Watson Chapel Jr. High School

Algebra 1 Curriculum Map

2019-2020

Watson Chapel Jr. High School

Algebra 1 at a Glance

2019-2020

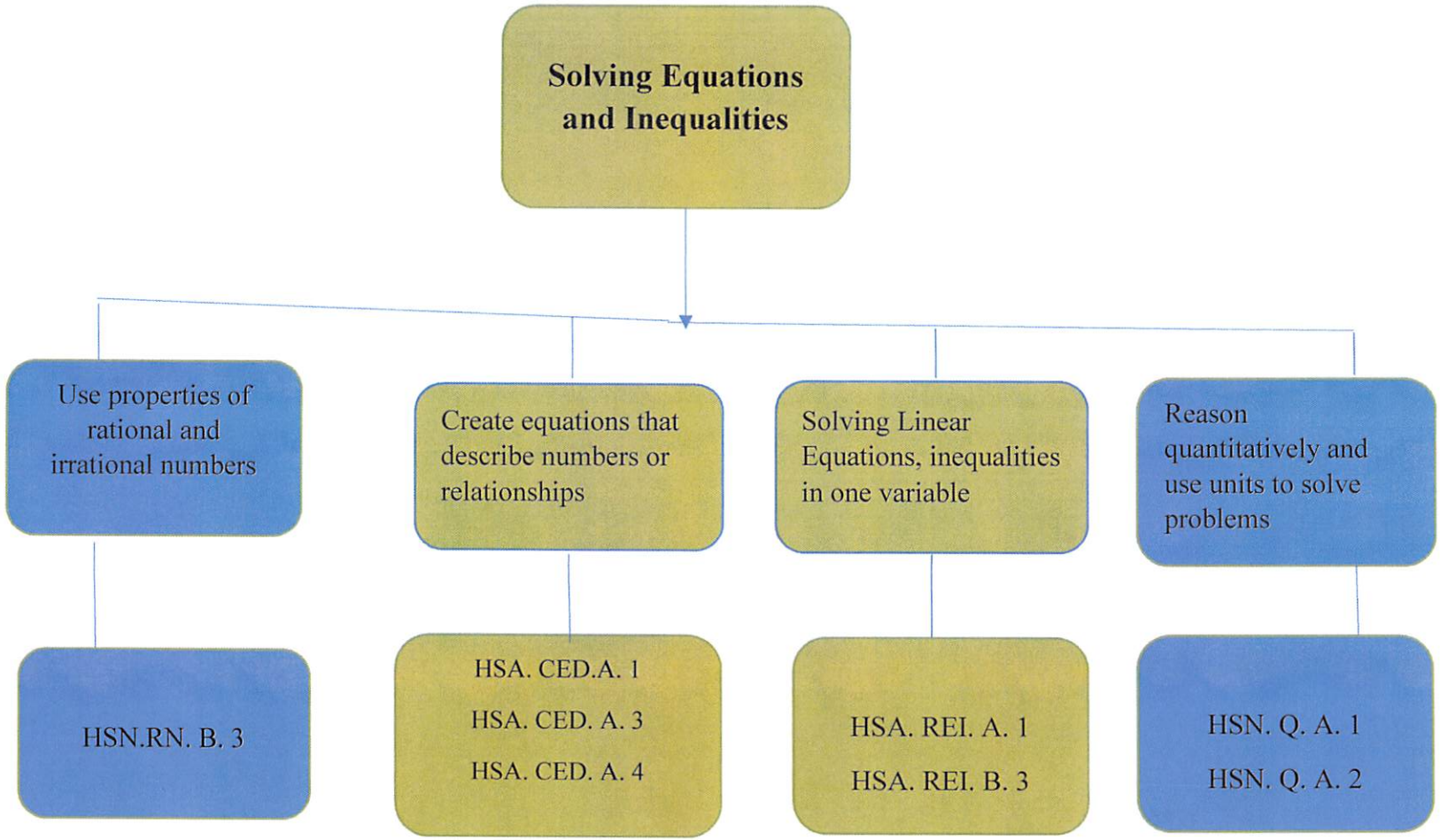
Months	Topics	Standards	Days of Instruction
August/September	**Unit 1** Solving Equations and Inequalities	HSN.RN.B.3, HSA.CED.A.1, HSA.REI.A.1, HSA.REI.B.3, HSN.Q.A.1, HSN.Q.A.2, HSA.CED.A.3, HSA.CED.A.4	16-17 days
September/October	**Unit 2** Linear Equations	HSA.CED.A.2, HSS.ID.C.7, HSF.LE.A.2, HSA.CED.A.1, HSA.CED.A.2, HSA.CED.A.3, HSA.CED.A.4, HSF.IF.C.7.A	10-11 days
Common Assessments : Unit 1 and Unit 2- September 26, 2019			
October/November	**Unit 3** Linear Functions	HSF.IF.A.1, HSF.IF.A.2, HSF.IF.B.5, HSF.LE.A.2, HSF.BF.B.3, HSF.IF.C.7, HSF.BF.A.1, HSS.ID.B.6.A, HSS.ID.B.6.C, HSS.ID.C.7, HSF.IF.A.3, HSF.BF.A.2, HSS.ID.B.6.B, HSS.ID.C.8, HSS.ID.C.9, HSS.ID.B.6.C	14-15 days
November/December	**Unit 4** Systems of Linear Equations and Inequalities	HSA.REI.C.6, HSA.CED.A.3, HSA.REI.C.5, HSA.REI.D.12, HSA.CED.A.2	12-13 days
Common Assessments : Unit 3 and Unit 4- November 7, 2019			
December	**Unit 5** Piecewise Functions	HSF.IF. B.4, HSF.IF. B.6, HSF.IF. C.7.B, HSF.IF. C.9, HSF.BF.B.3	10-11 days
Common Assessments: All five (5) Units- December 9, 2019			
End of 1st Semester December 20, 2019			

Months	Topics	Standards	Days of Instruction
January	**Unit 6** Exponents and Exponential Functions	HSN.RN.A.1, HSN.RN.A.2, HSF.IF.B.4, HSF.IF.B.5, HSF.BF.A.1, HSF.LE.A.1, HSF.LE.A.1.A, HSN.Q.A.3, HSA.SSE.A.1.B, HSA.SSE.B.3.C, HSA.CED.A.2, HSF.LE.A.2, HSF.LE.B.5, HSF.IF.A.3, HSF.BF.A.2, HSF.LE.A.2, HSF.IF.C.9, HSA.SSE.B.3	12-13 days
January/February	**Unit 7** Polynomials and Factoring	HSA.APR.A.1, HSA.SSE.A.2, HSA.SSE.A.1.A	16-17 days
Common Assessments : Unit 6 and Unit 7 February 20, 2020			
February/March	**Unit 8** Quadratic Functions	HSA.CED.A.2, HSF.IF.B.6, HSF.BF.B.3, HSF.IF.C.7, HSF.IF.B.4, HSF.IF.C.7.A, HSF.IF.C.8, HSF.IF.C.9, HSF.IF.A.2, HSF.BF.A.1, HSS.ID.B.6.A, HSS.ID.B.6.B, HAS.REI.D.10, HFS.LE.A.3	12-13 days
March/April	**Unit 9** Solving Quadratics Equations	HSA.CED.A.2, HSA.REI.D.11, HSA.CED.A.1, HSA.REI.B.4.B HSA.SSE.B.3.A, HSA.APR.B.3 – HSF.IF.C.8.A, HSN.RN.A.2 – HSA.SSE.A.2 - HSA.SSE.B.3.B, HSA.REI.B.4.A - HSA.SSE.B.3, HSA.CED.A.3, HSA.REI.B.4, HSA.REI.C.7, HSA.REI.D.11	16-17 days
Common Assessments : Unit 8 and Unit 9- April 13, 2020			
April/May	**Unit 10** Working with Functions	HSF.IF.B.4, HSF.IF.B.6, HSF.IF.C.7.B, HSF.IF.B.5, HSF.BF.B.3, HSF.BF.A.1.B, HSF.BF.B.4, HSF.BF.B.4.A	17 days
May	**Unit 11** Statistics	HSS.ID.A.1, HSS.ID.A.2, HSS.ID.A.3, HSA.ID.A.3, HSS.ID.B.5	12 days
Common Assessments: All six(6) Units- May 20, 2020			
End of 2nd Semester June 1, 2020			

