

**Mathematics Vertical Alignment Matrix  
Grade 8, High School**

Strand	Grade 8	Algebra 1	Geometry	MMA	Algebra 2	Pre-Calculus
<b>Strand 1: Number, Operation, and Quantitative Reasoning</b>	<b>Real Numbers</b> <b>P MATH.8.1A</b> Compare and order rational numbers in various forms including integers, percents, and positive and negative fractions and decimals.				<b>Complex Numbers</b> <b>ALGII.2B</b> Use complex numbers to describe the solutions of quadratic equations graphically, tabular, and in real world applications.	
					<b>ALGII.8B</b> Analyze and interpret the solutions of quadratic equations using discriminants and solve quadratic equations using the quadratic formula.	
	<b>MATH.8.1C</b> Approximate (mentally and with calculators) the value of irrational numbers (such as pi and $\sqrt{2}$ ) as they arise from algebraic or geometric problem situations.					
	<b>MATH.8.1D</b> Express numbers in scientific notation, including negative exponents, in appropriate problem situations.					
	<b>Solving Problems with Real Numbers Using Equations and Their Properties</b>					
	<b>P MATH.8.1B</b> Select and use appropriate forms of rational numbers to solve real-life problems including those involving proportional relationships.	<b>P ALGI.3A</b> Use manipulatives, drawings, verbal descriptions and symbols to represent unknowns and variables in real world situations.			<b>MMA.1A</b> Compare and analyze methods which involve the use of a variety of representations, tools, and technologies for solving a real-life problem. <b>P MMA.6A</b> Analyze methods of payment available in retail purchasing, compare relative advantages and disadvantages of each option, and make decisions concerning the most appropriate options for given real life situations.	

**Maathematics Vertical Alignment Matrix**  
**Grade 8, High School**

Strand	Grade 8	Algebra 1	Geometry	MMA	Algebra 2	Pre-Calculus
	<b>Solving Problems with Real Numbers Using Equations and Their Properties</b>					
<b>Strand 1: Number, Operation, and Quantitative Reasoning</b>	<p><b>P MATH.8.1B</b>            Select and use appropriate forms of rational numbers to solve real-life problems including those involving proportional relationships.</p>	<p><b>P ALGI.3A</b>            Use manipulatives, drawings, verbal descriptions and symbols to represent unknowns and variables in real world situations.</p>		<p><b>MMA.6B</b>            Use amortization models to investigate and analyze home financing options, compare buying and renting a home, and justify a decision to buy or rent a home in a given real life situation.</p>		
				<p><b>MMA.6C</b>            Use amortization models to investigate and analyze automobile financing options, compare buying and leasing a vehicle and justify a decision to buy or lease a vehicle in a given real life situation.</p>		
				<p><b>P MMA.7A</b>            Analyze types of savings options involving simple and compound interest and compare relative advantages of these options in given situations using algebraic formulas, numerical techniques and graphical representations.</p>		
		<p><b>MMA.7B</b>            Analyze and compare coverage options and rates in insurance to make decisions in real life situations.</p> <p><b>MMA.7C</b>            Investigate and compare investment options including stocks, bonds, annuities, and retirement plans and justify options chosen as the most appropriate for given real life situations.</p>				
	<p><b>MATH.8.2D</b>            Use multiplication by a constant factor (unit rate) to represent proportional relationships as functions and determine the unit rate for a proportional relationship.</p>					

**Maathematics Vertical Alignment Matrix  
Grade 8, High School**

Strand	Grade 8	Algebra 1	Geometry	MMA	Algebra 2	Pre-Calculus	
<b>Strand 1: Number, Operation, and Quantitative Reasoning</b>	<b>Solving Problems with Real Numbers Using Equations and Their Properties</b>						
	<b>MATH.8.2A</b> Select appropriate operations to solve problems involving rational numbers and justify the selections.	<b>ALGI.4A</b> Find specific function values; add, subtract, multiply, or divide to simplify polynomial expressions; transform and solve equations including factoring as necessary in problem situations which are expressed in verbal, algebraic, or pictorial (algebra tiles) representations.					
		<b>ALGI.4B</b> Demonstrate pictorially and algebraically the commutative, associative, and distributive properties to simplify algebraic expressions.					
	<b>MATH.8.2B</b> Use appropriate operations to solve problems involving rational numbers in problem situations and justify the problem-solving process of the solution.				<b>MMA.5B</b> Solve problems, given in real life contexts, which involve personal taxes.	<span style="color: red;">Ⓟ</span> <b>PC.2B</b> Perform operations including composition on functions, find inverses, and describe these procedures and results verbally, numerically, symbolically, and graphically.	
	<b>Estimation</b>						
	<b>MATH.8.2C</b> Evaluate a solution for reasonableness using a variety of strategies such as estimation using rounding or compatible numbers.	<b>ALGI.7C</b> Interpret and determine the reasonableness of solutions to linear equations and inequalities.					
	<b>ALGI.8C</b> Interpret and determine the reasonableness of solutions to systems of linear equations.						
<b>Strand 2: Algebraic thinking</b>	<b>Proportional Reasoning</b>						
	<span style="color: red;">Ⓟ</span> <b>MATH.8.3A</b> Compare and contrast proportional and non-proportional relationships using various methods including tables of values, algebraic rules, and graphs.	<b>ALGI.5A</b> Determine whether or not given situations can be represented by linear functions by determining finite differences and writing an algebraic representation.					

