Number, Number Sense and Operations Standard

Grades K-2

Ohio Benchmarks Grades K-2	Grade-Level Indicators Kindergarten	Grade-Level Indicators Grade 1	Grade-Level Indicators Grade 2
A. Use place value concepts to represent whole numbers using numerals, words and physical models.	5. Relate, read and write numerals for single-digit numbers (0 to 9).	5. Use place value concepts to represent whole numbers using numerals, words, expanded notation and physical models with ones and tens. For example: a. Develop a system to group and count by twos, fives and tens. b. Identify patterns and groupings in a 100's chart and relate to place value concepts. c. Recognize the first digit of a two-digit number as the most important to indicate size of a number and the nearness to 10 or 100. 3. Read and write the numerals for numbers to 100.	1. Use place value concepts to represent, compare and order whole numbers using physical models, numerals and words, with ones, tens and hundreds. For example: a. Recognize 10 can mean "10 ones" or a single entity (1 ten) through physical models and trading games. b. Read and write 3-digit numerals (e.g., 243 as two hundred forty three, 24 tens and 3 ones, or 2 hundreds and 43 ones, etc.) and construct models to represent each.

Number, Number Sense and Operations Standard

Grades K-2

Ohio Benchmarks Grades K-2	Grade-Level Indicators Kindergarten	Grade-Level Indicators Grade 1	Grade-Level Indicators Grade 2
B. Recognize, classify, compare and order whole numbers.	1. Compare and order whole numbers up to 10. 7. Compare the number of objects in two or more sets when one set has one or two more, or one or two fewer objects. 13. Recognize the number or quantity of sets up to 5 without counting; e.g., recognize without counting the dot arrangement on a domino as 5.	1. Use ordinal numbers to order objects; e.g., first, second, third. 2. Recognize and generate equivalent forms for the same number using physical models, words and number expressions; e.g., concept of ten is described by "10 blocks", full tens frame, numeral 10, 5 + 5, 15 - 5, one less than 11, my brother's age. 4. Count forward to 100, count backwards from 100, and count forward or backward starting at any number between 1 and 100. 15. Demonstrate that equal means "the same as" using visual representations.	1. Use place value concepts to represent, compare and order whole numbers using physical models, numerals and words, with ones, tens and hundreds. For example: a. Recognize 10 can mean "10 ones" or a single entity (1 ten) through physical models and trading games. b. Read and write 3-digit numerals (e.g., 243 as two hundred forty three, 24 tens and 3 ones, or 2 hundreds and 43 ones, etc.) and construct models to represent each. 2. Recognize and classify numbers as even or odd.

Number, Number Sense and Operations Standard

Grades K-2

Ohio Benchmarks Grades K-2	Grade-Level Indicators Kindergarten	Grade-Level Indicators Grade 1	Grade-Level Indicators Grade 2
C. Represent commonly used fractions using words and physical models.		9. Represent commonly used fractions using words and physical models for halves, thirds and fourths, recognizing fractions are represented by equal size parts of a whole and of a set of objects.	5. Represent fractions (halves, thirds, fourths, sixths and eighths), using words, numerals and physical models. For example: a. Recognize that a fractional part can mean different amounts depending on the original quantity. b. Recognize that a fractional part of a rectangle does not have to be shaded with contiguous parts. c. Identify and illustrate parts of a whole and parts of sets of objects. d. Compare and order physical models of halves, thirds and fourths in relations to 0 and 1.

Number, Number Sense and Operations Standard

Grades K-2

Ohio Benchmarks Grades K-2	Grade-Level Indicators Kindergarten	Grade-Level Indicators Grade 1	Grade-Level Indicators Grade 2
D. Determine the value of a collection of coins and dollar bills.	9. Identify and state the value of a penny, nickel and dime.	6. Identify and state the value of a penny, nickel, dime, quarter and dollar. 7. Determine the value of a small collection of coins (with a total value up to one dollar) using 1 or 2 different type coins, including pennies, nickels, dimes and quarters.	4. Represent and write the value of money using the ¢ sign and in decimal form when using the $ sign.
E. Make change using coins for values up to one dollar.		8. Show different combinations of coins that have the same value.	3. Count money and make change using coins and a dollar bill.