Algebra 1

Pacing Guide (YAG)

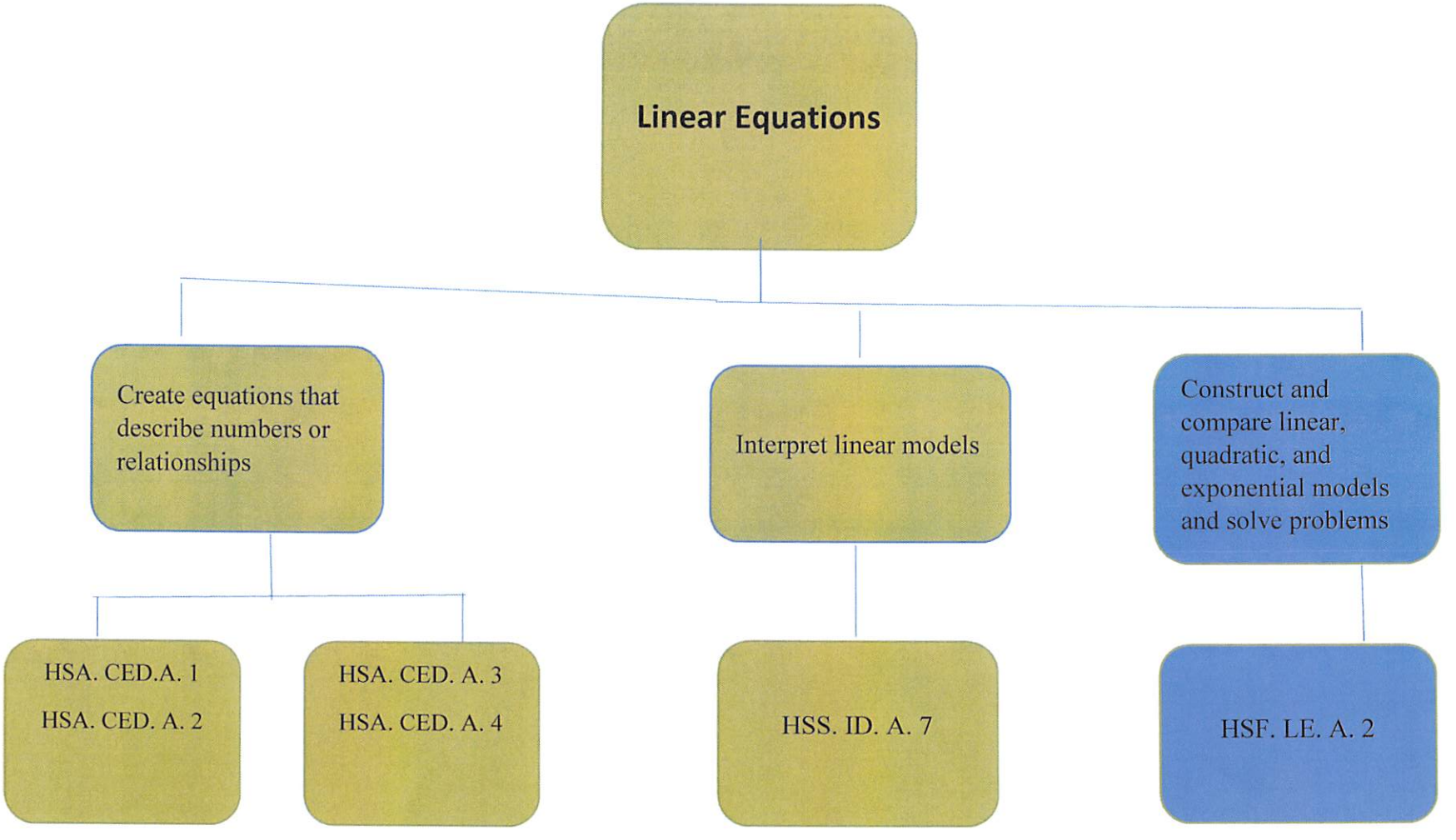
Unit 1- Solving Equations and Inequalities



Algebra 1

Pacing Guide (YAG)

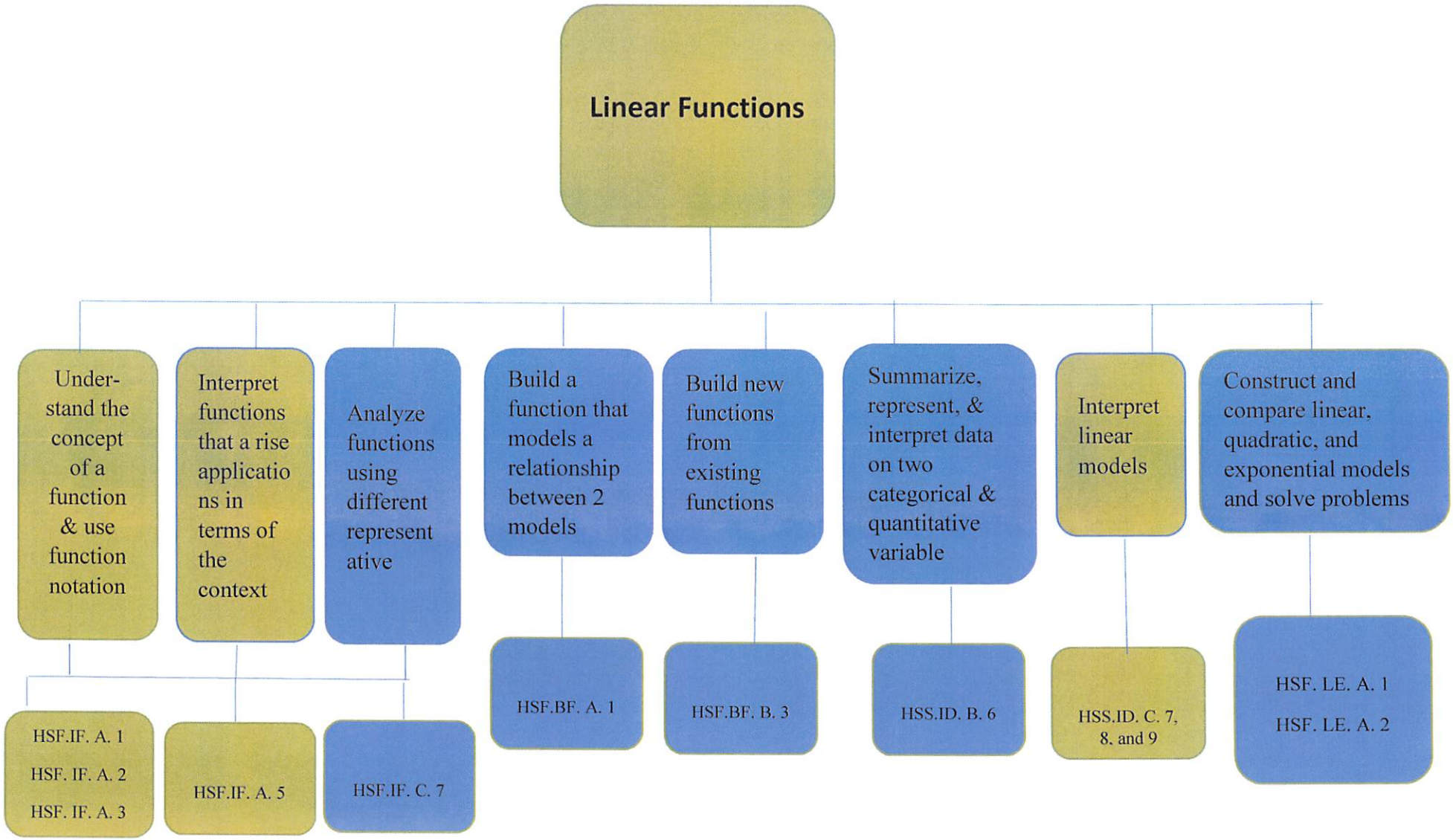
Unit 2- Linear Equations



Algebra 1

Pacing Guide (YAG)