**Maathematics Vertical Alignment Matrix  
Grade 8, High School**

Strand	Grade 8	Algebra 1	Geometry	MMA	Algebra 2	Pre-Calculus
<b>Strand 2: Patterns, relationships, and algebraic thinking</b>	<b>Proportional Reasoning</b>					
	<b>MATH.8.3B(1)</b> Estimate and find solutions to application problems involving proportional relationships such as similarity and rates using intuitive methods (such as unit rate method, factor-of-change approach, or a graphical/visual approach) as well as procedural methods.					
	<b>P MATH.8.3B(2)</b> Estimate and find solutions to application problems involving percents.					
	<b>Patterns, Relationships, and Making Predictions</b>					
		<b>P ALGI.3B</b> Look for patterns in finite differences, determine the value of the zero term, and write the algebraic representation.	<b>GEOM.3D</b> Use inductive reasoning by collecting information and finding patterns to formulate conjectures.		<b>ALGII.5D</b> Identify a conic section from the general equation $Ax^2 + Bxy + Cy^2 + Dx + Ey + F = 0$ and make generalizations from patterns in both equation and graphical form.	<b>PC.4A</b> Represent patterns demonstrated as graphs, tables, verbal and symbolic representation using arithmetic and geometric sequences and series.
			<b>P GEOM.5A</b> Analyze numeric and geometric patterns to develop algebraic expressions representing geometric properties.			
	<b>P GEOM.5B</b> Analyze numeric and geometric patterns to make generalizations about geometric properties, including properties of polygons, ratios in similar figures and solids, and angle relationships in polygons and circles.					

**Maathematics Vertical Alignment Matrix  
Grade 8, High School**

Strand	Grade 8	Algebra 1	Geometry	MMA	Algebra 2	Pre-Calculus
<b>Strand 2: Patterns, relationships, and algebraic thinking</b>	<b>Patterns, Relationships, and Making Predictions</b>					
	<b>MATH.8.4A</b> Generate a different representation of data given another representation of data (such as a table, graph, equation, or verbal description).	<b>ALGI.1C</b> Describe a functional relationships for given problem situations, and write linear equations or inequalities and quadratic equations to answer questions arising from the situation.	<b>GEOM.4A</b> Select an appropriate representation (concrete, pictorial, graphical, verbal, or symbolic) in order to solve problems.		<b>ALGII.2A</b> Apply tools including factoring and properties of exponents to simplify expressions and to transform and solve equations and inequalities.	
		<b>ALGI.1D</b> Represent relationships among quantities by using and building concrete models, completing tables, constructing graphs or diagrams, writing verbal descriptions, and writing equations or inequalities.			<b>ALGII.6B</b> Relate representations of quadratic functions in algebraic, tabular, graphical, and verbal forms.	<b>PC.3A</b> Investigate properties of trigonometric and polynomial functions as graphs, tables, and symbolic representations. <b>PC.4C</b> Describe limits of sequences and apply their properties to investigate convergent and divergent series.
		<b>ALGI.5C</b> Use, translate, and make connections among algebraic, tabular, graphical, or verbal descriptions of linear functions.			<b>ALGII.9B</b> Relate representations, such as algebraic, tabular, graphical, and verbal descriptions. of square root functions	
					<b>ALGII.10B</b> Analyze various representations of rational functions including tabular, verbal, symbolic, and graphical with respect to problem situations.	
		<b>ALGI.6A</b> Develop the concept of slope as rate of change, determine slopes from graphs, tables, and algebraic representations, and express slope as a ratio, decimal, or percent.	<b>GEOM.7B</b> Apply slopes and equations of lines to investigate geometric relationships, including parallel lines, perpendicular lines, and special segments of triangles and other polygons.			
		<b>ALGI.6G</b> Relate direct variation to linear functions and solve problems involving proportional change using concrete, pictorial, symbolic, verbal, and written representations.		<b>MMA.5A</b> Use rates, linear functions, and direct variation to solve problems involving personal finance and budgeting (including compensations and deductions) and justify the methods used.		

**Maathematics Vertical Alignment Matrix**  
**Grade 8, High School**

Strand	Grade 8	Algebra 1	Geometry	MMA	Algebra 2	Pre-Calculus
<b>Strand 2: Patterns, relationships, and algebraic thinking</b>	<b>Patterns, Relationships, and Making Predictions</b>					
		<p><b>P ALGI.11B</b> Analyze data and represent situations involving inverse variation using concrete models, tables, graphs, or algebraic methods.</p>		<p><b>P MMA.8C</b> Employ the use of direct and inverse variation to describe physical laws such as Hook's, Newton's, and Boyle's laws and solve problems using them.</p>	<p><b>P ALGII.4C</b> Describe and analyze the relationship between a function and its inverse using concrete representations, tables of values, graphs, and symbolic representations.</p>	<p><b>P PC.2B</b> Perform operations including composition on functions, find inverses, and describe these procedures and results verbally, numerically, symbolically, and graphically.</p>
					<p><b>ALGII.9G</b> Connect and express the inverses of square root functions with quadratic functions from tabular, graphical, and algebraic representations.</p>	
					<p><b>ALGII.10G</b> Use functions to model and make predictions in problem situations involving direct and inverse variation.</p>	
					<p><b>ALGII.11A</b> Develop the definition of logarithms by exploring and describing the relationship between exponential functions and their inverses using concrete functions, tables, and symbolic expressions.</p>	
	<p><b>MATH.8.5B</b> Write and evaluate an algebraic expression to determine any term in an arithmetic sequence (with a constant rate of change) and identify the appropriate algebraic expression given terms in a sequence.</p>	<p><b>ALGI.11A</b> Use patterns to generate properties of exponents and apply these properties in problem-solving situations when given like numerical or variable bases and integer exponents.</p>				
		<p><b>ALGI.11C</b> Analyze data, and identify and represent situations involving exponential growth and exponential decay using concrete models, tables, graphs, or algebraic methods.</p>				