Number, Number Sense and Operations Standard

Grades K-2

Ohio Benchmarks Grades K-2	Grade-Level Indicators Kindergarten	Grade-Level Indicators Grade 1	Grade-Level Indicators Grade 2
F. Count, using numerals and ordinal numbers.	2. Explain rules of counting, such as each object should be counted once and that order does not change the number. 3. Count to twenty; e.g., in play situations or while reading number books. 4. Determine "how many" in sets (groups) of 10 or fewer objects.	4. Count forward to 100, count backwards from 100, and count forward or backward starting at any number between 1 and 100.	

Number, Number Sense and Operations Standard

Grades K-2

Ohio Benchmarks Grades K-2	Grade-Level Indicators Kindergarten	Grade-Level Indicators Grade 1	Grade-Level Indicators Grade 2
G. Model, represent and explain addition as combining sets and counting on.	8. Represent and use whole numbers in flexible ways, including relating, composing and decomposing numbers; e.g., 5 marbles can be 2 red and 3 green or 1 red and 4 green. 10. Model and represent addition as combining sets and counting on, and subtraction as take-away and comparison. For example: a. Combine and separate small sets of objects in contextual situations; e.g., add or subtract one, two, or another small amount. b. Count on (forward) and count back (backward) on a number line between 0 and 10.	10. Model, represent and explain addition as combining sets (part + part = whole) and counting on. For example: a. Model and explain addition using physical materials in contextual situations. b. Draw pictures to model addition. c. Write number sentences to represent addition. d. Explain that adding two whole numbers yields a larger whole number. 12. Use conventional symbols to represent the operations of addition and subtraction.	

Number, Number Sense and Operations Standard

Grades K-2

Ohio Benchmarks Grades K-2	Grade-Level Indicators Kindergarten	Grade-Level Indicators Grade 1	Grade-Level Indicators Grade 2
H. Model, represent and explain subtraction as comparison, take-away and part-to-whole.	8. Represent and use whole numbers in flexible ways, including relating, composing and decomposing numbers; e.g., 5 marbles can be 2 red and 3 green or 1 red and 4 green. 10. Model and represent addition as combining sets and counting on, and subtraction as take-away and comparison. For example: a. Combine and separate small sets of objects in contextual situations; e.g., add or subtract one, two, or another small amount. b. Count on (forward) and count back (backward) on a number line between 0 and 10.	11. Model, represent and explain subtraction as take-away and comparison. For example: a. Model and explain subtraction using physical materials in contextual situations. b. Draw pictures to model subtraction. c. Write number sentences to represent subtraction. d. Explain that subtraction of whole numbers yields an answer smaller than the original number. 12. Use conventional symbols to represent the operations of addition and subtraction.	6. Model, represent and explain subtraction as comparison, take-away and part-to-whole; e.g., solve missing addend problems by counting up or subtracting, such as "I had six baseball cards, my sister gave me more, and I now have ten. How many did she give me?" can be represented as 6 + ? = 10 or 10 - 6 = ?.

Number, Number Sense and Operations Standard

Grades K-2

Ohio Benchmarks Grades K-2	Grade-Level Indicators Kindergarten	Grade-Level Indicators Grade 1	Grade-Level Indicators Grade 2
I. Model, represent and explain multiplication as repeated addition, rectangular arrays and skip counting.	6. Construct multiple sets of objects each containing the same number of objects. 11. Demonstrate joining multiple groups of objects, each containing the same number of objects; e.g., combining 3 bags of candy, each containing 2 pieces.	13. Model and represent multiplication as repeated addition and rectangular arrays in contextual situations; e.g., four people will be at my party and if I want to give 3 balloons to each person, how many balloons will I need to buy?	7. Model, represent and explain multiplication as repeated addition, rectangular arrays and skip counting.
J. Model, represent and explain division as sharing equally, repeated subtraction and rectangular arrays.	12. Partition or share a small set of objects into groups of equal size; e.g., sharing 6 stickers equally among 3 children.	14. Model and represent division as sharing equally in contextual situations; e.g., sharing cookies.	8. Model, represent and explain division as sharing equally and repeated subtraction.