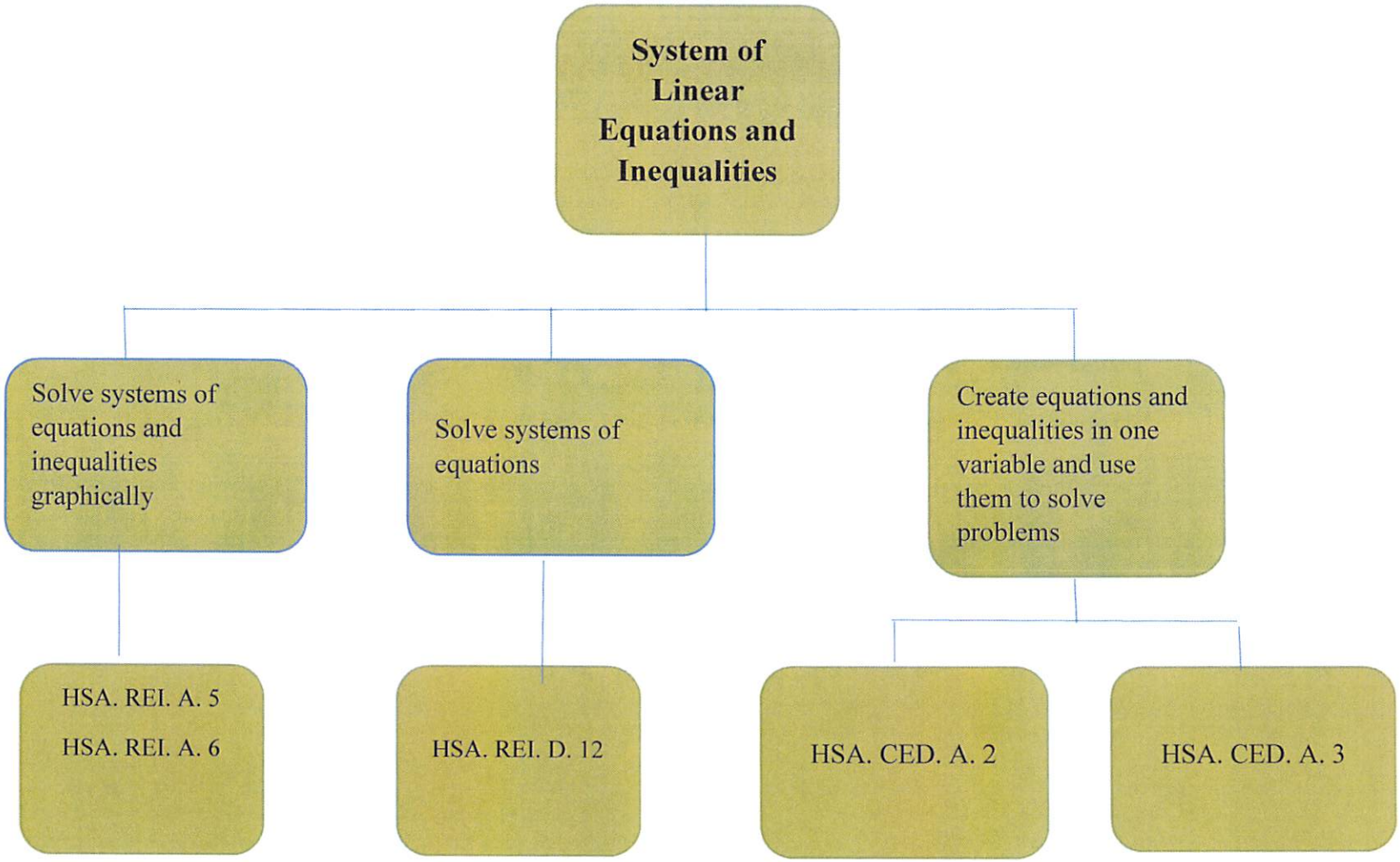
Unit 3- Linear Functions



Algebra 1

Pacing Guide (YAG)

Unit 4- System of Linear Equations and Inequalities



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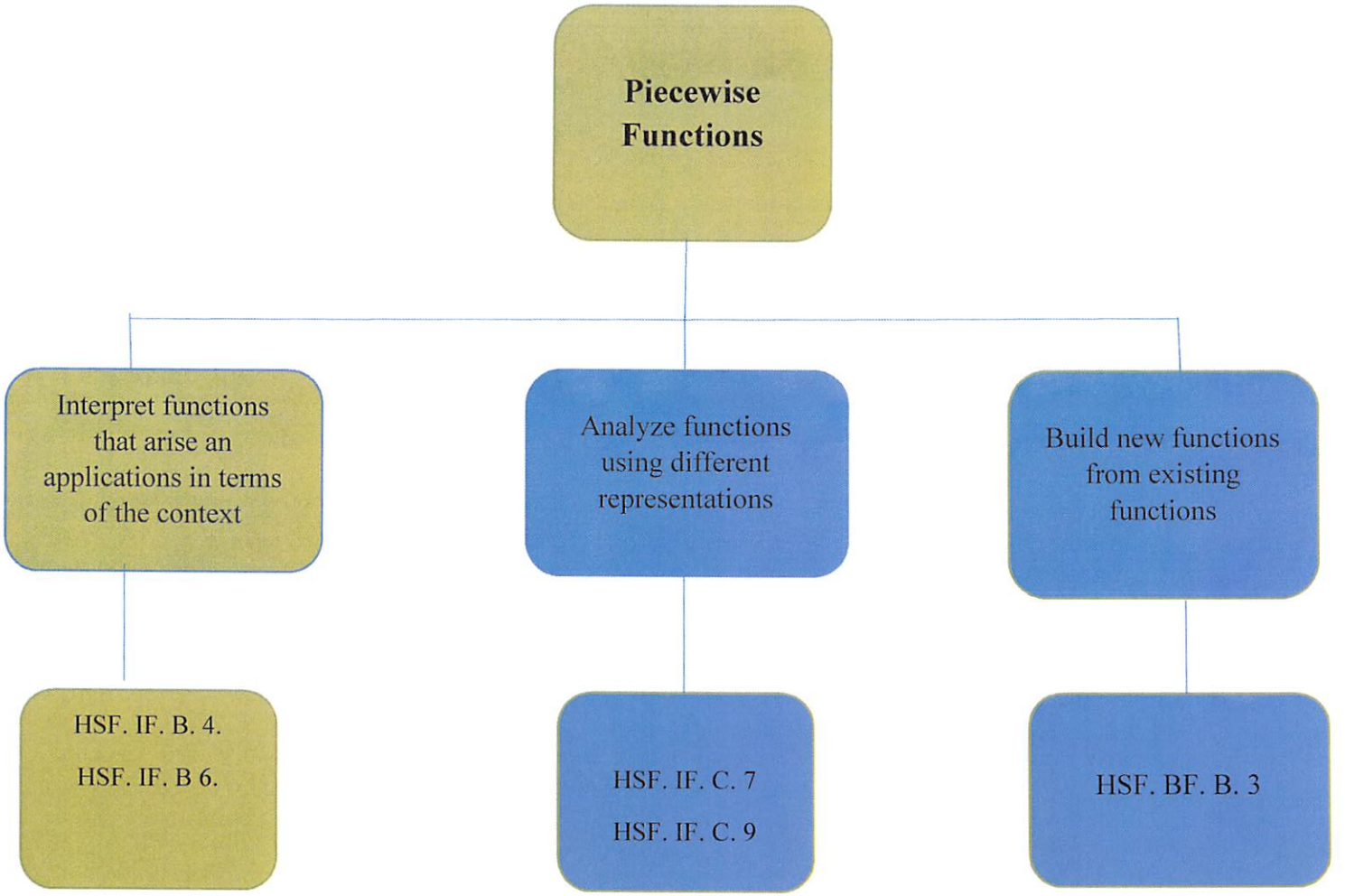
Pacing Guide (YAG)