**Maathematics Vertical Alignment Matrix  
Grade 8, High School**

Strand	Grade 8	Algebra 1	Geometry	MMA	Algebra 2	Pre-Calculus
<b>Strand 2: Patterns, relationships, and algebraic thinking</b>	<b>Equations and Functions</b>					
		<p><b>ALGI.5B</b> Determine the domain and range for linear functions in given situations which are represented graphically, tabularly, symbolically, verbally, and in writing.</p>			<p><b>ALGII.6A(1)</b> Determine the reasonable domain and range values of a quadratic function represented by a table of values, graph, function rule, or a contextual situation, as well as interpret and determine the reasonableness of solutions to quadratic equations and inequalities.</p>	<p><b>PC.1B</b> Determine the domain and range of functions using graphs, tables, and symbols, and relate to real world applications.</p>
		<p><b>ALGI.9A</b> Determine the domain and range for quadratic functions from graphic, tabular, symbolic, verbal, and written representations.</p>			<p><b>ALGII.9C(1)</b> Determine the reasonable domain and range values of square root functions.</p>	
					<p><b>ALGII.10C(1)</b> Determine the reasonable domain and range values of rational functions.</p>	
					<p><b>ALGII.11C(1)</b> Determine the reasonable domain and range values of exponential and logarithmic functions including subsets of the domain and range which have meaning in a given situation.</p>	
	<p><b>MATH.8.5A</b> Predict, find, and justify solutions to application problems using appropriate tables, graphs, and algebraic equations.</p>	<p><b>ALGI.7A</b> Analyze situations involving linear functions in forms of a graph, table, equation, or verbal description in order to formulate a linear equation or inequality to solve a problem.</p>	<p><b>GEOM.7C</b> Derive and use formulas involving horizontal, vertical, and oblique distances, slope, and midpoint and use in context to applications of distance and midpoint formulas.</p>		<p><b>ALGII.3A</b> Analyze situations and formulate systems of equations in two or more unknowns or inequalities in two unknowns, to solve problems.</p>	<p><b>PC.3C</b> Use regression to determine the appropriateness of a linear function to model real-life data (including using technology to determine the correlation coefficient).</p>
	<p><b>ALGI.8A</b> Analyze a problem situation that can be represented by a linear system in two unknowns, and develop a plan for solving the system using a concrete representation and linear equations.</p>			<p><b>ALGII.8A</b> Analyze situations involving quadratic functions and formulate quadratic equations or inequalities to solve problems.</p>	<p><b>PC.3B</b> Use and analyze functions such as logarithmic, exponential, trigonometric, polynomial, etc. to model real-life data.</p>	

**Maathematics Vertical Alignment Matrix  
Grade 8, High School**

Strand	Grade 8	Algebra 1	Geometry	MMA	Algebra 2	Pre-Calculus	
<b>Equations and Functions</b>							
<b>Strand 2: Patterns,</b>	<b>P MATH.8.5A</b> Predict, find, and justify solutions to application problems using appropriate tables, graphs, and algebraic equations.				<b>ALGII.9F</b> Analyze situations modeled by square root functions, formulate equations or inequalities, select a method including tabular, graphical, or algebraic to solve problems.	<b>P PC.1D</b> Recognize and use connections among significant values of a function (zeros, maximum values, minimum values, etc.), points on the graph of a function, tabular and the symbolic representation of a function.	
					<b>ALGII.10F</b> Analyze a situation modeled by a rational function, formulate an equation or inequality composed of a linear or quadratic function, and solve the problem.		
					<b>ALGII.11F</b> Analyze a situation modeled by an exponential function, formulate an equation or inequality, solve the problem, and relate the solution to the domain and range that have meaning in the context of the situation.		
		<b>ALGI.5C</b> Use, translate, and make connections among algebraic, tabular, graphical, or verbal descriptions of linear functions.					
		<b>ALGI.7B</b> Investigate methods for solving linear equations and inequalities using concrete models, graphs, and the properties of equality, select a method, and solve the equations and inequalities involving one or two variables.			<b>P MMA.1B</b> Use multiple approaches (algebraic, graphical, and geometric methods) to solve problems from a variety of disciplines.		<b>P PC.3D</b> Use properties of functions to analyze and solve problems and make predictions of graphs, tables, verbal and symbolic representations of real world applications.
		<b>ALGI.8B</b> Solve systems of linear equations using concrete models, graphs, tables, and algebraic methods (substitution and elimination).			<b>MMA.8B</b> Utilize trigonometric ratios and functions available through technology to calculate distances and model periodic motion, solve problems, and evaluate the reasonableness of the solutions.	<b>P ALGII.3B</b> Apply algebraic methods including substitution or linear combination, graphs, tables, or matrices, to solve systems of equations or inequalities.	<b>PC.3E</b> Solve problems from physical situations using trigonometry, including the use of Law of Sines, Law of Cosines, and area formulas and incorporate radian measure where needed.