Number, Number Sense and Operations Standard

Grades K-2

Ohio Benchmarks Grades K-2	Grade-Level Indicators Kindergarten	Grade-Level Indicators Grade 1	Grade-Level Indicators Grade 2
K. Demonstrate fluency in addition facts with addends through 9 and corresponding subtractions.	8. Represent and use whole numbers in flexible ways, including relating, composing and decomposing numbers; e.g., 5 marbles can be 2 red and 3 green or 1 red and 4 green.	16. Develop strategies for basic addition facts, such as: a. counting all; b. counting on; c. one more, two more; d. doubles; e. doubles plus or minus one; f. make ten; g. using tens frames; h. identity property (adding zero). 17. Develop strategies for basic subtraction facts, such as: a. relating to addition (for example, think of 7 - 3 = ? as "3 plus ? equals 7"); b. one less, two less; c. all but one (for example, 8 - 7, 5 - 4); d. using tens frames; e. missing addends.	10. Demonstrate fluency in addition facts with addends through 9 and corresponding subtractions; e.g., 9 + 9 = 18, 18 – 9 = 9.

Number, Number Sense and Operations Standard

Grades K-2

Ohio Benchmarks Grades K-2	Grade-Level Indicators Kindergarten	Grade-Level Indicators Grade 1	Grade-Level Indicators Grade 2
L. Demonstrate fluency in adding and subtracting multiples of 10, and recognize combinations that make 10.		16. Develop strategies for basic addition facts, such as: a. counting all; b. counting on; c. one more, two more; d. doubles; e. doubles plus or minus one; f. make ten; g. using tens frames; h. identity property (adding zero). 17. Develop strategies for basic subtraction facts, such as: a. relating to addition (for example, think of 7 - 3 = ? as "3 plus ? equals 7"); b. one less, two less; c. all but one (for example, 8 - 7, 5 - 4); d. using tens frames; e. missing addends.	11. Add and subtract multiples of 10.

Number, Number Sense and Operations Standard

Grades K-2

Ohio Benchmarks Grades K-2	Grade-Level Indicators Kindergarten	Grade-Level Indicators Grade 1	Grade-Level Indicators Grade 2
M. Add and subtract two-digit numbers with and without regrouping.			9. Model and use the commutative property for addition. 12. Demonstrate multiple strategies for adding and subtracting 2- or 3-digit whole numbers, such as: a. compatible numbers; b. compensatory numbers; c. informal use of commutative and associative properties of addition.
			Note: There are instances where a grade-level indicator is linked to a benchmark for a grade band that does not include the grade level of the indicator. See Grade 3 (page 16) for indicator 13.

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Number, Number Sense and Operations Standard

Grades 3-4

Ohio Benchmarks Grades 3-4	Grade-Level Indicators Grade 3	Grade-Level Indicators Grade 4
A. Use place value structure of the base-ten number system to read, write, represent and compare whole numbers and decimals.	2. Use place value concepts to represent whole numbers and decimals using numerals, words, expanded notation and physical models. For example: a. Recognize 100 means "10 tens" as well as a single entity (1 hundred) through physical models and trading games b. Describe the multiplicative nature of the number system; e.g., the structure of 3205 as 3 x 1000 plus 2 x 100 plus 5 x 1. c. Model the size of 1000 in multiple ways; e.g., packaging 1000 objects into 10 boxes of 100, modeling a meter with centimeter and decimeter strips, or gathering 1000 pop-can tabs. d. Explain the concept of tenths and hundredths using physical such models, as metric pieces, base ten blocks, decimal squares or money. 3. Use mathematical language and symbols to compare and order; e.g., less than, greater than, at most, at least, <, >, =, ≤, ≥.	2. Use place value structure of the base-ten number system to read, write, represent and compare whole numbers through millions and decimals through thousandths. 3. Round whole numbers to a given place value.

