem contexts.
- Understand and use number lines.
- Understand what multiples of a number are. Be able to list the multiples of a particular number as products (e.g.: 1×7 , 2×7 , $3 \times 1 - 5 \times 7$, 4×7 , etc.) Identify common multiples and least common multiple for a set of numbers. Apply all of this in solving problems in real contexts.
- Use exponents when convenient in writing the prime factorization of whole numbers, and in representing large numbers (with or without scientific notation).
- Know what a perfect square is, and recognize perfect squares up to 144. Understand what a square root is. Use the radical sign to indicate positive square roots. Be able to approximate square roots to the nearest integer mentally, and to the nearest hundredth using a calculator.
- Understand what pi is; use the symbol; use a reasonable approximation of in real situations.

- Distinguish between rational and irrational numbers; understand that Real numbers are all the numbers which have a place on the number line, and which can be represented as decimals.