**Maathematics Vertical Alignment Matrix  
Grade 8, High School**

Strand	Grade 8	Algebra 1	Geometry	MMA	Algebra 2	Pre-Calculus	
<b>Strand 2: Patterns, relationships, and algebraic thinking</b>	<b>Equations and Functions</b>						
	<p><b>P</b> <b>MATH.8.5A</b> Predict, find, and justify solutions to application problems using appropriate tables, graphs, and algebraic equations.</p>	<p><b>P</b> <b>ALGI.10A</b> Solve quadratic equations in applied settings using concrete models, tables, graphs, and algebraic methods including factoring and the quadratic formula.</p>				<p><b>P</b> <b>ALGII.8D</b> Solve quadratic equations and inequalities using graphs, tables, and algebraic methods.</p>	<p><b>PC.4B</b> Use and apply arithmetic, geometric, and other sequences and series to solve real-life problems.</p>
						<p><b>ALGII.9D</b> Analyze solutions of square root equations using graphs, tables, and algebraic methods and relate to real world applications</p>	<p><b>PC.4D</b> Apply sequences and series to solve problems including sums and binomial expansion.</p>
						<p><b>ALGII.9E</b> Analyze solutions of square root inequalities using graphs and tables and relate to real world applications.</p>	
						<p><b>P</b> <b>ALGII.10D</b> Analyze the solutions of rational equations using graphs, tables, and algebraic methods.</p>	
						<p><b>ALGII.10E</b> Analyze solutions of rational inequalities using graphs and tables.</p>	
						<p><b>ALGII.11D</b> Determine solutions of exponential and logarithmic equations using the GRAPH, TRACE, and TABLE features on a graphing calculator as well as algebraic methods.</p>	
						<p><b>ALGII.11E</b> Determine solutions of exponential and logarithmic inequalities using the GRAPH, TRACE, and TABLE features on a graphing calculator as well as algebraic methods.</p>	
	<p><b>ALGI.7C</b> Interpret and determine the reasonableness of solutions to linear equations and inequalities.</p>				<p><b>ALGII.3C</b> Interpret and determine appropriate domain and range values, and the reasonableness of solutions to systems of equations or inequalities, for given contexts.</p>		

**Maathematics Vertical Alignment Matrix  
Grade 8, High School**

Strand	Grade 8	Algebra 1	Geometry	MMA	Algebra 2	Pre-Calculus	
<b>Strand 2: Patterns, relationships, and algebraic thinking</b>	<b>Equations and Functions</b>						
	<p><b>P</b> <b>MATH.8.5A</b> Predict, find, and justify solutions to application problems using appropriate tables, graphs, and algebraic equations.</p>	<p><b>ALGI.8C</b> Interpret and determine the reasonableness of solutions to systems of linear equations.</p>		<p><b>MMA.1C</b> Select a method to solve a problem, defend the method, and justify the reasonableness of the results.</p>		<p><b>ALGII.6A(2)</b> Determine the reasonableness of solutions to quadratic equations and inequalities.</p>	
						<p><b>ALGII.9C(2)</b> Interpret and determine the reasonableness of solutions to square root equations and inequalities.</p>	
						<p><b>ALGII.10C(2)</b> Interpret and determine the reasonableness of solutions to rational equations and inequalities.</p>	
						<p><b>ALGII.11C(2)</b> Interpret and determine the reasonableness of solutions to exponential and logarithmic equations and inequalities.</p>	
	<b>Attributes of Functions</b>						
		<p><b>P</b> <b>ALGI.1A</b> Describe and identify independent and dependent quantities and express them in functional relationships.</p>				<p><b>ALGII.1A</b> Identify the mathematical domains and ranges of functions, determine reasonable domain and range values for continuous and discrete situations, and describe situations given domain and range values.</p>	
		<p><b>P</b> <b>ALGI.2B</b> Identify mathematical domains and ranges and determine reasonable domain and range values for given situations, described by continuous or discrete data.</p>					
		<p><b>ALGI.4C</b> Connect the function notation of "y = " and "f(x) = " for example, y = x+1 and f(x) = x + 1.</p>					
		<p><b>ALGI.6B</b> Interpret the meaning of positive, negative, zero, and undefined slopes and x- and y-intercepts in situations using data, symbolic representations, or graphs.</p>					

**Maathematics Vertical Alignment Matrix  
Grade 8, High School**

Strand	Grade 8	Algebra 1	Geometry	MMA	Algebra 2	Pre-Calculus
	<b>Attributes of Functions</b>					
		<b>ALGI.6E</b> Determine the intercepts of the graphs of linear functions and zeros of linear functions from graphs, tables, and algebraic representations.			<b>ALGII.6C</b> Determine a quadratic function from its roots and from a graph.	
		<b>P ALGI.10B</b> Make connections among the solutions (roots) of quadratic equations, the zeros of their related functions, and the horizontal intercepts (x-intercepts) of the graph of the function on graphs, tables, or algebraic expressions.			<b>P ALGII.8C</b> Compare and translate between algebraic solutions and graphical solutions of quadratic equations, and describe the relationship between the roots of a quadratic equation and the zeros of the corresponding quadratic function.	<b>P PC.2C</b> Investigate identities graphically and verify them symbolically, including logarithmic properties, trigonometric identities, and exponential properties.
<b>Strand 3: Geometry and Spatial Reasoning</b>	<b>Geometric Language</b>					
			<b>GEOM.10B</b> Justify and apply triangle congruence relationships in a proofs including flow proofs, transformational proofs, paragraph proofs, coordinate proofs, and two-column proofs.			
			<b>GEOM.9D</b> Analyze the characteristics of polyhedra and other three-dimensional figures such as prisms, pyramids, cylinders, cones, and spheres, and their component parts (including vertices, edges, faces, and diagonals) based on explorations and concrete models.			
			<b>GEOM.11B</b> Apply ratios to solve problems involving similar figures.			
			<b>GEOM.11C</b> Develop, apply, and justify triangle similarity relationships, such as rmean proportionals within triangles, trigonometric ratios (sine, cosine, and tangent), Pythagorean triples, and 45-45-90 and 30-60-90 triangles using a variety of methods.			