Unit 5- Piecewise Functions



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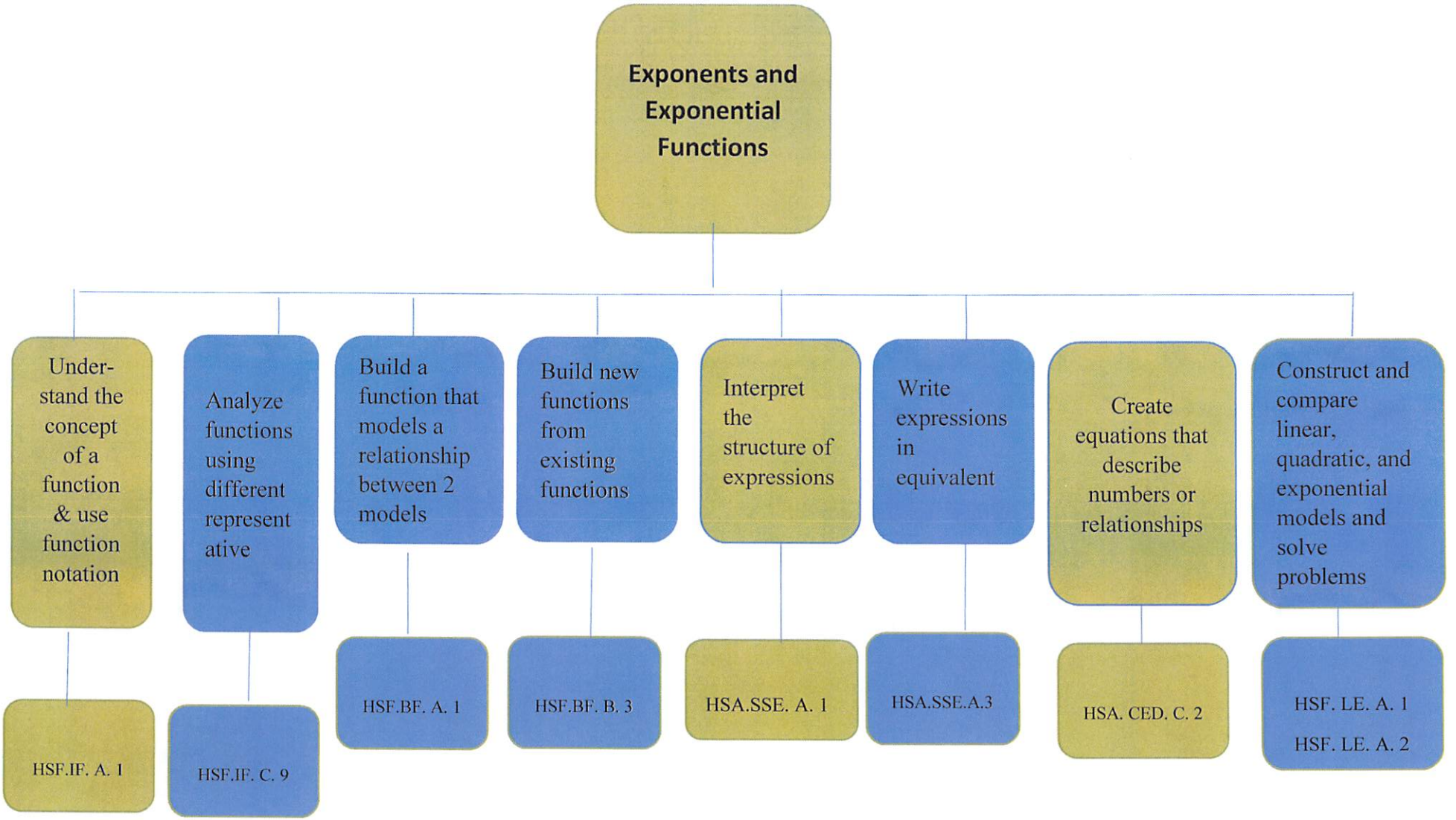
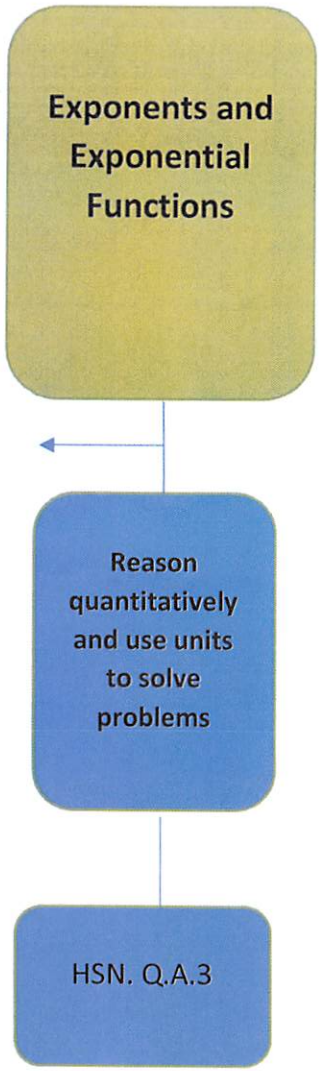
Pacing Guide (YAG)

