ASOL MATHEMATICS SCOPE AND SEQUENCE MATRIX: GRADE 8

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 8 ASOL BLUEPRINT	UNDERSTANDING THE STANDARD
Number, Number Sense, Computation and Estimation	8M-NSCE 1 (SOL 8.1)	• *Expression* is a word used to designate any symbolic mathematical phrase that may contain numbers and/or variables. Expressions do not contain equal or inequality signs. • The set of rational numbers includes the set of all numbers that can be expressed as fractions in the form $\frac{a}{b}$ where *a* and *b* are integers and *b* does not equal zero (e.g., $\sqrt{25}$, $\frac{1}{4}$ -2.3, 75%, $4.\overline{59}$). • A rational number is any number that can be written in fraction form. • A numerical expression contains only numbers and the operations on those numbers. • Expressions are simplified using the order of operations and the properties for operations with real numbers, i.e., associative, commutative, and distributive and inverse properties. • The order of operations, a mathematical convention, is as follows: Complete all operations within grouping symbols*. If there are grouping symbols within other grouping symbols (embedded), do the innermost operation first. Evaluate all exponential expressions. Multiply and/or divide in order from left to right. Add and/or subtract in order from left to right. *Parentheses ( ), brackets [ ], braces { }, the absolute value $\lvert\ \rvert$, division/fraction bar −, and the square root symbol $\sqrt{}$ should be treated as grouping symbols. • A power of a number represents repeated multiplication of the number. For example, $(-5)^4$ means $(-5) \cdot (-5) \cdot (-5) \cdot (-5)$. The base is the number that is multiplied, and the exponent represents the number of times the base is used as a factor. In this example, (–5) is the base, and 4 is the exponent. The product is 625. Notice that the base appears inside the grouping symbols. The meaning changes with the removal of the grouping symbols. For example, -5^4 means $5 \cdot 5 \cdot 5 \cdot 5$ negated which results in a product of -625. The expression $-(5)^4$ means to take the opposite of $5 \cdot 5 \cdot 5 \cdot 5$ which is -625. Students should be exposed to all three representations. • Scientific notation is used to represent very large or very small numbers. • A number written in scientific notation is the product of two factors: a decimal greater than or equal to one but less than 10 multiplied by a power of 10 (e.g., $3.1 \times 10^5 = 310{,}000$ and $3.1 \times 10^{-5} = 0.000031$). • Any real number raised to the zero power is 1. The only exception to this rule is zero itself. Zero raised to the zero power is undefined. • All state approved scientific calculators use algebraic logic (follow the order of operations).
	8M-NSCE 2 (SOL 8.2)	• The set of real numbers includes natural numbers, counting numbers, whole numbers, integers, rational and irrational numbers. • The set of natural numbers is the set of counting numbers {1, 2, 3, 4, ...}. • The set of whole numbers includes the set of all the natural numbers or counting numbers and zero {0, 1, 2, 3…}. • The set of integers includes the set of whole numbers and their opposites {…-2, -1, 0, 1, 2…}. • The set of rational numbers includes the set of all numbers that can be expressed as fractions in the form $\frac{a}{b}$ where a and