**Maathematics Vertical Alignment Matrix  
Grade 8, High School**

Strand	Grade 8	Algebra 1	Geometry	MMA	Algebra 2	Pre-Calculus
<b>Strand 3: Geometry and Spatial</b>	<b>Geometric Structure</b>					
			<b>GEOM.1A</b> Develop an awareness of the structure of a mathematical system, including the need for definitions and the use of logical reasoning to verify statements.			
			<b>GEOM.1B</b> Recognize the historical development of geometric systems and know mathematics is developed for a variety of purposes.			
			<b>GEOM.1C</b> Compare and contrast the structures and implications of Euclidean and non-Euclidean geometries by determining that some Euclidean definitions and theorems are not valid in non-Euclidean geometries.			
			<b>GEOM.3A</b> Determine the validity of a conditional statement, its converse, inverse, and contrapositive using everyday situations and geometric properties that have been developed.			
			<b>GEOM.3B</b> Construct and justify statements about geometric figures including triangles, quadrilaterals, regular polygons, and circles, and their properties.			
			<b>GEOM.3C</b> Use logical reasoning and several methods of proof (flow proofs, transformation proofs, coordinate proofs, and two-column proofs) to prove statements are true, and find counter examples to disprove statements that are false.			
		<b>GEOM.3E</b> Use deductive reasoning to prove a statement.				

**Maathematics Vertical Alignment Matrix**  
**Grade 8, High School**

Strand	Grade 8	Algebra 1	Geometry	MMA	Algebra 2	Pre-Calculus
<b>Strand 3: Geometry and Spatial Reasoning</b>	<b>Geometric Structure</b>					
			<b>GEOM.9B</b> Formulate and test conjectures about the properties and attributes of polygons and their component parts including diagonals, interior and exterior angles, sides, and vertices based on explorations and concrete models.			
			<b>P GEOM.9C</b> Formulate and test conjectures about the properties and attributes of circles, including segments within circles and the lines that intersect the circles, based on explorations and concrete models.			
	<b>Graphing and Transformations</b>					
	<b>MATH.8.6A</b> Generate similar figures using dilations including enlargements and reductions, describe the relationship between the pre-image and the image using scale factor and magnitude, and apply scale factors in problem solving situations.	<b>ALGI.6C</b> Investigate, describe, and predict the effects of changes in $m$ and $b$ on the graph of $y = mx + b$ .	<b>GEOM.2B</b> Make conjectures about angles, lines, polygons, circles, and three-dimensional figures and determine the validity of the conjectures, choosing from a variety of approaches such as coordinate, transformational, or axiomatic.		<b>P ALGII.4B</b> Extend parent functions with parameters including $a$ in $g(x) = a[f(x)]$ , $k$ in $g(x) = f(x) + k$ , and $h$ in $g(x) = f(x - h)$ , and describe the effects of the parameter changes on the graph of parent functions.	
		<b>P ALGI.6F</b> Interpret and predict the effects of changing slope and $y$ -intercept in applied situations using tabular, graphical, symbolic, and written representations.	<b>P GEOM.5C</b> Apply properties of reflections, translations, rotations, and glide reflections to make connections between mathematics and the real world, such as tessellations.			
	<b>P MATH.8.6B</b> Graph dilations, reflections, and translations on a coordinate plane and describe the relationships between the pre-image and the image.	<b>P ALGI.9B</b> Investigate, describe, and predict the effects of changes in $a$ on the graph of $y = ax^2 + c$ .			<b>ALGII.5E</b> Use the method of completing the square to solve quadratic equations and to transform general forms of conic sections in order to graph.	

**Maathematics Vertical Alignment Matrix  
Grade 8, High School**

Strand	Grade 8	Algebra 1	Geometry	MMA	Algebra 2	Pre-Calculus	
<b>Strand 3: Geometry and Spatial Reasoning</b>	<b>Graphing and Transformations</b>						
	<p><b>P</b> <b>MATH.8.6B</b> Graph dilations, reflections, and translations on a coordinate plane and describe the relationships between the pre-image and the image.</p>	<p><b>P</b> <b>ALG1.9C</b> Investigate, describe, and predict the effects of changes in <math>c</math> on the graph of <math>y = ax^2 + c</math>.</p>				<p><b>ALGII.5B</b> Sketch graphs of conic sections to relate simple parameter changes in the equations of circles, <math>(x - h)^2 + (y - k)^2 = r^2</math>, parabolas <math>y = (x - h)^2 + k</math> or <math>x = (y - k)^2 + h</math>, ellipses <math>(x - h)^2/a^2 + (y - k)^2/b^2 = 1</math>, and hyperbolas <math>(x - h)^2/a^2 - (y - k)^2/b^2 = 1</math> or <math>(y - k)^2/a^2 - (x - h)^2/b^2 = 1</math>.</p>	
					<p><b>ALGII.7B</b> Use the parent function to investigate, describe, and predict the effects of changes in <math>a</math>, <math>h</math>, and <math>k</math> on the graphs of <math>y = a(x - h)^2 + k</math> form of a function and what those changes in symbolic representation may mean in a real world applications.</p>		
					<p><b>ALGII.9A</b> Use the parent function to investigate, describe, and predict the effects of parameter changes on the graphs of square root functions and describe limitations on the domain and ranges.</p>	<p><b>P</b> <b>PC.1E</b> Investigate the concepts of continuity, end behavior, asymptotes, and limits and connect these characteristics to functions represented graphically and numerically.</p>	
					<p><b>P</b> <b>ALGII.10A</b> Use quotients of polynomials to describe the graphs of rational functions, predict the effects of parameter changes, describe limitations on the domains and ranges, and examine asymptotic behavior.</p>		
				<p><b>ALGII.11B</b> Use the parent functions to investigate, describe, and predict the effects of parameter changes on the graphs of exponential and logarithmic functions, describe limitations on the domains and ranges, and identify and write the equations of asymptotes.</p>			