Number, Number Sense and Operations Standard
Grades 3-4

Ohio Benchmarks Grades 3-4	Grade-Level Indicators Grade 3	Grade-Level Indicators Grade 4
B. Recognize and generate equivalent representations for whole numbers, fractions and decimals.	1. Identify and generate equivalent forms of whole numbers; e.g., 36, 30+6, 9 x 4, 46-10, number of inches in a yard. 7. Recognize and use decimal and fraction concepts and notations as related ways of representing parts of a whole or a set; e.g., 3 of 10 marbles are red can also be described as $\frac{3}{10}$ and 3 tenths are red.	1. Identify and generate equivalent forms of fractions and decimals. For example: a. Connect physical, verbal and symbolic representations of fractions, decimals and whole numbers; e.g., $\frac{1}{2}$, $\frac{5}{10}$, "five tenths," 0.5, shaded rectangles with half, and five tenths. b. Understand and explain that ten tenths is the same as one whole in both fraction and decimal form.
C. Represent commonly used fractions and mixed numbers using words and physical models.	5. Represent fractions and mixed numbers using words, numerals and physical models.	

Number, Number Sense and Operations Standard
Grades 3-4

Ohio Benchmarks Grades 3-4	Grade-Level Indicators Grade 3	Grade-Level Indicators Grade 4
D. Use models, points of reference and equivalent forms of commonly used fractions to judge the size of fractions and to compare, describe and order them.	3. Use mathematical language and symbols to compare and order; e.g., less than, greater than, at most, at least, <, >, =, ≤, ≥. 6. Compare and order commonly used fractions and mixed numbers using number lines, models (such as fraction circles or bars), points of reference (such as more or less than ½), and equivalent forms found using physical or visual models.	5. Use models and points of reference to compare commonly used fractions.
E. Recognize and classify numbers as prime or composite and list factors.		4. Identify and represent factors and multiples of whole numbers through 100, and classify numbers as prime or composite.
F. Count money and make change using both coins and paper bills.	4. Count money and make change using coins and paper bills to ten dollars.	8. Solve problems involving counting money and making change, using both coins and paper bills.

Number, Number Sense and Operations Standard
Grades 3-4

Ohio Benchmarks Grades 3-4	Grade-Level Indicators Grade 3	Grade-Level Indicators Grade 4
G. Model and use commutative and associative properties for addition and multiplication.	11. Model and use the commutative and associative properties for addition and multiplication.	
H. Use relationships between operations, such as subtraction as the inverse of addition and division as the inverse of multiplication.	10. Explain and use relationships between operations, such as: a. relate addition and subtraction as inverse operations; b. relate multiplication and division as inverse operations; c. relate addition to multiplication (repeated addition); d. relate subtraction to division (repeated subtraction).	
I. Demonstrate fluency in multiplication facts with factors through 10 and corresponding divisions.	13. Demonstrate fluency in multiplication facts through 10 and corresponding division facts.	14. Demonstrate fluency in adding and subtracting whole numbers and in multiplying and dividing whole numbers by 1- and 2-digit numbers and multiples of ten.

Number, Number Sense and Operations Standard
Grades 3-4

Ohio Benchmarks Grades 3-4	Grade-Level Indicators Grade 3	Grade-Level Indicators Grade 4
J. Estimate the results of whole number computations using a variety of strategies, and judge the reasonableness.	13. *Estimate the results of whole number addition and subtraction problems using front-end estimation, and judge the reasonableness of the answers*. **(Grade 2)** 15. Evaluate the reasonableness of computations based upon operations and the numbers involved; e.g., considering relative size, place value and estimates.	9. Estimate the results of computations involving whole numbers, fractions and decimals, using a variety of strategies.

Number, Number Sense and Operations Standard

Grades 3-4

Ohio Benchmarks Grades 3-4	Grade-Level Indicators Grade 3	Grade-Level Indicators Grade 4
K. Analyze and solve multi-step problems involving addition, subtraction, multiplication and division using whole numbers.	12. Add and subtract whole numbers with and without regrouping. 14. Multiply and divide 2- and 3-digit numbers by a single-digit number, without remainders for division.	*8. Use geometric models to solve problems in other areas of mathematics, such as number (multiplication/division) and measurement (area, perimeter, border).* ***Geometry and Spatial Sense*** 6. Use associative and distributive properties to simplify and perform computations; e.g., use left to right multiplication and the distributive property to find an exact answer without paper and pencil, such as: 5 x 47 = 5 x 40 + 5 x 7 = 200+35 = 235. 7. Recognize that division may be used to solve different types of problem situations and interpret the meaning of remainders; e.g., situations involving measurement, money. 12. Analyze and solve multi-step problems involving addition, subtraction, multiplication and division using an organized approach, and verify and interpret results with respect to the original problem.