		b are integers and b does not equal zero (e.g., $\sqrt{25}$, $\frac{1}{4}$, -2.3, 75%, $4.\overline{59}$). • The set of irrational numbers is the set of all nonrepeating, nonterminating decimals. An irrational number cannot be written in fraction form {e.g., π, $\sqrt{2}$, 1.232332333…}.
	8M-NSCE 3 (SOL 8.5)	• A perfect square is a whole number whose square root is an integer (e.g., The square root of 25 is 5 and -5; thus, 25 is a perfect square). • The square root of a number is any number which when multiplied by itself equals the number. • Whole numbers have both positive and negative roots. • Any whole number other than a perfect square has a square root that lies between two consecutive whole numbers. • The square root of a whole number that is not a perfect square is an irrational number (e.g., $\sqrt{2}$ is an irrational number). An irrational number cannot be expressed exactly as a ratio. • Students can use grid paper and estimation to determine what is needed to build a perfect square.
Measurement and Geometry	8M-MG 1 (SOL 8.6)	• Vertical angles are (all nonadjacent angles) formed by two intersecting lines. Vertical angles are congruent and share a common vertex. • Complementary angles are any two angles such that the sum of their measures is 90°. • Supplementary angles are any two angles such that the sum of their measures is 180°. • Reflex angles measure more than 180°. • Adjacent angles are any two non-overlapping angles that share a common side and a common vertex.
	8M-MG 2 (SOL 8.7)	• A polyhedron is a solid figure whose faces are all polygons. • A pyramid is a polyhedron with a base that is a polygon and other faces that are triangles with a common vertex. • The area of the base of a pyramid is the area of the polygon which is the base. • The total surface area of a pyramid is the sum of the areas of the triangular faces and the area of the base. • The volume of a pyramid is $\frac{1}{3}Bh$, where B is the area of the base and h is the height. • The area of the base of a circular cone is πr^2. • The surface area of a right circular cone is $\pi r^2 + \pi rl$, where l represents the slant height of the cone. • The volume of a cone is $\frac{1}{3}\pi r^2 h$, where h is the height and πr^2 is the area of the base. • The surface area of a right circular cylinder is $2\pi r^2 + 2\pi rh$. • The volume of a cylinder is the area of the base of the cylinder multiplied by the height. • The surface area of a rectangular prism is the sum of the areas of the six faces. • The volume of a rectangular prism is calculated by multiplying the length, width and height of the prism. • A prism is a solid figure that has a congruent pair of parallel bases and faces that are parallelograms. The surface area of a prism is the sum of the areas of the faces and bases. • When one attribute of a prism is changed through multiplication or division the volume increases by the same factor that the attribute increased by. For example, if a prism has a volume of 2 x 3 x 4, the volume is 24. However, if one of the attributes are doubled, the volume doubles. • The volume of a prism is Bh, where B is the area of the base and h is the height of the prism.

		• Nets are two-dimensional representations that can be folded into three-dimensional figures.
	8M-MG 3 (SOL 8.8)	• A rotation of a geometric figure is a clockwise or counterclockwise turn of the figure around a fixed point. The point may or may not be on the figure. The fixed point is called the *center of rotation.* • A reflection of a geometric figure moves all of the points of the figure across an axis. Each point on the reflected figure is the same distance from the axis as the corresponding point in the original figure. • A translation of a geometric figure moves all the points on the figure the same distance in the same direction. • A dilation of a geometric figure is a transformation that changes the size of a figure by a scale factor to create a similar figure. • Practical applications may include, but are not limited to, the following: – A rotation of the hour hand of a clock from 2:00 to 3:00 shows a turn of 30° clockwise; – A reflection of a boat in water shows an image of the boat flipped upside down with the water line being the line of reflection; – A translation of a figure on a wallpaper pattern shows the same figure slid the same distance in the same direction; and – A dilation of a model airplane is the production model of the airplane. • The image of a polygon is the resulting polygon after a transformation. The preimage is the original polygon before the transformation. • A transformation of preimage point *A* can be denoted as the image *A′* (read as "A prime").
Probability, Statistics, Patterns, Functions, and Algebra	8M-PSPFA 1 (SOL 8.14)	• A relation is any set of ordered pairs. For each first member, there may be many second members. • A function is a relation in which there is one and only one second member for each first member. • As a table of values, a function has a unique value assigned to the second variable for each value of the first variable. • As a graph, a function is any curve (including straight lines) such that any vertical line would pass through the curve only once. • Some relations are functions; all functions are relations. • Graphs of functions can be discrete or continuous. • In a discrete function graph there are separate, distinct points. You would not use a line to connect these points on a graph. The points between the plotted points have no meaning and cannot be interpreted. • In a graph of continuous function every point in the domain can be interpreted therefore it is possible to connect the points on the graph with a continuous line as every point on the line answers the original question being asked. • Functions can be represented as tables, graphs, equations, physical models, or in words.
	8M-PSPFA 2 (SOL 8.15)	• A multistep equation is an equation that requires more than one different mathematical operation to solve. • A two-step inequality is defined as an inequality that requires the use of two different operations to solve (e.g., $3x - 4 > 9$). • In an equation, the equal sign indicates that the value on the left is the same as the value on the right. • To maintain equality, an operation that is performed on one side of an equation must be performed on the other side. • When both expressions of an inequality are multiplied or divided by a negative number, the inequality sign reverses. • The commutative property for addition states that changing the order of the addends does not change the sum (e.g., $5 + 4 = 4 + 5$). • The commutative property for multiplication states that changing the order of the factors does not change the product