**Maathematics Vertical Alignment Matrix  
Grade 8, High School**

Strand	Grade 8	Algebra 1	Geometry	MMA	Algebra 2	Pre-Calculus	
<b>Strand 3: Geometry and Spatial Reasoning</b>	<b>Graphing and Transformations</b>						
	<p><b>P MATH.8.6B</b> Graph dilations, reflections, and translations on a coordinate plane and describe the relationships between the pre-image and the image.</p>		<p><b>P GEOM.10A</b> Use congruence transformations to make conjectures and justify properties of geometric figures including figures represented on a coordinate plane.</p>	<p><b>P MMA.9A</b> Use geometric transformations, symmetry, and perspective drawings to describe and analyze mathematical patterns and structure in art and architecture.</p>		<p><b>P PC.2A</b> Apply basic transformations, including <math>a \cdot f(x)</math>, <math>f(x) + d</math>, <math>f(x - c)</math>, <math>f(b \cdot x)</math>, and compositions with absolute value functions, including <math> f(x) </math>, and <math>f( x )</math>, to the parent functions.</p>	
			<p><b>GEOM.11A</b> Use and extend similarity properties and transformations to explore and justify conjectures about geometric figures including identification of corresponding parts of similar figures.</p>	<p><b>MMA.9B</b> Use geometric transformations, proportions, and periodic motion to describe and analyze mathematical patterns and structure in music.</p>			
	<b>Geometric Models and Graphing</b>						
	<p><b>MATH.8.7D</b> Locate and name points on a coordinate plane using ordered pairs of rational numbers based on algebraic (equations or inequalities) or geometric situations.</p>	<p><b>ALGI.6D</b> Graph and write equations of lines given characteristics such as two points, a point and a slope, or a slope and y-intercept when given graphically, symbolically or in written representations.</p>	<p><b>P GEOM.7A</b> Employ one-(numberline) and two-dimensional coordinate systems to represent points, lines, rays, line segments, and figures.</p>				
		<p><b>ALGI.2A</b> Identify and sketch the general forms of linear (<math>f(x) = x</math>) and quadratic (<math>f(x) = x^2</math>) parent functions, and describe the graphs verbally and in writing.</p>	<p><b>GEOM.2B</b> Make conjectures about angles, lines, polygons, circles, and three-dimensional figures and determine the validity of the conjectures, choosing from a variety of approaches such as coordinate, transformational, or axiomatic.</p>		<p><b>P ALGII.4A</b> Identify and sketch graphs of parent functions, including linear (<math>f(x) = x</math>), quadratic (<math>f(x) = x^2</math>), exponential (<math>f(x) = a^x</math>), logarithmic (<math>f(x) = \log_a x</math>), absolute value of <math>x</math> (<math>f(x) =  x </math>), square root (<math>f(x) = \sqrt{x}</math>), and reciprocal of <math>x</math> (<math>f(x) = 1/x</math>) functions.</p>	<p><b>P PC.1A</b> Describe parent functions symbolically and graphically, including <math>f(x) = x^n</math>, <math>f(x) = \ln x</math>, <math>f(x) = \log_a x</math>, <math>f(x) = 1/x</math>, <math>f(x) = e^x</math>, <math>f(x) =  x </math>, <math>f(x) = a^x</math>, <math>f(x) = \sin x</math>, <math>f(x) = \arcsin x</math>, etc.</p>	
				<p><b>ALGII.7A</b> Use characteristics of the quadratic parent function to sketch the related graphs and connect between the <math>f(x) = ax^2 + bx + c</math> and the <math>f(x) = a(x - h)^2 + k</math> symbolic representations of quadratic functions, and write the quadratic function in <math>f(x) = ax^2 + bx + c</math> or <math>f(x) = a(x - h)^2 + k</math> given the graph of the function.</p>	<p><b>P PC.1E</b> Investigate the concepts of continuity, end behavior, asymptotes, and limits and connect these characteristics to functions represented graphically and numerically.</p>		