Number, Number Sense and Operations Standard

Grades 3-4

Ohio Benchmarks Grades 3-4	Grade-Level Indicators Grade 3	Grade-Level Indicators Grade 4
L. Use a variety of methods and appropriate tools (mental math, paper and pencil, calculators) for computing with whole numbers.	8. Model, represent and explain multiplication; e.g., repeated addition, skip counting, rectangular arrays and area model. For example: a. Use conventional mathematical symbols to write equations for word problems involving multiplication. b. Understand that, unlike addition and subtraction, the factors in multiplication and division may have different units; e.g., 3 boxes of 5 cookies each. 9. Model, represent and explain division; e.g., sharing equally, repeated subtraction, rectangular arrays and area model. For example: a. Translate contextual situations involving division into conventional mathematical symbols. b. Explain how a remainder may impact an answer in a real-world situation; e.g., 14 cookies being shared by 4 children.	11. Develop and explain strategies for performing computations mentally. 13. Use a variety of methods and appropriate tools for computing with whole numbers; e.g., mental math, paper and pencil, and calculator. 14. Demonstrate fluency in adding and subtracting whole numbers and in multiplying and dividing whole numbers by 1- and 2-digit numbers and multiples of ten.

Number, Number Sense and Operations Standard

Grades 3-4

Ohio Benchmarks Grades 3-4	Grade-Level Indicators Grade 3	Grade-Level Indicators Grade 4
M. Add and subtract commonly used fractions with like denominators and decimals, using models and paper and pencil.		9. Estimate the results of computations involving whole numbers, fractions and decimals, using a variety of strategies. 10. Use physical models, visual representations, and paper and pencil to add and subtract decimals and commonly used fractions with like denominators.

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Number, Number Sense and Operations Standard
Grades 5-7

Ohio Benchmarks Grades 5-7	Grade-Level Indicators Grade 5	Grade-Level Indicators Grade 6	Grade-Level Indicators Grade 7
A. Represent and compare numbers less than 0 through familiar applications and extending the number line.	6. Represent and compare numbers less than 0 by extending the number line and using familiar applications; e.g., temperature, owing money.		
B. Compare, order and convert among fractions, decimals and percents.	1. Use models and visual representations to develop the concept of ratio as part-to-part and part-to-whole, and the concept of percent as part-to-whole. 2. Use various forms of "one" to demonstrate the equivalence of fractions; e.g., $\frac{18}{24} = \frac{9}{12} \times \frac{2}{2} = \frac{3}{4} \times \frac{6}{6}$ 3. Identify and generate equivalent forms of fractions, decimals and percents.		

Number, Number Sense and Operations Standard

Grades 5-7

Ohio Benchmarks Grades 5-7	Grade-Level Indicators Grade 5	Grade-Level Indicators Grade 6	Grade-Level Indicators Grade 7
C. Develop meaning for percents including percents greater than 100 and less than 1.		4. Describe what it means to find a specific percent of a number, using real-life examples. 5. Use models and pictures to relate concepts of ratio, proportion and percent, including percents less than 1 and greater than 100.	

Number, Number Sense and Operations Standard

Grades 5-7

Ohio Benchmarks Grades 5-7	Grade-Level Indicators Grade 5	Grade-Level Indicators Grade 6	Grade-Level Indicators Grade 7
D. Use models and pictures to relate concepts of ratio, proportion and percent.	1. Use models and visual representations to develop the concept of ratio as part-to-part and part-to-whole, and the concept of percent as part-to-whole.	3. Explain why a number is referred to as being "rational," and recognize that the expression $\frac{a}{b}$ can mean *a* parts of size $\frac{1}{b}$ each, *a* divided by *b*, or the ratio of *a* to *b*. 5. Use models and pictures to relate concepts of ratio, proportion and percent, including percents less than 1 and greater than 100. 9. Give examples of how ratios are used to represent comparisons; e.g., part-to-part, part-to-whole, whole-to-part.	

