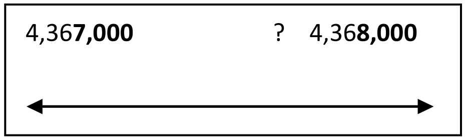
ASOL MATHEMATICS SCOPE AND SEQUENCE MATRIX: GRADE 4

MATHEMATICS ASOL SUMMARY MATRIX
Based on the 2009 *Mathematics* Standards of Learning

Reporting Category	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	High School
Number, Number Sense, Computation and Estimation	3M-NSCE 1 3M-NSCE 2 3M-NSCE 3 3M-NSCE 4 3M-NSCE 5 3M-NSCE 6 3M-NSCE 7	4M-NSCE 1 4M-NSCE 2 4M-NSCE 3 4M-NSCE 4 4M-NSCE 5	5M-NSCE 1 5M-NSCE 2 5M-NSCE 3 5M-NSCE 4	6M-NSCE 1 6M-NSCE 2 6M-NSCE 3 6M-NSCE 4 6M-NSCE 5	7M-NSCE 1 7M-NSCE 2 7M-NSCE 3	8M-NSCE 1 8M-NSCE 2 8M-NSCE 3	
Measurement and Geometry	3M-MG 1 3M-MG 2 3M-MG 3 3M-MG 4	4M-MG 1 4M-MG 2 4M-MG 3	5M-MG 1	6M-MG 1	7M-MG 1 7M-MG 2	8M-MG 1 8M-MG 2 8M-MG 3	
Probability, Statistics, Patterns, Functions, and Algebra	3M-PSPFA 1 3M-PSPFA 2 3M-PSPFA 3	4M-PSPFA 1	5M-PSPFA 1 5M-PSPFA 2	6M-PSPFA 1 6M-PSPFA 2 6M-PSPFA 3	7M-PSPFA 1 7M-PSPFA 2 7M-PSPFA 3	8M-PSPFA 1 8M-PSPFA 2 8M-PSPFA 3 8M-PSPFA 4	
Expressions and Operations							HSM-EO 1 HSM-EO 2
Equations and Inequalities							HSM-EI 1 HSM-EI 2 HSM-EI 3
Functions and Statistics							HSM-FS 1 HSM-FS 2 HSM-FS 3 HSM-FS 4

REPORTING CATEGORIES	GRADE 4 ASOL BLUEPRINT	UNDERSTANDING THE STANDARD
	4M-NSCE 1 (SOL 4.1)	• The structure of the Base-10 number system is based upon a simple pattern of tens, in which the value of each place is ten times the value of the place to its right. • Place value refers to the value of each digit and depends upon the position of the digit in the number. For example, in the number 7,864,352, the eight is in the hundred thousands place, and the value of the 8 is eight hundred thousand or 800,000. • Whole numbers may be written in a variety of formats: – Standard: 1,234,567, – Written: one million, two hundred thirty-four thousand, five hundred sixty-seven, – Expanded: $(1 \times 1{,}000{,}000) + (2 \times 100{,}000) + (3 \times 10{,}000) + (4 \times 1{,}000) + (5 \times 100) + (6 \times 10) + (7 \times 1)$. • Numbers are arranged into groups of three places called *periods* (ones, thousands, millions, …). Places within the periods repeat (hundreds, tens, ones). Commas are used to separate the periods. Knowing the place value and period of a number helps students find values of digits in any number as well as read and write numbers. • Reading and writing large numbers should be meaningful for students. Experiences can be provided that relate practical situations (e.g., numbers found in the students' environment including population, number of school lunches sold statewide in a day, etc.). Concrete materials such as Base-10 blocks and bundles of sticks may be used to represent whole numbers through thousands. Larger numbers may be represented by digit cards and place value charts. • Mathematical symbols (>, <) used to compare two unequal numbers are called *inequality symbols*. • A procedure for comparing two numbers by examining place value may include the following: – Compare the digits in the numbers to determine which number is greater (or which is less). – Use a number line to identify the appropriate placement of the numbers based on the place value of the digits. – Use the appropriate symbol > or < or words *greater than* or *less than* to compare the numbers in the order in which they are presented. – If both numbers have the same value, use the symbol = or words *equal to*. • A strategy for rounding numbers to the nearest thousand, ten thousand, and hundred thousand is as follows: – Use a number line to determine the rounded number (e.g., when rounding 4,367,925 to the nearest thousand, identify the 'thousands' the number would fall between on the number line, then determine the thousand that the number is closest to):  – Look one place to the right of the digit to which you wish to round.