Unit 6- Exponents and Exponential Functions



Continue- Unit 6: Exponentials and Exponents Functions



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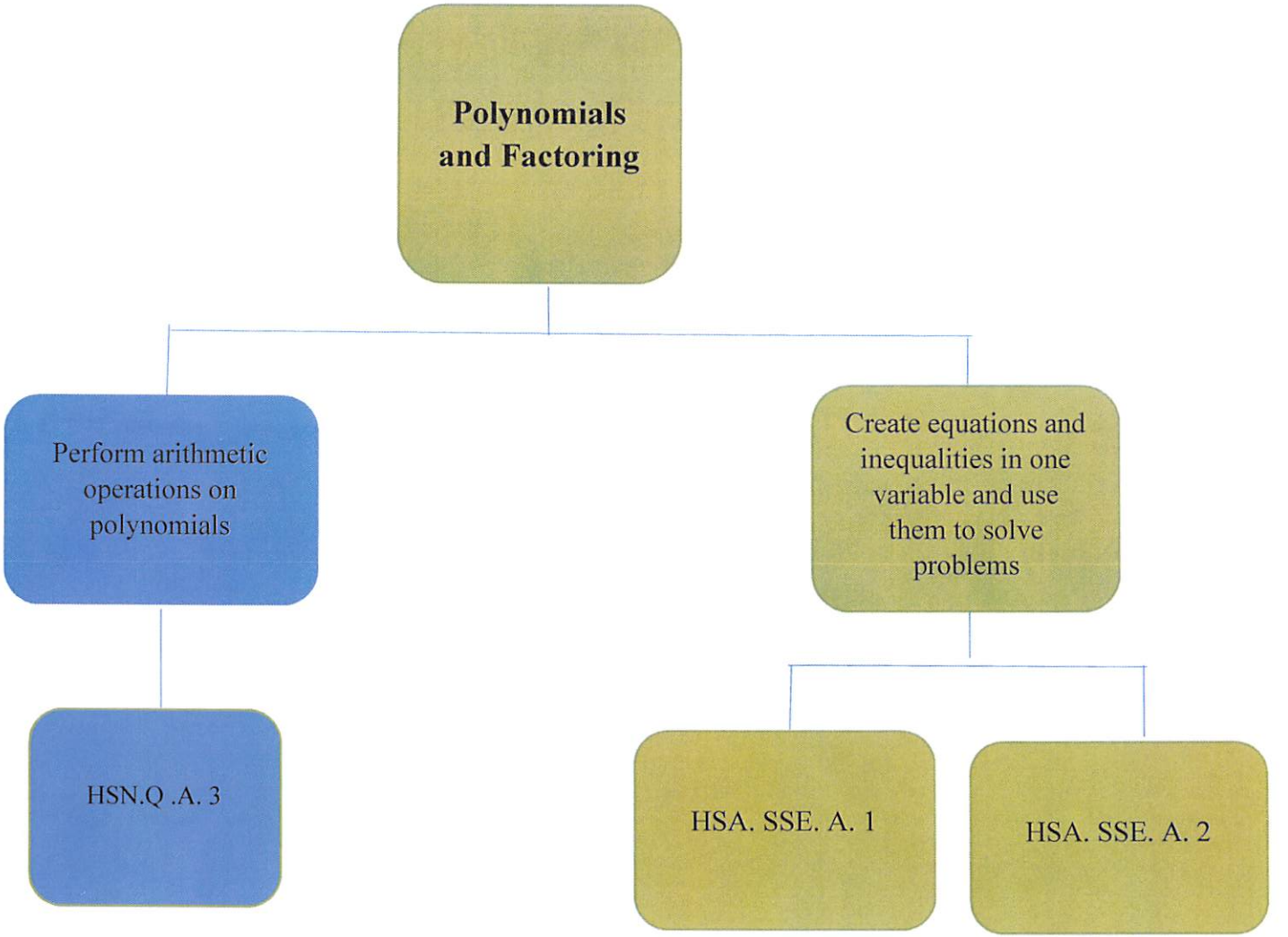
Pacing Guide (YAG)

Unit 7- Polynomials and Factoring



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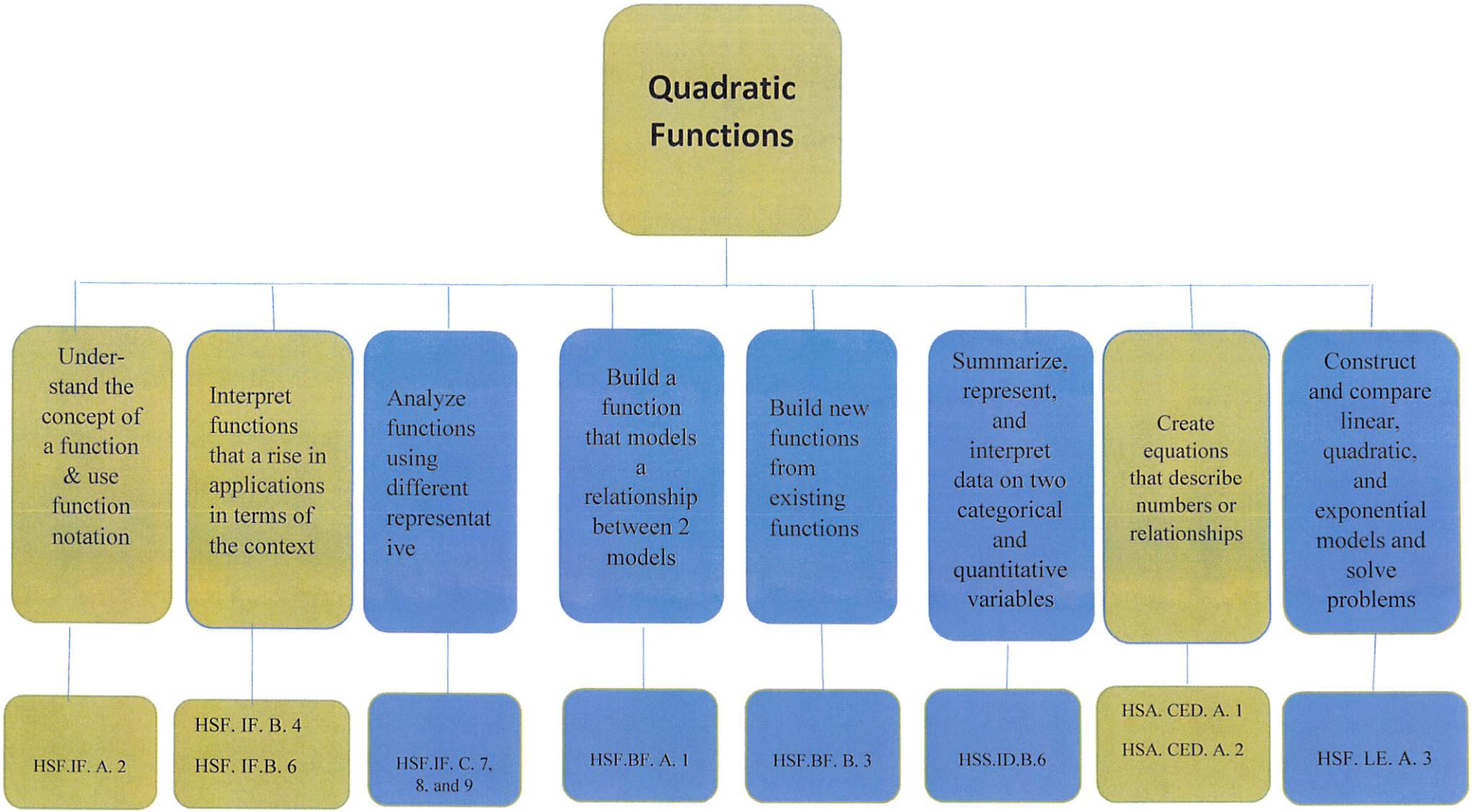
Pacing Guide (YAG)