Number, Number Sense and Operations Standard
Grades 5-7

Ohio Benchmarks Grades 5-7	Grade-Level Indicators Grade 5	Grade-Level Indicators Grade 6	Grade-Level Indicators Grade 7
E. Use order of operations, including use of parenthesis and exponents to solve multi-step problems, and verify and interpret the results.	8. Identify and use relationships between operations to solve problems. 9. Use order of operations, including use of parentheses, to simplify numerical expressions. *Note: There are instances when a grade-level indicator for one standard is linked to a benchmark for a different standard. See also correlation for **Patterns, Functions and Algebra** (page 11) for indicator 8.*	6. Use the order of operations, including the use of exponents, decimals and rational numbers, to simplify numerical expressions.	4. Use order of operations and properties to simplify numerical expressions involving integers, fractions and decimals.
F. Apply number system properties when performing computations.	7. Use commutative, associative, distributive, identity and inverse properties to simplify and perform computations.		

Number, Number Sense and Operations Standard

Grades 5-7

Ohio Benchmarks Grades 5-7	Grade-Level Indicators Grade 5	Grade-Level Indicators Grade 6	Grade-Level Indicators Grade 7
G. Apply and explain the use of prime factorizations, common factors, and common multiples in problem situations.	5. Recognize and identify perfect squares and their roots.	1. Decompose and recompose whole numbers using factors and exponents (e.g., 32 = 2 x 2 x 2 x 2 x 2 = 2^5), and explain why "squared" means "second power" and "cubed" means "third power." 2. Find and use the prime factorization of composite numbers. For example: a. Use the prime factorization to recognize the greatest common factor (GCF). b. Use the prime factorization to recognize the least common multiple (LCM). c. Apply the prime factorization to solve problems and explain solutions.	9. Represent and solve problem situations that can be modeled by and solved using concepts of absolute value, exponents and square roots (for perfect squares).

Number, Number Sense and Operations Standard

Grades 5-7

Ohio Benchmarks Grades 5-7	Grade-Level Indicators Grade 5	Grade-Level Indicators Grade 6	Grade-Level Indicators Grade 7
H. Use and analyze the steps in standard and non-standard algorithms for computing with fractions, decimals and integers.	10. Justify why fractions need common denominators to be added or subtracted. 11. Explain how place value is related to addition and subtraction of decimals; e.g., 0.2 + 0.14; the two tenths is added to the one tenth because they are both tenths.	8. Represent multiplication and division situations involving fractions and decimals with models and visual representations; e.g., show with pattern blocks what it means to take $2\frac{2}{3} \div \frac{1}{6}$. 12. Develop and analyze algorithms for computing with fractions and decimals, and demonstrate fluency in their use.	5. Explain the meaning and effect of adding, subtracting, multiplying and dividing integers; e.g., how adding two integers can result in a lesser value. 8. Develop and analyze algorithms for computing with percents and integers, and demonstrate fluency in their use.

Number, Number Sense and Operations Standard

Grades 5-7

Ohio Benchmarks Grades 5-7	Grade-Level Indicators Grade 5	Grade-Level Indicators Grade 6	Grade-Level Indicators Grade 7
I. Use a variety of strategies, including proportional reasoning, to estimate, compute, solve and explain solutions to problems involving integers, fractions, decimals and percents.	4. Round decimals to a given place value and round fractions (including mixed numbers) to the nearest half. 12. Use physical models, points of reference, and equivalent forms to add and subtract commonly used fractions with like and unlike denominators and decimals. 13. Estimate the results of computations involving whole numbers, fractions and decimals, using a variety of strategies.	7. Use simple expressions involving integers to represent and solve problems; e.g., if a running back loses 15 yards on the first carry but gains 8 yards on the second carry, what is the net gain/loss? 11. Perform fraction and decimal computations and justify their solutions; e.g., using manipulatives, diagrams, mathematical reasoning. 13. Estimate reasonable solutions to problem situations involving fractions and decimals; e.g., $\frac{7}{8}+\frac{12}{13}\approx 2$ and $4.23\times 5.8\approx 25$.	6. Simplify numerical expressions involving integers and use integers to solve real-life problems. 7. Solve problems using the appropriate form of a rational number (fraction, decimal or percent). 9. Represent and solve problem situations that can be modeled by and solved using concepts of absolute value, exponents and square roots (for perfect squares).