		– If the digit is less than 5, leave the digit in the rounding place as it is, and change the digits to the right of the rounding place to zero. – If the digit is 5 or greater, add 1 to the digit in the rounding place and change the digits to the right of the rounding place to zero.
Number, Number Sense, Computation and Estimation	4M-NSCE 2 (SOL 4.2)	• A fraction is a way of representing part of a whole (as in a region/area model or a measurement model) or part of a group (as in a set model). A fraction is used to name a part of one thing or a part of a collection of things. • In the area/region and length/measurement fraction models, the parts must be equal. In the set model, the elements of the set do not have to be equal (i.e., “What fraction of the class is wearing the color red?”). • The denominator tells how many equal parts are in the whole or set. The numerator tells how many of those parts are being counted or described. • When fractions have the same denominator, they are said to have “common denominators” or “like denominators.” Comparing fractions with like denominators involves comparing only the numerators. • Strategies for comparing fractions having unlike denominators may include – comparing fractions to familiar benchmarks (e.g., 0, $\frac{1}{2}$, 1); – finding equivalent fractions, using manipulative models such as fraction strips, number lines, fraction circles, rods, pattern blocks, cubes, Base-10 blocks, tangrams, graph paper, or a multiplication chart and patterns; and – finding a common denominator by finding the least common multiple (LCM) of both denominators and then rewriting each fraction as an equivalent fraction, using the LCM as the denominator. • A variety of fraction models should be used to expand students’ understanding of fractions and mixed numbers: – Region/area models: a surface or area is subdivided into smaller equal parts, and each part is compared with the

		whole (e.g., fraction circles, pattern blocks, geoboards, grid paper, color tiles). – Set models: the whole is understood to be a set of objects, and subsets of the whole make up fractional parts (e.g., counters, chips). – Measurement models: similar to area models but lengths instead of areas are compared (e.g., fraction strips, rods, cubes, number lines, rulers). • A mixed number has two parts: a whole number and a fraction. • Equivalent fractions name the same amount. Students should use a variety of models to identify different names for equivalent fractions. • Students should focus on finding equivalent fractions of familiar fractions such as halves, thirds, fourths, sixths, eighths, tenths, and twelfths. • Decimals and fractions represent the same relationships; however, they are presented in two different formats. The decimal 0.25 is written as $\frac{1}{4}$. When presented with the fraction $\frac{3}{5}$, the division expression representing a fraction is written as 3 divided by 5.
	4M-NSCE 3 (SOL 4.3)	• The structure of the Base-10 number system is based upon a simple pattern of tens, where each place is ten times the value of the place to its right. This is known as a ten-to-one place value relationship. • Understanding the system of tens means that ten tenths represents one whole, ten hundredths represents one tenth, ten thousandths represents one hundredth. • A decimal point separates the whole number places from the places that are less than one. Place values extend infinitely in two directions from a decimal point. A number containing a decimal point is called a *decimal number* or simply a *decimal*. • To read decimals, – read the whole number to the left of the decimal point, if there is one; – read the decimal point as "and"; – read the digits to the right of the decimal point just as you would read a whole number; and – say the name of the place value of the digit in the smallest place. • Any decimal less than 1 will include a leading zero (e.g., 0.125). • Decimals may be written in a variety of forms: – Standard: 26.537, – Written: twenty-six and five hundred thirty-seven thousandths, – Expanded: $(2 \times 10) + (6 \times 1) + (5 \times 0.1) + (3 \times 0.01) + (7 \times 0.001)$. • Decimals and fractions represent the same relationships; however, they are presented in two different formats. The decimal 0.25 is written as $\frac{1}{4}$. Decimal numbers are another way of writing fractions. When presented with the fraction $\frac{3}{5}$, the division expression representing a fraction is written as 3 divided by 5. The Base-10 models concretely relate fractions to decimals (e.g., 10-by-10 grids, meter sticks, number lines, decimal squares, money).