Unit 8- Quadratic Functions



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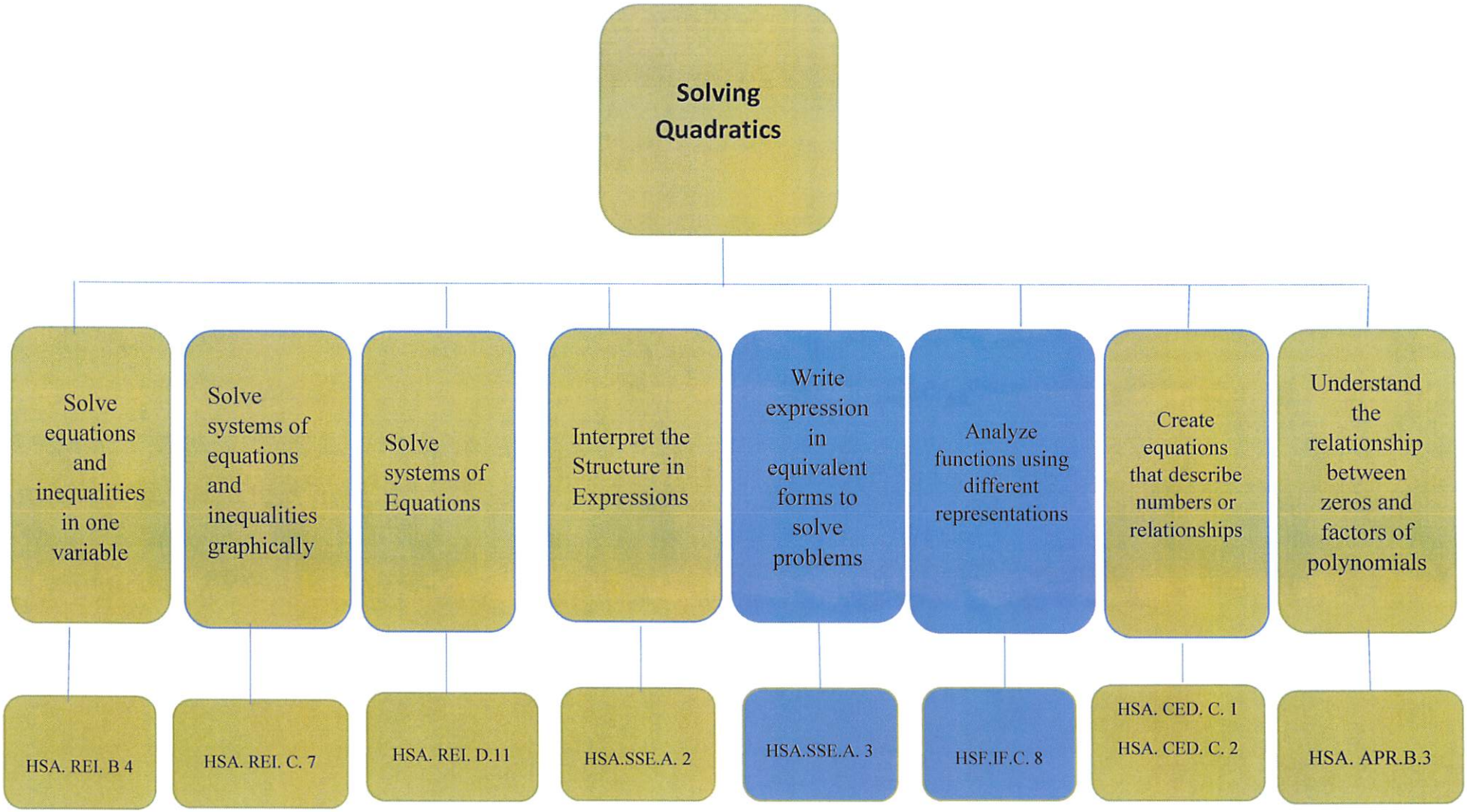
Pacing Guide (YAG)

Unit 9- Solving Quadratics



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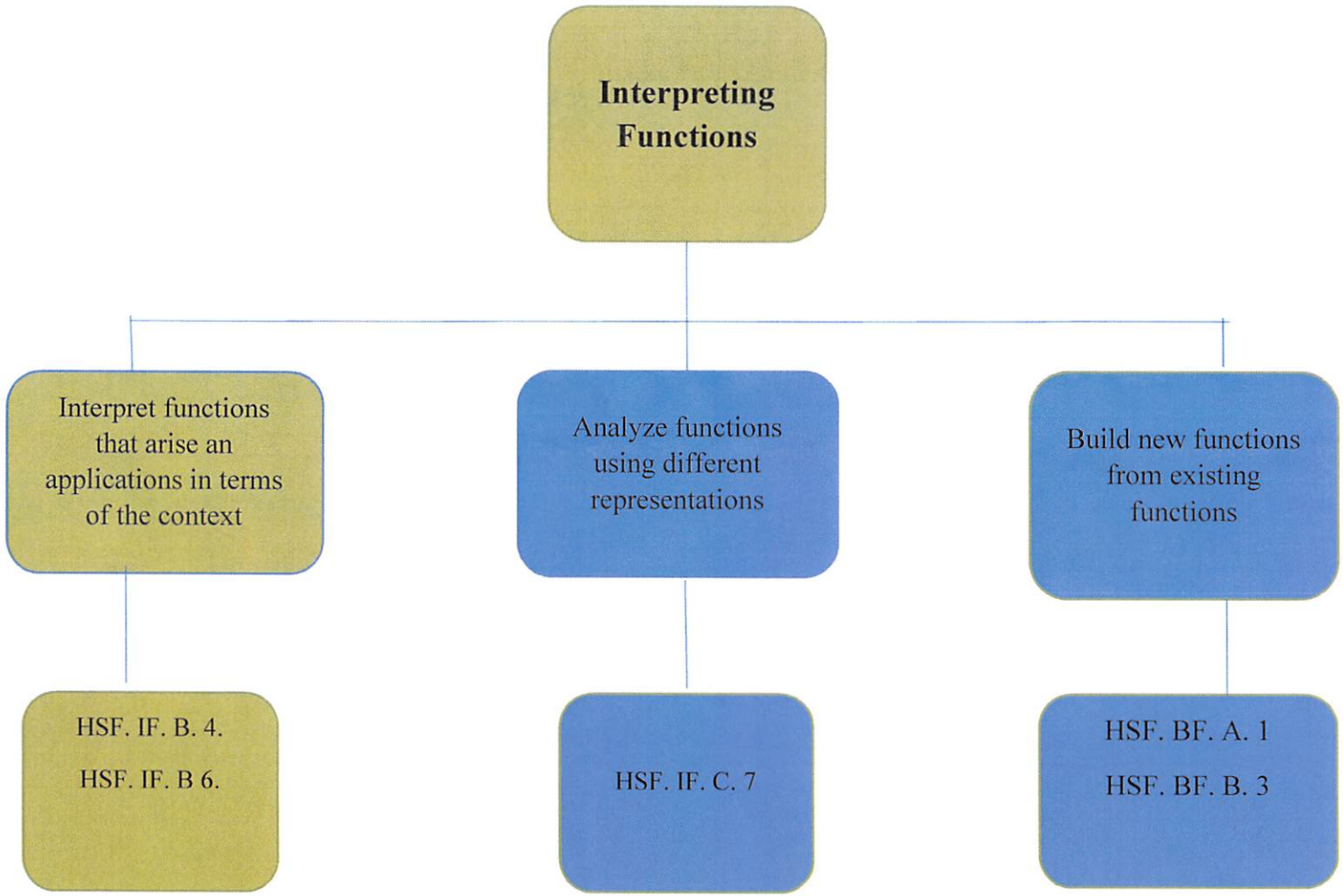
Unit 10- Working with Functions