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Number, Number Sense and Operations Standard

Grades 5-7

Ohio Benchmarks Grades 5-7	Grade-Level Indicators Grade 5	Grade-Level Indicators Grade 6	Grade-Level Indicators Grade 7
I. Use a variety of strategies, including proportional reasoning, to estimate, compute, solve and explain solutions to problems involving integers, fractions, decimals and percents.		14. Use proportional reasoning, ratios and percents to represent problem situations and determine the reasonableness of solutions. 15. Determine the percent of a number and solve related problems; e.g., find the percent markdown if the original price was $140, and the sale price is $100.	
	Note: There are instances where a grade-level indicator is linked to a benchmark for a grade band that does not include the grade level of the indicator. See Grade 8 (page 33) for indicator 5.	*Note: There are instances where a grade-level indicator is linked to a benchmark for a grade band that does not include the grade level of the indicator. See Grade 8 (page 31) for indicator 10.*	*Note: There are instances where a grade-level indicator is linked to a benchmark for a grade band that does not include the grade level of the indicator. See Grade 8 (page 28) for indicator 1; Grade 8 (page 34) for indicator 2; Grade 8 (page 29) for indicator 3; Grade 8 (page 31) for indicator 5.*

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Number, Number Sense and Operations Standard

Grades 8-10

Ohio Benchmarks Grades 8-10	Grade-Level Indicators Grade 8	Grade-Level Indicators Grade 9	Grade-Level Indicators Grade 10
A. Use scientific notation to express large numbers and numbers less than one.	1. *Demonstrate an understanding of place value using powers of 10 and write large numbers in scientific notation.* **(Grade 7)** 1. Use scientific notation to express large numbers and small numbers between 0 and 1.		

Number, Number Sense and Operations Standard

Grades 8-10

Ohio Benchmarks Grades 8-10	Grade-Level Indicators Grade 8	Grade-Level Indicators Grade 9	Grade-Level Indicators Grade 10
B. Identify subsets of the real number system.	3. *Describe differences between rational and irrational numbers; e.g., use technology to show that some numbers (rational) can be expressed as terminating or repeating decimals and others (irrational) as non-terminating and non-repeating decimals.* **(Grade 7)** 2. Recognize that natural numbers, whole numbers, integers, rational numbers and irrational numbers are subsets of the real number system.		
C. Apply properties of operations and the real number system and justify when they hold for a set of numbers.	4. Explain and use the inverse and identity properties and use inverse relationships (addition/subtraction, multiplication/division, squaring/square roots) in problem solving situations.	1. Identify and justify whether properties (closure, identity, inverse, commutative and associative) hold for a given set and operations; e.g., even integers and multiplication.	

Number, Number Sense and Operations Standard

Grades 8-10

Ohio Benchmarks Grades 8-10	Grade-Level Indicators Grade 8	Grade-Level Indicators Grade 9	Grade-Level Indicators Grade 10
D. Connect physical, verbal and symbolic representations of integers, rational numbers and irrational numbers.			1. Connect physical, verbal and symbolic representations of irrational numbers; e.g., construct $\sqrt{2}$ as a hypotenuse or on a number line. 2. Explain the meaning of the nth root.
E. Compare, order and determine equivalent forms of real numbers.		2. Compare, order and determine equivalent forms for rational and irrational numbers.	

Number, Number Sense and Operations Standard
Grades 8-10

Ohio Benchmarks Grades 8-10	Grade-Level Indicators Grade 8	Grade-Level Indicators Grade 9	Grade-Level Indicators Grade 10
F. Explain the effects of operations on the magnitude of quantities.	10. *Recognize that a quotient may be larger than the dividend when the divisor is a fraction; e.g., 6 ÷ $\frac{1}{2}$ = 12.* **(Grade 6)** 5. *Explain the meaning and effect of adding, subtracting, multiplying and dividing integers; e.g., how adding two integers can result in a lesser value.* **(Grade 7)**	3. Explain the effects of operations such as multiplication or division, and of computing powers and roots on the magnitude of quantities.	