		(e.g., $5 \cdot 4 = 4 \cdot 5$). • The associative property of addition states that regrouping the addends does not change the sum [e.g., $5 + (4 + 3) = (5 + 4) + 3$]. • The associative property of multiplication states that regrouping the factors does not change the product [e.g., $5 \cdot (4 \cdot 3) = (5 \cdot 4) \cdot 3$]. • Subtraction and division are neither commutative nor associative. • The distributive property states that the product of a number and the sum (or difference) of two other numbers equals the sum (or difference) of the products of the number and each other number [e.g., $5 \cdot (3 + 7) = (5 \cdot 3) + (5 \cdot 7)$, or $5 \cdot (3 – 7) = (5 \cdot 3) – (5 \cdot 7)$]. • Identity elements are numbers that combine with other numbers without changing the other numbers. The additive identity is zero (0). The multiplicative identity is one (1). There are no identity elements for subtraction and division. • The additive identity property states that the sum of any real number and zero is equal to the given real number (e.g., $5 + 0 = 5$). • The multiplicative identity property states that the product of any real number and one is equal to the given real number (e.g., $8 \cdot 1 = 8$). • Inverses are numbers that combine with other numbers and result in identity elements [e.g., $5 + (–5) = 0$; $\frac{1}{5} \cdot 5 = 1$]. • The additive inverse property states that the sum of a number and its additive inverse always equals zero [e.g., $5 + (–5) = 0$]. • The multiplicative inverse property states that the product of a number and its multiplicative inverse (or reciprocal) always equals one (e.g., $4 \cdot \frac{1}{4} = 1$). • Zero has no multiplicative inverse. • The multiplicative property of zero states that the product of any real number and zero is zero. • Division by zero is not a possible arithmetic operation. • Combining like terms means to combine terms that have the same variable and the same exponent (e.g., $8x + 11 – 3x$ can be $5x + 11$ by combining the like terms of $8x$ and $-3x$).
	8M-PSPFA 3 (SOL 8.16)	• A linear equation is an equation in two variables whose graph is a straight line, a type of continuous function (see SOL 8.14). • A linear equation represents a situation with a constant rate. For example, when driving at a rate of 35 mph, the distance increases as the time increases, but the rate of speed remains the same. • Graphing a linear equation requires determining a table of ordered pairs by substituting into the equation values for one variable and solving for the other variable, plotting the ordered pairs in the coordinate plane, and connecting the points to form a straight line. • The axes of a coordinate plane are generally labeled *x* and *y*; however, any letters may be used that are appropriate for the function.
	8M-PSPFA 4 (SOL 8.17)	• The domain is the set of all the input values for the independent variable in a given situation. • The range is the set of all the output values for the dependent variable in a given situation. • The independent variable is the input value.

- The dependent variable depends on the independent variable and is the output value.
- Below is a table of values for finding the circumference of circles, $C = \pi d$, where the value of π is approximated as 3.14.

Diameter	Circumference
1 in.	3.14 in.
2 in.	6.28 in.
3 in.	9.42 in.
4 in.	12.56 in.

- The independent variable, or input, is the diameter of the circle. The values for the diameter make up the domain.
- The dependent variable, or output, is the circumference of the circle. The set of values for the circumference makes up the range.