MATHEMATICS VERTICAL ARTICULATION TOOL (MVAT)
2016 *Mathematics Standards of Learning* – Measurement and Geometry
Kindergarten-Algebra II Progression

All K-8 Mathematics SOL for the Measurement and Geometry strand are represented in this document. All End-of-Course Mathematics SOL are <u>NOT</u> represented.

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Grade K	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	Related to Algebra 1	Related to Geometry	Related to Algebra 2	Money
K.7												recognize the attributes of a penny, nickel, dime, and quarter and identify the number of pennies equivalent to a nickel, a dime, and a quarter
ES	**1.8**											determine the value of a collection of like coins (pennies, nickels, or dimes) whose total value is 100 cents or less
ES	ES	**2.7a**										count and compare a collection of pennies, nickels, dimes, and quarters whose total value is $2.00 or less
ES	ES	**2.7b**										use the cent symbol, dollar symbol, and decimal point to write a value of money
ES	ES	ES	**3.6a**									determine the value of a collection of bills and coins whose total value is $5.00 or less
ES	ES	ES	**3.6b**									compare the value of two sets of coins or two sets of coins and bills
ES	ES	ES	**3.6c**									make change from $5.00 or less

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K-8 Cross-Strand Connections – Money

Number and Number Sense Connections
1.1 The student will
    d) count forward orally by ones, twos, fives, and tens to determine the total number of objects to 110.
1.2 The student, given up to 110 objects, will
    a) group a collection into tens and ones and write the corresponding numeral
2.2 The student will
    a) count forward by twos, fives, and tens to 120, starting at various multiples of 2, 5, or 10

Computation and Estimation Connections
2.6 The student will
    a) estimate sums and differences;
    b) determine sums and differences, using various methods
3.3 The student will
    a) estimate and determine the sum or difference of two whole numbers;

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Grade K	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	Related to Algebra 1	Related to Geometry	Related to Algebra 2	Time
K.8												investigate the passage of time by reading and interpreting a calendar
ES	**1.9a**											investigate the passage of time and tell time to the hour and half-hour, using analog and digital clocks
ES	**1.9b**											read and interpret a calendar
ES	ES	**2.9**										tell time and write time to the nearest five minutes, using analog and digital clocks
ES	ES	**2.10a**										determine past and future days of the week
ES	ES	**2.10b**										identify specific days and dates on a given calendar
			3.9a									tell time to the nearest minute, using analog and digital clocks
ES	ES	ES	**3.9b**									solve practical problems related to elapsed time in one-hour increments within a 12-hour period
ES	ES	ES	**3.9c**									identify equivalent periods of time and solve practical problems related to equivalent periods of time
ES	ES	ES	ES	**4.9**								solve practical problems related to elapsed time in hours and minutes within a 12-hour period
ES	ES	ES	ES	ES	**5.11**							solve practical problems related to elapsed time in hours and minutes within a 24-hour period

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K-8 Cross-Strand Connections – Time

Number and Number Sense Connections

1.1 The student will
    d) count forward orally by ones, twos, fives, and tens to determine the total number of objects to 110.
1.2 The student, given up to 110 objects, will
    a) group a collection into tens and ones and write the corresponding numeral
2.2 The student will
    a) count forward by twos, fives, and tens to 120, starting at various multiples of 2, 5, or 10

Computation and Estimation Connections

2.6 The student will
    a) estimate sums and differences;
    b) determine sums and differences, using various methods
3.3 The student will
    a) estimate and determine the sum or difference of two whole numbers;