Number, Number Sense and Operations Standard

Grades 8-10

Ohio Benchmarks Grades 8-10	Grade-Level Indicators Grade 8	Grade-Level Indicators Grade 9	Grade-Level Indicators Grade 10
G. Estimate, compute and solve problems involving real numbers, including ratio, proportion and percent, and explain solutions.	5. Determine when an estimate is sufficient and when an exact answer is needed in problem situations, and evaluate estimates in relation to actual answers; e.g., very close, less than, greater than. 6. Estimate, compute and solve problems involving rational numbers, including ratio, proportion and percent, and judge the reasonableness of solutions.	4. Demonstrate fluency in computations using real numbers.	

Number, Number Sense and Operations Standard
Grades 8-10

Ohio Benchmarks Grades 8-10	Grade-Level Indicators Grade 8	Grade-Level Indicators Grade 9	Grade-Level Indicators Grade 10
H. Find the square root of perfect squares, and approximate the square root of non-perfect squares.	5. *Recognize and identify perfect squares and their roots.* ***(Grade 5)*** 7. Find the square root of perfect squares, and approximate the square root of non-perfect squares as consecutive integers between which the root lies; e.g., $\sqrt{130}$ is between 11 and 12.		

Number, Number Sense and Operations Standard

Grades 8-10

Ohio Benchmarks Grades 8-10	Grade-Level Indicators Grade 8	Grade-Level Indicators Grade 9	Grade-Level Indicators Grade 10
I. Estimate, compute and solve problems involving scientific notation, square roots and numbers with integer exponents.	2. *Explain the meaning of exponents that are negative or 0.* **(Grade 7)** 3. Apply order of operations to simplify expressions and perform computations involving integer exponents and radicals. 8. Add, subtract, multiply, divide and compare numbers written in scientific notation.	5. Estimate the solutions for problem situations involving square and cube roots.	4. Approximate the nth root of a given number greater than zero between consecutive integers when n is an integer; e.g., the 4th root of 50 is between 2 and 3.
			Note: There are instances where a grade-level indicator is linked to a benchmark for a grade band that does not include the grade level of the indicator. See Grade 11 (page 36) for indicator 3.

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Number, Number Sense and Operations Standard

Grades 11-12

Ohio Benchmarks Grades 11-12	Grade-Level Indicators Grade 11	Grade-Level Indicators Grade 12
A. Demonstrate that vectors and matrices are systems having some of the same properties of the real number system.	1. Determine what properties hold for matrix addition and matrix multiplication; e.g., use examples to show addition is commutative and when multiplication is not commutative. 2. Determine what properties hold for vector addition and multiplication, and for scalar multiplication.	
B. Develop an understanding of properties of and representations for addition and multiplication of vectors and matrices.	1. Determine what properties hold for matrix addition and matrix multiplication; e.g., use examples to show addition is commutative and when multiplication is not commutative. 2. Determine what properties hold for vector addition and multiplication, and for scalar multiplication. 5. Model using the coordinate plane, vector addition and scalar multiplication.	

Number, Number Sense and Operations Standard

Grades 11-12

Ohio Benchmarks Grades 11-12	Grade-Level Indicators Grade 11	Grade-Level Indicators Grade 12
C. Apply factorials and exponents, including fractional exponents, to solve practical problems.	3. *Use factorial notation and computations to represent and solve problem situations involving arrangements.* **(Grade 10)** 8. Use fractional and negative exponents as optional ways of representing and finding solutions for problem situations; e.g., $27^{2/3} = (27^{1/3})^2 = 9$.	2. Apply combinations as a method to create coefficients for the Binomial Theorem, and make connections to everyday and workplace problem situations.
D. Demonstrate fluency in operations with real numbers, vectors and matrices, using mental computation or paper and pencil calculations for simple cases, and technology for more complicated cases.	4. Use matrices to represent given information in a problem situation. 6. Compute sums, differences and products of matrices using paper and pencil calculations for simple cases, and technology for more complicated cases. 9. Use vector addition and scalar multiplication to solve problems.	

Number, Number Sense and Operations Standard

Grades 11-12

Ohio Benchmarks Grades 11-12	Grade-Level Indicators Grade 11	Grade-Level Indicators Grade 12
E. Represent and compute with complex numbers.	3. Represent complex numbers on the complex plane. 7. Compute sums, differences, products and quotients of complex numbers.	1. Determine what properties (closure, identity, inverse, commutative and associative) hold for operations with complex numbers.

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