**Maathematics Vertical Alignment Matrix**  
**Grade 8, High School**

Strand	Grade 8	Algebra 1	Geometry	MMA	Algebra 2	Pre-Calculus	
<b>Strand 3: Geometry and Spatial Reasoning</b>			<b>Geometric Models and Graphing</b>				
			<b>GEOM.2A</b> Apply constructions to explore attributes of geometric figures and to make conjectures about geometric relationships by copying an angle and a segment using various construction techniques such as paper folding, computer programs, compass and straightedge.	<b>Ⓟ MMA.8A</b> Utilize geometric models available through technology to model growth and decay in areas such as population, biology, and ecology, solve problems using these models, and analyze their effectiveness in given situations.			<b>PC.6A</b> Use and apply the concept of vectors to model situations defined by magnitude and direction.
							<b>PC.6B</b> Analyze and solve vector problems generated by real-life situations.
							<b>PC.5C</b> Convert between parametric and rectangular forms of functions and equations to graph them.
							<b>PC.5D</b> Use and apply parametric functions to simulate problems involving motion.
			<b>Ⓟ MATH.8.7A</b> Draw three-dimensional figures from different perspectives and match drawings of top, front, and side views to figures.	<b>Ⓟ GEOM.6A</b> Describe and draw various three-dimensional figures and draw the intersection of a given plane with various three-dimensional geometric figures.		<b>Ⓟ ALGII.5A</b> Describe a conic section (circle, ellipse, parabola, and hyperbola) as the intersection of a plane and a cone by comparing $\alpha$ , the acute angle the plane forms with the axis of the cone and $\beta$ , the acute angle the face of the cone forms with its axis.	<b>PC.5A</b> Apply conic sections to model motion, such as the graph of velocity vs. position of a pendulum and motions of planets.
						<b>ALGII.5C</b> Identify symmetries from graphs of conic sections.	<b>Ⓟ PC.5B</b> Use and apply properties of conic sections to describe physical phenomena such as the reflective properties of light and sound.
		<b>GEOM.6B</b> Draw and use nets to represent, construct, and deconstruct three-dimensional geometric figures.					
		<b>GEOM.6C</b> Sketch and use orthographic and isometric views to represent, construct, and deconstruct three-dimensional geometric figures and solve problems.					

**Maathematics Vertical Alignment Matrix  
Grade 8, High School**

Strand	Grade 8	Algebra 1	Geometry	MMA	Algebra 2	Pre-Calculus	
<b>Strand 3: Geometry and Spatial Reasoning</b>	<b>Geometric Models and Graphing</b>						
	<b>Ⓟ MATH.8.7B</b> Use geometric concepts (including symmetry, similarity, congruence, and transformations) and properties of two- and three-dimensional shapes to solve problems in fields such as art and architecture.	<b>ALGI.2C</b> Interpret situations in terms of given graphs or create situations that fit given graphs.	<b>Ⓟ GEOM.8A</b> Determine areas of regular polygons, circles, and composite figures using the area of triangles, squares, rectangles, parallelograms, and/or trapezoids.				
		<b>Ⓟ ALGI.9D</b> Analyze maximum or minimum points, direction of opening, symmetry, and x- and y-intercepts of graphs of quadratic functions and draw conclusions from the graph and analysis.				<b>PC.1C</b> Describe and demonstrate symmetry of graphs of even and odd functions.	
	<b>MATH.8.7C</b> Use pictures or models to demonstrate the Pythagorean Theorem.		<b>Ⓟ GEOM.5D</b> Identify and apply patterns from right triangles to solve meaningful problems, including special right triangles (45-45-90 and 30-60-90) and triangles whose sides are Pythagorean triples.				
<b>Strand 4: Measurement</b>	<b>Measuring</b>						
	<b>MATH.8.8B</b> Connect models of prisms, cylinders, pyramids, spheres, and cones to formulas for volume of these objects.		<b>Ⓟ GEOM.8D</b> Determine surface areas and volumes of prisms, pyramids, spheres, cones, cylinders, and composites of these figures in problem situations using formulas and nets.				
	<b>Ⓟ MATH.8.8A</b> Find lateral and total surface area of prism, pyramids, and cylinders using concrete and/or pictorial models and nets (two-dimensional models.)						

**Maathematics Vertical Alignment Matrix  
Grade 8, High School**

Strand	Grade 8	Algebra 1	Geometry	MMA	Algebra 2	Pre-Calculus
<b>Strand 4: Measurement</b>	<b>Proportional Reasoning in Measurement</b>					
	<b>MATH.8.10A</b> Using concrete or pictorial models as well as verbal or algebraic descriptions, describe the resulting effects on perimeter and area when dimensions of a shape are changed proportionally.		<b>GEOM.11D</b> Describe the effect on perimeter, area, and volume when one or more dimensions of a figure are changed and apply this idea in solving problems.			
	<b>MATH.8.10B</b> Using concrete or pictorial models as well as verbal or algebraic descriptions, describe the resulting effect on volume when dimensions of a solid are changed proportionally.					
	<b>MATH.8.9B</b> Use proportional relationships in similar two-dimensional figures or similar three-dimensional figures to find missing measurements.		<b>GEOM.8B</b> Determine areas of sectors and arc lengths of circles using proportional reasoning.			
	<b>Solving Problems Using Measurement</b>					
	<b>MATH.8.9A</b> Identify appropriate contextual situations for the use of the Pythagorean Theorem and use the Pythagorean Theorem to solve real-life problems.		<b>GEOM.8C</b> Derive, extend, and use the Pythagorean Theorem to determine a missing side of a given right triangle and to solve real world problems.			
	<b>MATH.8.8C</b> Estimate measurements and use formulas and conversions such as those given on the TAKS Grade 8 Mathematics Chart to solve application problems involving lateral and total surface area and volume.					