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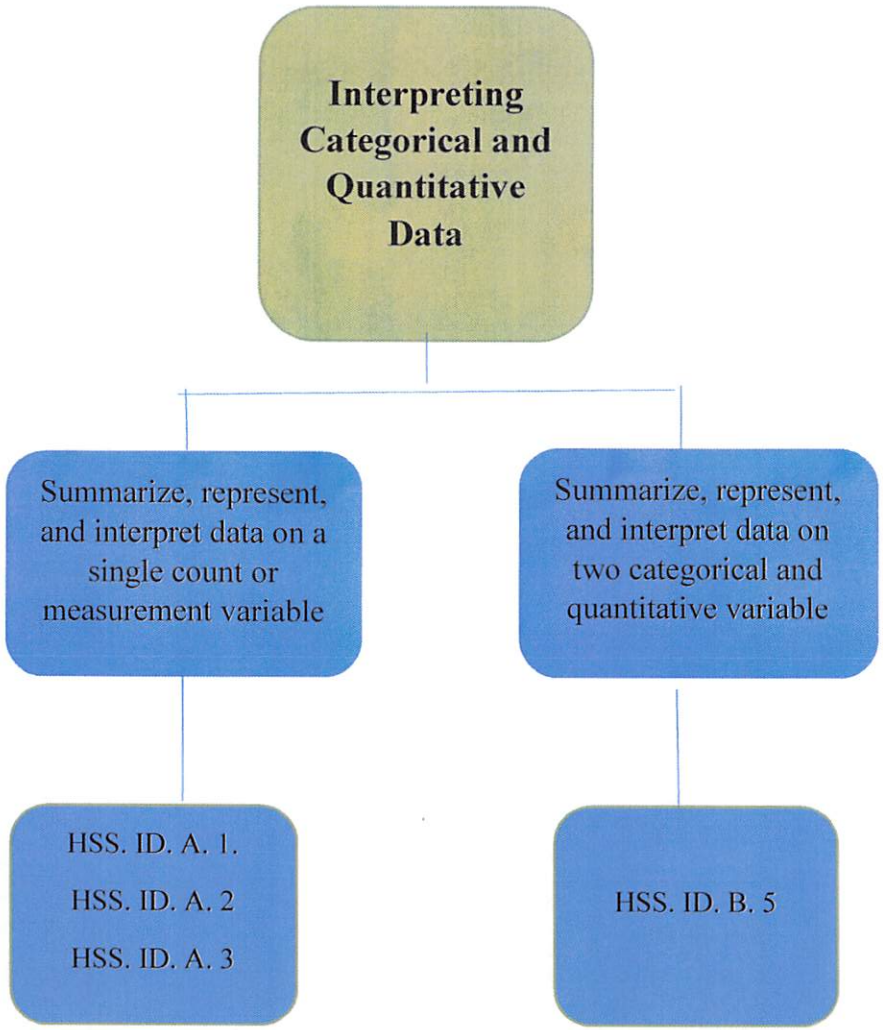
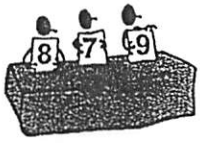
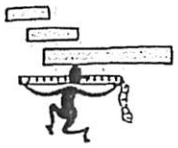
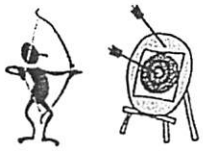
Unit 11- Statistics



Standard for Mathematical Practice	Student Friendly Language
1. Make sense of problems and persevere in solving them. 	• I can try many times to understand and solve a math problem.
2. Reason abstractly and quantitatively. 	• I can think about the math problem in my head, first.
3. Construct viable arguments and critique the reasoning of others. 	• I can make a plan, called a strategy, to solve the problem and discuss other students' strategies too.
4. Model with mathematics. 	• I can use math symbols and numbers to solve the problem.
5. Use appropriate tools strategically. 	• I can use math tools, pictures, drawings, and objects to solve the problem.
6. Attend to precision. 	• I can check to see if my strategy and calculations are correct.
7. Look for and make use of structure 	• I can use what I already know about math to solve the problem.
8. Look for and express regularity in repeated reasoning. 	• I can use a strategy that I used to solve another math problem.

Mathematics Practices		Students:	Teacher(s):
Modeling and Using Tools	4. Model with mathematics	☐ Apply prior knowledge to solve real world problems ☐ Identify important quantities and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts, and/or formulas ☐ Use assumptions and approximations to make a problem simpler ☐ Check to see if an answer makes sense within the context of a situation and change a model when necessary Comments:	☐ Use mathematical models appropriate for the focus of the lesson ☐ Encourage student use of developmentally and content-appropriate mathematical models (e.g., variables, equations, coordinate grids) ☐ Remind students that a mathematical model used to represent a problem's solution is 'a work in progress,' and may be revised as needed Comments:
	5. Use appropriate tools strategically	☐ Make sound decisions about the use of specific tools (Examples might include: calculator, concrete models, digital technologies, pencil/paper, ruler, compass, protractor) ☐ Use technological tools to visualize the results of assumptions, explore consequences, and compare predications with data ☐ Identify relevant external math resources (digital content on a website) and use them to pose or solve problems ☐ Use technological tools to explore and deepen understanding of concepts Comments:	☐ Use appropriate physical and/or digital tools to represent, explore and deepen student understanding ☐ Help students make sound decisions concerning the use of specific tools appropriate for the grade level and content focus of the lesson ☐ Provide access to materials, models, tools and/or technology-based resources that assist students in making conjectures necessary for solving problems Comments:
Seeing structure and generalizing	7. Look for and make use of structure	☐ Look for patterns or structure, recognizing that quantities can be represented in different ways ☐ Recognize the significance in concepts and models and use the patterns or structure for solving related problems ☐ View complicated quantities both as single objects or compositions of several objects and use operations to make sense of problems Comments:	☐ Engage students in discussions emphasizing relationships between particular topics within a content domain or across content domains ☐ Recognize that they quantitative relationships modeled by operations and their properties remain important regardless of the operational focus of a lesson ☐ Provide activities in which students demonstrate their flexibility in representing mathematics in a number of ways e.g., $76 = (7 \times 10) + 6$; discussing types of quadrilaterals, etc. Comments:
	8. Look for and express regularity in repeated reasoning	☐ Notice repeated calculations and look for general methods and shortcuts ☐ Continually evaluate the reasonableness of intermediate results (comparing estimates), while attending to details, and make generalizations based on findings Comments:	☐ Engage students in discussion related to repeated reasoning that may occur in a problem's solution ☐ Draw attention to the prerequisite steps necessary to consider when solving a problem ☐ Urge students to continually evaluate the reasonableness of their results Comments:

Engaging in the Mathematical Practices (Look-fors)

	Mathematics Practices	Students:	Teachers:
Overarching habits of mind of a productive math thinker	1. Make sense of problems and persevere in solving them	☐ Understand the meaning of the problem and look for entry points to its solution ☐ Analyze information (givens, constrains, relationships, goals) ☐ Make conjectures and plan a solution pathway ☐ Monitor and evaluate the progress and change course as necessary ☐ Check answers to problems and ask, "Does this make sense?" Comments:	☐ Involve students in rich problem-based tasks that encourage them to persevere in order to reach a solution ☐ Provide opportunities for students to solve problems that have multiple solutions ☐ Encourage students to represent their thinking while problem solving Comments:
	6. Attend to precision	☐ Communicate precisely using clear definitions ☐ State the meaning of symbols, carefully specifying units of measure, and providing accurate labels ☐ Calculate accurately and efficiently, expressing numerical answers with a degree of precision ☐ Provide carefully formulated explanations ☐ Label accurately when measuring and graphing Comments:	☐ Emphasize the importance of precise communication by encouraging students to focus on clarity of the definitions, notation, and vocabulary used to convey their reasoning ☐ Encourage accuracy and efficiency in computation and problem-based solutions, expressing numerical answers, data, and/or measurements with a degree of precision appropriate for the context of the problem Comments:
Reasoning and Explaining	2. Reason abstractly and quantitatively	☐ Make sense of quantities and relationships in problem situations ☐ Represent abstract situations symbolically and understand the meaning of quantities ☐ Create a coherent representation of the problem at hand ☐ Consider the units involved ☐ Flexibly use properties of operations Comments:	☐ Facilitate opportunities for students to discuss or use representations to make sense of quantities and their relationships ☐ Encourage the flexible use of properties of operations, objects, and solution strategies when solving problems ☐ Provide opportunities for students to decontextualize (abstract a situation) and/or contextualize (identify referents for symbols involved) the mathematics they are learning Comments:
	3. Construct viable arguments and critique the reasoning of others	☐ Use definitions and previously established causes/effects (results) in constructing arguments ☐ Make conjectures and use counterexamples to build a logical progression of statements to explore and support ideas ☐ Communicate and defend mathematical reasoning using objects, drawings, diagrams, and/or actions ☐ Listen to or read the arguments of others ☐ Decide if the arguments of others make sense and ask probing questions to clarify or improve the arguments Comments:	☐ Provide and orchestrate opportunities for students to listen to the solution strategies of others, discuss alternative solutions, and defend their ideas ☐ Ask higher-order questions which encourage students to defend their ideas ☐ Provide prompts that encourage students to think critically about the mathematics they are learning Comments:

 * All indicators are not necessary for providing full evidence of practice(s). Each practice may not be evident during every lesson.