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Grade K	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	Related to Algebra 1	Related to Geometry	Related to Algebra 2	Length, Weight/Mass, Liquid Volume and Temperature
K.9												compare two objects or events, using direct comparisons, according to one or more of the following attributes: length (longer, shorter), height (taller, shorter), weight (heavier, lighter), temperature (hotter, colder), volume (more, less), and time (longer, shorter)
ES	**1.10**											use nonstandard units to measure and compare length, weight, and volume
ES	ES	**2.8a**										estimate and measure length to the nearest inch
ES	ES	**2.8b**										estimate and measure weight to the nearest pound
ES	ES	**2.11**										read temperature to the nearest 10 degrees
ES	ES	ES	**3.7a**									estimate and use the U.S. Customary and metric units to measure length to the nearest ½ inch, inch, foot, yard, centimeter, and meter
ES	ES	ES	**3.7b**									estimate and use the U.S. Customary and metric units to measure liquid volume in cups, pints, quarts, gallons, and liters
ES	ES	ES	**3.10**									read temperature to the nearest degree
ES	ES	ES	ES	**4.8a**								estimate and measure length and describe the result in U.S. Customary and metric units
ES	ES	ES	ES	**4.8b**								estimate and measure weight/mass and describe the result in U.S. Customary and metric units
ES	ES	ES	ES	**4.8c**								given the equivalent measure of one unit, identify equivalent measures of length, weight/mass, and liquid volume between units within the U.S. Customary
ES	ES	ES	ES	**4.8d**								solve practical problems that involve length, weight/mass, and liquid volume in the U.S. Customary units
ES	ES	ES	ES	ES	**5.9a**							given the equivalent measure of one unit, identify equivalent measurements within the metric system
ES	ES	ES	ES	ES	**5.9b**							solve practical problems involving length, mass, and liquid volume using metric units

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			3.8a									estimate and measure the distance around a polygon in order to determine its perimeter using U.S. Customary and metric units
			3.8b									estimate and count the number of square units needed to cover a given surface in order to determine its area
			ES	**4.7**								solve practical problems that involve determining perimeter and area in U.S. Customary and metric units
			ES	ES	**5.8a**							solve practical problems that involve perimeter, area, and volume in standard units of measure
			ES	ES	**5.8b**							differentiate among perimeter, area, and volume and identify whether the application of the concept of perimeter, area, or volume is appropriate for a given situation
			ES	ES	ES	**6.7a**						derive pi
			ES	ES	ES	**6.7b**						solve problems and practical problems, involving circumference and area of a circle
			ES	ES	ES	**6.7c**						solve problems and practical problems, involving area and perimeter of triangles and rectangles
			ES	ES	ES			**8.10**				solve area and perimeter problems, including practical problems, involving composite figures

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K-8 Cross-Strand Connections – Area, Perimeter, and Circumference

Algebra 1

A.4   The student will solve
  c) literal equations for a specified variable;

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Grade K	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	Related to Algebra 1	Related to Geometry	Related to Algebra 2	Volume and Surface Area
							7.4a					describe and determine the volume and surface area of rectangular prisms and cylinders
							7.4b					solve problems, including practical problems, involving the volume and surface area of rectangular prisms and cylinders
								8.6a				solve problems, involving practical problems, involving volume and surface area of cones and square-based pyramids
								8.6b				describe how changing one measured attribute of a rectangular prism affects the volume and surface area
										G.13		use surface area and volume of three-dimensional objects to solve practical problems.
										G.14a		**The student will apply the concepts of similarity to two- or three-dimensional geometric figures. This will include** comparing ratios between lengths, perimeters, areas, and volumes of similar figures
										G.14b		**The student will apply the concepts of similarity to two- or three-dimensional geometric figures. This will include** determining how changes in one or more dimensions of a figure affect area and/or volume of the figure
										G.14c		**The student will apply the concepts of similarity to two- or three-dimensional geometric figures. This will include** determining how changes in area and/or volume of a figure affect one or more dimensions of the figure
										G.14d		**The student will apply the concepts of similarity to two- or three-dimensional geometric figures. This will include** solving problems, including practical problems, about similar geometric figures

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K-8 Cross-Strand Connections –Volume and Surface Area

Algebra 1

A.4 The student will solve
   c) literal equations for a specified variable;

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Grade K	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	Related to Algebra 1	Related to Geometry	Related to Algebra 2	Point, Line, Line Segment, Ray and Angle - Identify, Describe, Classify, and Measure
			3.11									identify and draw representations of points, lines, line segments, rays and angles
			ES	**4.10a**								identify and describe points, lines, line segments, rays, and angles, including endpoints and vertices
			ES	**4.10b**								identify and describe intersecting, parallel, and perpendicular lines
			ES	ES	**5.12**							classify and measure right, acute, obtuse, and straight angles
			ES	ES	ES			**8.5**				use the relationships among pairs of angles that are vertical angles, adjacent angles, supplementary angles, and complementary angles to determine the measure of unknown angles
			ES	ES	ES					**G.2a**		**The student will use the relationships between angles formed by two lines intersected by a transversal to** prove two or more lines are parallel
			ES	ES	ES					**G.2b**		**The student will use the relationships between angles formed by two lines intersected by a transversal to** solve problems, including practical problems, involving angles formed when parallel lines are intersected by a transversal