**Maathematics Vertical Alignment Matrix  
Grade 8, High School**

Strand	Grade 8	Algebra 1	Geometry	MMA	Algebra 2	Pre-Calculus
<b>Stand 5: Probability and Statistics</b>	<b>Displaying and Interpreting Data</b>					
	<b>P MATH.8.12C</b> Select and use an appropriate representation for presenting and displaying relationships among collected data, including line plots, line graphs, stem and leaf plots, circle graphs, bar graphs, box and whisker plots, histograms, and Venn diagrams, with and without the use of technology.	<b>P ALGI.1B</b> Gather and record data and use data sets to determine functional relationships between quantities and write a general equation describing the functional relationship.		<b>P MMA.2A</b> Interpret information from various graphs, including line graphs, bar graphs, circle graphs, histograms, scatterplots, line plots, stem and leaf plots, and box and whisker plots to draw conclusions from the data.	<b>ALGII.1B</b> Collect and organize data in a table or list, make and interpret scatterplots using graphing calculators, fit the graph of a function to the data, interpret the results, and proceed to model, predict, and make decisions and critical judgments.	<b>PC.3C</b> Use regression to determine the appropriateness of a linear function to model real-life data (including using technology to determine the correlation coefficient).
		<b>ALGI.1E</b> Interpret and make decisions, predictions, and critical judgments from functional relationships.		<b>P MMA.2B</b> Analyze numerical data given in real situations using measures of central tendency, variability, and correlation in order to make inferences, and evaluate the reasonableness of those inferences.		
				<b>MMA.5C</b> Analyze data to make decisions about banking, and justify the decisions made.		
<b>MATH.8.12B</b> Draw conclusions and make predictions by analyzing trends in scatterplots by identifying and describing positive, negative, or no correlation in them.			<b>P MMA.2D</b> Use regression methods available through technology to describe various models for data such as linear, quadratic, exponential, etc., select the most appropriate model, and use the model to interpret and analyze information.			

**Maathematics Vertical Alignment Matrix  
Grade 8, High School**

Strand	Grade 8	Algebra 1	Geometry	MMA	Algebra 2	Pre-Calculus
<b>Stand 5: Probability and Statistics</b>	<b>Displaying and Interpreting Data</b>					
	<b>MATH.8.12B</b> Draw conclusions and make predictions by analyzing trends in scatterplots by identifying and describing positive, negative, or no correlation in them.	<b>ALGI.2D</b> Collect and organize data, make and interpret scatterplots (including recognizing positive, negative, or no correlation for data approximating linear situations), and model, predict, and make decisions and critical judgments in problem situations.		<b>MMA.3A</b> Given a real life situation, formulate a meaningful question, determine the data needed to answer the question, gather the appropriate data, analyze the data, and draw reasonable conclusions.		
	<b>MATH.8.13B</b> Recognize misuses of graphical or numerical information and conclusions based on data analysis.			<b>MMA.3B</b> Communicate methods used, analyses conducted, and conclusions drawn for a data-analysis project by written report, visual display, oral report, or multi-media presentation.		
	<b>MATH.8.13A</b> Evaluate methods of sampling to determine validity of an inference made from a set of data.			<b>MMA.2C</b> Analyze graphs from journals, newspapers, and other sources to determine the validity of stated arguments.		
	<b>MATH.8.12A</b> Select the appropriate measure of central tendency or range to describe a set of data, justify the selection for a particular situation, and identify the missing piece of data that will produce a target mean, median, mode, and/or range for a data set.			<b>MMA.3C</b> Determine the appropriateness of a model for making predictions from a given set of data presented in a real life situation.		

**Maathematics Vertical Alignment Matrix  
Grade 8, High School**

Strand	Grade 8	Algebra 1	Geometry	MMA	Algebra 2	Pre-Calculus
<b>Stand 5: Probability and Statistics</b>	<b>Probability</b>					
	<p><b>P</b> <b>MATH.8.11A</b> Find the probabilities of dependent and independent events in real world situations.</p>					
	<p><b>MATH.8.11B</b> Use theoretical probabilities and experiments to make predictions and decisions about the data set of a given situation.</p>			<p><b>MMA.4A</b> Compare and contrast theoretical and empirical probability in everyday situations.</p>		
	<p><b>MATH.8.11C</b> Select and use different models (such as organized lists, tree diagrams, area models, spinners, dice, cards, or computer simulations) to simulate an event.</p>			<p><b>MMA.4B</b> Use experiments involving concrete manipulatives, pictorial representations, or simulations of real life situations to determine the reasonableness of a theoretical model such as binomial, geometric, etc.</p>		
Strand	Grade 8	Algebra 1	Geometry	Algebra 2	Pre-Calculus	
<b>Stand 6: Underlying Processes and Mathematical Tools</b>	<b>MATH.8.14A</b>	<p><b>P</b> <b>MATH.8.14A</b> Identify and apply mathematics to everyday experiences, to activities in and outside of school, with other disciplines, and with other mathematical topics.</p>				
		<p><b>P</b> <b>MATH.8.14B</b> Use a problem-solving model that incorporates understanding the problem, making a plan, carrying out the plan, and evaluating the solution for reasonableness.</p>				
	<b>MATH.8.14C</b>	<p><b>P</b> <b>MATH.8.14C</b> Select or develop an appropriate problem-solving strategy from a variety of different types, including drawing a picture, looking for a pattern, systematic guessing and checking, acting it out, making a table, working a simpler problem or working backwards to solve a problem.</p>				
		<p><b>MATH.8.14D</b> Select tools such as real objects, manipulatives, paper/pencil, and technology or techniques such as mental math, estimation, and number sense to solve problems.</p>				
		<p><b>P</b> <b>MATH.8.15A</b> Communicate mathematical ideas using language, efficient tools, appropriate units, and graphical, numerical, physical, or algebraic mathematical models.</p>				
		<p><b>MATH.8.15B</b> Evaluate the effectiveness of different representations to communicate ideas.</p>				
		<p><b>MATH.8.16A</b> Make conjectures from patterns or sets of examples and nonexamples.</p>				
		<p><b>MATH.8.16B</b> Validate conclusions using mathematical properties and relationships.</p>				