		• The procedure for rounding decimal numbers is similar to the procedure for rounding whole numbers. • A strategy for rounding decimal numbers to the nearest tenth and hundredth is as follows: – Look one place to the right of the digit you want to round to. – If the digit is 5 or greater, add 1 to the digit in the rounding place, and drop the digits to the right of the rounding place. – If the digit is less than 5, leave the digit in the rounding place as it is, and drop the digits to the right of the rounding place. • Different strategies for rounding decimals include: – Use a number line to locate a decimal between two numbers. For example, 18.83 is closer to 18.8 than to 18.9. – Compare the digits in the numbers to determine which number is greater (or which is less). – Compare the value of decimals, using the symbols >, <, = (e.g., 0.83 > 0.8 or 0.19 < 0.2). – Order the value of decimals, from least to greatest and greatest to least (e.g., 0.83, 0.821, 0.8). • Decimal numbers are another way of writing fractions (halves, fourths, fifths, and tenths). The Base-10 models concretely relate fractions to decimals (e.g., 10-by-10 grids, meter sticks, number lines, decimal squares, decimal circles money). • Provide a fraction model (halves, fourths, fifths, and tenths) and ask students for its decimal equivalent. • Provide a decimal model and ask students for its fraction equivalent (halves, fourths, fifths, and tenths).
	4M-NSCE 4 (SOL 4.4)	• A sum is the result of adding two or more numbers. • A difference is the amount that remains after one quantity is subtracted from another. • An estimate is a number close to an exact solution. An estimate tells about how much or about how many. • Different strategies for estimating include using compatible numbers to estimate sums and differences and using front-end estimation for sums and differences. – Compatible numbers are numbers that are easy to work with mentally. Number pairs that are easy to add or subtract are compatible. When estimating a sum, replace actual numbers with compatible numbers (e.g., 52 + 74 can be estimated by using the compatible numbers 50 + 75). When estimating a difference, use numbers that are close to the original numbers. Tens and hundreds are easy to subtract (e.g., 83 – 38 is close to 80 – 40). – The front-end strategy for estimating is computing with the front digits. Front-end estimation for addition can be used even when the addends have a different number of digits. The procedure requires the addition of the values of the digits in the greatest of the smallest number. For example: 2367 → 2300 243 → 200 + 1186 → + 1100 3600 • Front-end or leading-digit estimation always gives a sum less than the actual sum; however, the estimate can be adjusted or refined so that it is closer to the actual sum. • Addition is the combining of quantities; it uses the following terms: *addend* → 45,623 *addend* → + 37,846

		sum → 83,469 • Subtraction is the inverse of addition; it yields the difference between two numbers and uses the following terms: *minuend* → 45,698 *subtrahend* → – 32,741 *difference* → 12,957 • Before adding or subtracting with paper and pencil, addition and subtraction problems in horizontal form should be rewritten in vertical form by lining up the places vertically. • Using Base-10 materials to model and stimulate discussion about a variety of problem situations helps students understand regrouping and enables them to move from the concrete to the pictorial, to the abstract. Regrouping is used in addition and subtraction algorithms. In addition, when the sum in a place is 10 or more, is used to regroup the sums so that there is only one digit in each place. In subtraction, when the number (minuend) in a place is not enough from which to subtract, regrouping is required. • A certain amount of practice is necessary to develop fluency with computational strategies for multidigit numbers; however, the practice must be meaningful, motivating, and systematic if students are to develop fluency in computation, whether mentally, with manipulative materials, or with paper and pencil. • Calculators are an appropriate tool for computing sums and differences of large numbers, particularly when mastery of the algorithm has been demonstrated. • The terms associated with multiplication are *factor* → 376 *factor* → × 23 *product* → 8,648 • One model of multiplication is repeated addition. • Another model of multiplication is the "Partial Product" model. 24 × 3 12 ← Multiply the ones: 3 × 4 = 12 + 60 ← Multiply the tens: 3 × 20 = 60 72 • Another model of multiplication is the "Area Model" (which also represents partial products) and should be modeled first with Base-10 blocks. (e.g., 23 x 68) • Students should continue to develop fluency with single-digit multiplication facts and their related division facts. • Calculators should be used to solve problems that require tedious calculations. • Estimation should be used to check the reasonableness of the product. Examples of estimation strategies include the following: – The front-end method: multiply the front digits and then complete the product by recording the number of zeros found in the factors. It is important to develop understanding of this process before using the step-by-step procedure.

		523 → 500 × 31 → × 30 15,000 – This is 3 × 5 = 15 with 3 zeros. – Compatible numbers: replace factors with compatible numbers, and then multiply. Opportunities for students to discover patterns with 10 and powers of 10 should be provided. 64 → 64 × 11 → × 10 • Division is the operation of making equal groups or equal shares. When the original amount and the number of shares are known, divide to find the size of each share. When the original amount and the size of each share are known, divide to find the number of shares. Both situations may be modeled with Base-10 manipulatives. • Multiplication and division are inverse operations. • Terms used in division are *dividend*, *divisor*, and *quotient.* dividend ÷ divisor = quotient $\text{divisor}\,\overline{)\text{dividend}}$ with quotient written above • Opportunities to invent division algorithms help students make sense of the algorithm. Teachers should teach division by various methods such as repeated multiplication and subtraction (partial quotients) before teaching the traditional long division algorithm.
	4M-NSCE 5 (SOL 4.5)	• A factor of a number is an integer that divides evenly into that number with a remainder of zero. • A factor of a number is a divisor of the number. • A multiple of a number is the product of the number and any natural number. • A common factor of two or more numbers is a divisor that all of the numbers share. • The least common multiple of two or more numbers is the smallest common multiple of the given numbers. • The greatest common factor of two or more numbers is the largest of the common factors that all of the numbers share. • Students should investigate addition and subtraction with fractions, using a variety of models (e.g., fraction circles, fraction strips, rulers, linking cubes, pattern blocks). • When adding or subtracting with fractions having like denominators, add or subtract the numerators and use the same denominator. Write the answer in simplest form using common multiples and factors. • When adding or subtracting with fractions having unlike denominators, rewrite them as fractions with a common denominator. The least common multiple (LCM) of the unlike denominators is a common denominator (LCD). Write the answer in simplest form using common multiples and factors. • Addition and subtraction of decimals may be explored, using a variety of models (e.g., 10-by-10 grids, number lines, money). • For decimal computation, the same ideas developed for whole number computation may be used, and these ideas may be applied to decimals, giving careful attention to the placement of the decimal point in the solution. Lining up tenths to tenths, hundredths to hundredths, etc. helps to establish the correct placement of the decimal.