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Grade K	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	Related to Algebra 1	Related to Geometry	Related to Algebra 2	Circles and Polygons-Identify and Describe
K.10a												identify and describe plane figures (circle, triangle, square, and rectangle)
K.10c												describe the location of one object relative to another (above, below, next to) and identify representations of plane figures (circle, triangle, square, and rectangle) regardless of their positions and orientations in space
ES	**1.11a**											identify, trace, describe, and sort plane figures (triangles, squares, rectangles, and circles) according to the number of sides, vertices, and angles
ES	**1.11b**											identify and describe representations of circles, squares, rectangles, and triangles in different environments, regardless of orientation, and explain reasoning
ES	ES	ES	**3.12a**									define polygon
ES	ES	ES	**3.12 b**									identify and name polygons with 10 or fewer sides
ES	ES	ES	**3.12c**									combine and subdivide polygons with three or four sides and name the resulting polygon(s)
ES	ES	ES	ES	ES	**5.10**							identify and describe the diameter, radius, chord, and circumference of a circle
ES	ES	ES	ES	ES	**5.14b**							investigate and describe the results of combining and subdividing polygons
ES	ES	ES	ES	ES	ES					**G.12**		solve problems involving equations of circles

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Grade K	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	Related to Algebra 1	Related to Geometry	Related to Algebra 2	Circles and Polygons-Classify and Measure
		2.12a										draw a line of symmetry in a figure
		2.12b										identify and create figures with at least one line of symmetry
		ES	ES	**4.12**								classify quadrilaterals as parallelograms, rectangles, squares, rhombi, and/or trapezoids
		ES	ES	ES	**5.13a**							classify triangles as right, acute, obtuse and equilateral, scalene, or isosceles
		ES	ES	ES	**5.13b**							investigate the sum of the interior angles in a triangle and determine an unknown angle measure
		ES	ES	ES	ES		**7.6a**					compare and contrast quadrilaterals based on their properties
		ES	ES	ES	ES		**7.6b**					determine the unknown side lengths or angle measures of quadrilaterals
		ES	ES	ES	ES			**8.9a**				verify the Pythagorean Theorem
		ES	ES	ES	ES			**8.9b**				apply the Pythagorean Theorem
		ES	ES	ES	ES					**G.5a**		The student, given information concerning the lengths of sides and/or measures of angles in triangles, will solve problems, including practical problems. This will include order the sides by length, given angle measures
		ES	ES	ES	ES					**G.5b**		order the angles by degree measure, given side lengths
		ES	ES	ES	ES					**G.5c**		determine whether a triangle exists
		ES	ES	ES	ES					**G.5d**		determine the range in which the length of the third side must lie
		ES	ES	ES	ES					**G.8a**		The student will solve problems, including practical problems, involving right triangles. This will include applying the Pythagorean Theorem and its converse
		ES	ES	ES	ES					**G.8b**		properties of special right triangles

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Grade K	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	Related to Algebra 1	Related to Geometry	Related to Algebra 2	Circles and Polygons- Classify and Measure Continued
		ES	ES	ES	ES					**G.8c**		trigonometric ratios
		ES	ES	ES	ES					**G.9**		verify and use properties of quadrilaterals to solve problems, including practical problems.
		ES	ES	ES	ES					G.10a		**The student will solve problems, including practical problems, involving angles of convex polygons. This will include determining the** sum of the interior and/or exterior angles;
										G.10b		measure of an interior and/or exterior angle
		ES	ES	ES	ES					G.10c		number of sides of a regular polygon
		ES	ES	ES	ES					G.11a		**The student will solve problems, including practical problems, by applying properties of circles. This will include determining** angle measures formed by intersecting chords, secants, and/or tangents;
		ES	ES	ES	ES					G.11b		lengths of segments formed by intersecting chords, secants, and/or tangents
		ES	ES	ES	ES					G.11c		arc length
		ES	ES	ES	ES					G.11d		area of a sector

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K-8 Cross-Strand Connections –Circles and Polygons- Classify, Measure and Determine

Number and Number Sense
6.4 The student will recognize and represent patterns with whole number exponents and perfect squares.
7.1 The student will:
    d) determine square roots of perfect squares
8.3 The student will
    a) estimate and determine the two consecutive integers between which a square root lies; and
    b) determine both the positive and negative square roots of a given perfect square.