		• Fractions may be related to decimals by using models (e.g., 10-by-10 grids, decimal squares, money).
Measurement and Geometry	4M-MG 1 (SOL 4.6)	• Weight and mass are different. Mass is the amount of matter in an object. Weight is determined by the pull of gravity on the mass of an object. The mass of an object remains the same regardless of its location. The weight of an object changes depending on the gravitational pull at its location. In everyday life, most people are actually interested in determining an object's mass, although they use the term *weight* (e.g., "How much does it weigh?" versus "What is its mass?"). • Balances are appropriate measuring devices to measure weight in U.S. Customary units (ounces, pounds) and mass in metric units (grams, kilograms). Practical experience measuring the mass of familiar objects helps to establish benchmarks and facilitates the student's ability to estimate weight/mass. Students should estimate the mass/weight of everyday objects (e.g., foods, pencils, book bags, shoes), using appropriate metric or U.S. Customary units. • Practical experience measuring the mass of familiar objects helps to establish benchmarks and facilitates the student's ability to estimate weight/mass. • Students should estimate the mass/weight of everyday objects (e.g., foods, pencils, book bags, shoes), using appropriate metric or U.S. Customary units.
	4M-MG 2 (SOL 4.9)	• Elapsed time is the amount of time that has passed between two given times. • Elapsed time should be modeled and demonstrated using analog clocks and timelines. • Elapsed time can be found by counting on from the beginning time to the finishing time. – Count the number of whole hours between the beginning time and the finishing time. – Count the remaining minutes. – Add the hours and minutes. For example, to find the elapsed time between 10:15 a.m. and 1:25 p.m., count 10 minutes; and then, add 3 hours to 10 minutes to find the total elapsed time of 3 hours and 10 minutes.
	4M-MG 3 (SOL 4.10)	• A point is a location in space. It has no length,-width, or height. A point is usually named with a capital letter. • A line is a collection of points going on and on infinitely in both directions. It has no endpoints. When a line is drawn, at least two points on it can be marked and given capital letter names. Arrows must be drawn to show that the line goes on in both directions infinitely (e.g., $\overleftrightarrow{AB}$, read as "the line AB"). • A line segment is part of a line. It has two endpoints and includes all the points between those endpoints. To name a line segment, name the endpoints (e.g., $\overline{AB}$, read as "the line segment AB"). • A ray is part of a line. It has one endpoint and continues infinitely in one direction. To name a ray, say the name of its endpoint first and then say the name of one other point on the ray (e.g., $\overrightarrow{AB}$, read as "the ray AB"). • Two rays that have the same endpoint form an angle. This endpoint is called the *vertex*. Angles are found wherever lines and line segments intersect. An angle can be named in three different ways by using – three letters to name, in this order, a point on one ray, the vertex, and a point on the other ray; – one letter at the vertex; or – a number written inside the rays of the angle. • Intersecting lines have one point in common.

		• Perpendicular lines are special intersecting lines that form right angles where they intersect. • Parallel lines are lines that lie in the same place and do not intersect. Parallel lines are always the same distance apart and do not share any points. • Students should explore intersection, parallelism, and perpendicularity in both two and three dimensions. For example, students should analyze the relationships between the edges of a cube. Which edges are parallel? Which are perpendicular? What plane contains the upper left edge and the lower right edge of the cube? Students can visualize this by using the classroom itself to notice the lines formed by the intersection of the ceiling and walls, of the floor and wall, and of two walls.
Probability, Statistics, Patterns, Functions, and Algebra	4M-PSPFA 1 (SOL 4.15)	• Most patterning activities should involve some form of concrete materials to make up a pattern. – Students will identify and extend a wide variety of patterns, including rhythmic, geometric, graphic, numerical, and algebraic. The patterns will include both growing and repeating patterns. • Reproduction of a given pattern in a different representation, using symbols and objects, lays the foundation for writing the relationship symbolically or algebraically. • Tables of values should be analyzed for a pattern to determine the next value.