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Grade K	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	Related to Algebra 1	Related to Geometry	Related to Algebra 2	Plane (2-D) and Solid Figures (3-D) - Compare, Contrast, and Construct
K.10b												compare the size (smaller/larger) and shape of plane figures (circle, triangle, square, and rectangle)
		2.13										identify, describe, compare, and contrast plane and solid figures (circles/spheres, squares/cubes, and rectangles/rectangular prisms)
				4.11								identify, describe, compare, and contrast plane and solid figures according to their characteristics (number of angles, vertices, edges, and the number and shape of faces) using concrete models and pictorial representations
								8.8				construct a three-dimensional model, given the top or bottom, side, and front views
										G.4 a-h		construct and justify the constructions of a) a line segment congruent to a given line segment; b) the perpendicular bisector of a line segment; c) a perpendicular to a given line from a point not on the line; d) a perpendicular to a given line at a given point on the line; e) the bisector of a given angle, f) an angle congruent to a given angle; g) a line parallel to a given line through a point not on the line; and h) an equilateral triangle, a square, and a regular hexagon inscribed in a circle.

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Grade K	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	Related to Algebra 1	Related to Geometry	Related to Algebra 2	Congruence and Similarity
			3.13									identify and describe congruent and noncongruent figures.
			ES			**6.9**						determine congruence of segments, angles, and polygons
			ES				**7.5**					solve problems, including practical problems, involving the relationship between corresponding sides and corresponding angles of similar quadrilaterals and triangles
			ES							**G.6**		given information in the form of a figure or statement, students will prove two triangles are congruent
			ES							**G.7**		given information in the form of a figure or statement, students will prove two triangles are similar

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K-8 Cross-Strand Connections – Congruence and Similarity

Number and Number Sense Connections
6.1 The student will represent relationships between quantities using ratios, and will use appropriate notations, such as a/b , a to b, and a:b.
Computation and Estimation Connections
7.3 The student will solve single-step and multistep practical problems, using proportional reasoning.
Patterns, Functions, and Algebra Connections
3.17 The student will create equations to represent equivalent mathematical relationships.
4.16 The student will recognize and demonstrate the meaning of equality in an equation.
5.19 The student will
b) write an equation to represent a given mathematical relationship, using a variable;
6.12 The student will
a) represent a proportional relationship between two quantities, including those arising from practical situations;
b) determine the unit rate of a proportional relationship and use it to find a missing value in a ratio table;
6.13 The student will solve one-step linear equations in one variable, including practical problems that require the solution of a one-step linear equation in one variable
7.11 The student will evaluate algebraic expressions for given replacement values of the variables
7.12 The student will solve two-step linear equations in one variable, including practical problems that require the solution of a two-step linear equation in one variable.

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Grade K	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	Related to Algebra 1	Related to Geometry	Related to Algebra 2	Coordinate Planes and Transformations
					5.14a							recognize and apply transformations, such as translation, reflection, and rotation
						6.8a						identify the components of the coordinate plane
						6.8b						identify the coordinates of a point and graph ordered pairs in a coordinate plane
							7.7					apply translations and reflections of right triangles and rectangles in the coordinate plane
								8.7a				given a polygon, apply transformations, to include translations, reflections, and dilations, in the coordinate plane
								8.7b				identify practical applications of transformations
										G.3a		**The student will solve problems involving symmetry and transformation. This will include** investigate and use formulas for determining distance, midpoint, and slope
										G.3b		**The student will solve problems involving symmetry and transformation. This will include** apply slope to verify and determine whether lines are parallel or perpendicular
										G.3c		**The student will solve problems involving symmetry and transformation. This will include** investigate symmetry and determine whether a figure is symmetric with respect to a line or a point
										G.3d		**The student will solve problems involving symmetry and transformation. This will include** determining whether a figure has been translated, reflected, rotated, or dilated, using coordinate methods

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K-8 Cross-Strand Connections – Coordinate Planes and Transformations
<u>**Computation and Estimation Connections**</u>
<u>6.6</u> The student will a) add, subtract, multiply, and divide integers;   **<u>7.3</u>** The student will solve single-step and multistep practical problems, using proportional reasoning.

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