Algebra I Curriculum Map

Unit 1: Solving Equations and Inequalities

Pacing 16 – 17 Days (September)

<table>
<tr><td colspan="2">From the previous year, students should have mastered:</td></tr>
<tr><td colspan="2">Recognizing that rational numbers can be written in the form a/b, where a and b are integers, b ≠ 0 and that all numbers that are not rational are irrational. Comparing and ordering rational and irrational numbers and completing mathematical computations with them.</td></tr>
<tr><td>Enduring Understandings</td><td>Essential Questions</td></tr>
<tr><td>• Using general strategies when solving equations with rational and irrational numbers.
• An understand that linear equations can be used to solve mathematical and real-world problems.
• An understanding that the solution of an inequality in one variable is solved by using the properties of inequalities.</td><td>• What general strategies can you use to solve simple equations?</td></tr>
<tr><td colspan="2">By the end of this unit, students should be able to:</td></tr>
<tr><td colspan="2">• Find the sum or product of two rational numbers and explain why the answer is rational.
• Find the sum or product of a rational and an irrational number and explain when the answer is irrational.
• Explain that each step in solving a linear equation follows from the equality in the previous step.
• Create and solve linear equations with one variable using the properties of equality.
• Use the properties of equality to solve linear equations with a variable on both sides.
• Identify whether linear equalities have one solution, infinitely many solutions, or no solution.
• Rearrange formulas and equations to highlight a quality of interest by isolating the variable using the same reasoning used to solve equations.
• Use formulas and equations to solve problems.
• Create and solve inequalities in one variable.
• Interpret solutions to inequalities within the context.
• Test and verify the appropriateness of their math models.
• Explain why the results from a mathematical model might not align exactly with the problem situation.
• Create and solve a system of inequalities.
• Interpret the solution to a compound inequality within a modeling context.
• Solve absolute value equations and inequalities.
• Use absolute value equations and inequalities to solve problems.</td></tr>
</table>

. Learning Standards		
HSN.RN.B.3 – HSA.CED.A.1 – HSA.REI.A.1 - HSA.REI.B.3 – HSN.Q.A.1 - HSN.Q.A.2 - HSA.CED.A.3 - HSA.CED.A.4 MP.4: Model with mathematics and MP.5: Use appropriate tools strategically.		
Vocabulary	Resources	Assessment
element of a set set subset formula literal equation compound inequality	enVision Algebra 1 – Volume 1 - Topic 1 Beginning of the year assessment (pages 1-6 in assessment resources book) Math modeling in 3 acts Vocabulary support Topic Review Formative assessments (admit and exit tickets) Reteach and build understandings Additional practice Readiness assessment Lesson quizzes Assessments Form A and B enVision STEM	Topic Review Topic Readiness Assessment Topic Performance Assessment Topic Assessment Forms A and B Formative assessments (admit and exit tickets) Lesson quizzes Topic Assessment

Unit 2: Linear Equations

Pacing: 10-11 Days (October)

From the previous year, students should have mastered:	
How to perform operations with rational numbers and use their properties to solve equations especially when applying their knowledge when calculating slope and intercepts of linear equations. What the properties of equality are and how to find the value of a variable, solve for y and re-write equations in slope intercept form.	
Enduring Understandings	Essential Questions
• Solving for different forms of linear equations which are as follows: $y=mx+b$ where the line intersects the y-axis at (0,b), so the y-intercept is b and point-slope form of a linear equation.	• Why is it useful to have different forms of linear equations
By the end of this unit, students should be able to:	
• Write linear equations in two variables using slope intercept form to represent the relationship between two qualities. • Write and graph linear equations in point-slope form. • Analyze different forms of a line to intercept the slope and y-intercept of a linear model in the context of data. • Write and graph linear equations in standard form. • Use linear equations in standard form to intercept both the x-and y-intercepts in the context of given data. • Use mathematical modeling to represent a problem situation and to propose a solution. • Test and verify the appropriateness of their math models. • Explain why the results from a mathematical model might not align exactly with the problem situation. • Create equations to represent lines that are parallel or perpendicular to a given line. • Graph lines to show an understanding of the relationship between the slopes of parallel and perpendicular lines. • Solve real-world problems with parallel or perpendicular lines.	
Learning Standards	
HSA.CED.A.2 – HSS.ID.C.7 – HSF.LE.A.2 – HSA.CED.A.1 - HSA.CED.A.2 - HSA.CED.A.3 - HSA.CED.A.4 – HSF.IF.C.7.A MP.3: Construct viable arguments and MP.7: Look for and make use of structure.	

Vocabulary	Resources	Assessment
slope-intercept form y-intercept point-slope form standard form of a linear equation parallel lines perpendicular lines	enVision Algebra 1 – Volume 1 - Topic 2 Math modeling in 3 acts Vocabulary support Topic Review Graphing technology activities Formative assessments (admit and exit tickets)	Topic Review Topic Readiness Assessment Topic Performance Assessment Topic Assessment Forms A and B Formative assessments (admit and exit tickets)

Algebra I Curriculum Map

Unit 3: Linear Functions

Pacing: 14-15 Days (October and Nov.)

From the previous year, students should have mastered:	
The exploration of linear and nonlinear functions and learned about the key features of linear functions including slope and rate of change.	
Enduring Understandings	Essential Questions
• Extending their understanding of linear and nonlinear functions as they determine the domain and range of linear functions. • Writing linear function rules and transform linear functions.	• How can linear functions be used to model situations and solve problems?
By the end of this unit, students should be able to:	
• Understand that a relation is a function if each element of the domain is assigned to exactly one element in the range. • Determine a reasonable domain and identify constraints on the domain based on the content of a real-world problem. • Write and evaluate linear functions using function notation. • Graph a linear function and relate the domain of a function to its graph. • Interrupt functions represented by graphs, tables, verbal descriptions, and function notation in terms of context. • Graph transformations of linear functions by identifying the effect of multiplying and adding specific values of k to the input or output of a function. • Interrupt the key features of the graph of a linear function and use them to write the function that the graph represents. • Use mathematical modeling to represent a problem situation and to propose a solution. • Test and verify the appropriateness of their math models. • Explain why the results from a mathematical model might not align exactly with the problem situation. • Write arithmetic and geometric sequences both recursively and with an explicit formula. • Use explicit formulas and recursive formulas to model real-world situations. • Fit a function to linear data in a scatter plot to solve problems in the context of data. • Interrupt the slope of a trend line within the context of data. • Compute and interrupt the correlation coefficient for linear data. • Plot and analyze residuals to assess the fit of a function. • Distinguish between correlation and causation.	
Learning Standards	
HSF.IF.A.1 - HSF.IF.A.2 - HSF.IF.B.5 - HSF.LE.A.2 - HSF.BF.B.3 - HSF.IF.C.7 - HSF.BF.A.1 – HSS.ID.B.6.A – HSS.ID.B.6.C – HSS.ID.C.7 - HSF.IF.A.3 - HSF.BF.A.2 - HSS.ID.B.6.B - HSS.ID.C.8 - HSS.ID.C.9 - HSS.ID.B.6.C	

reciprocal	Reteach and build understandings Additional practice Readiness assessment Lesson quizzes Assessments Form A and B enVision STEM	Lesson quizzes Topic Assessment

- **F-IF.A.2:** edited to provide a financial context for evaluating functions and interpreting statements that use function notation in the model Algebra I course.
- **F-IF.B:** edited the "Interpreting Functions" cluster heading to clarify the model Algebra I course is limited to interpreting linear, quadratic, and exponential functions.
- **F-BF.B. 3:** edited to clarify the focus for writing functions (including linear, quadratic, and exponential) that model relationships and building new functions from existing functions (including linear, quadratic, exponential, and absolute value) for the model Algebra I course.

MP.5: Use appropriate tools strategically and MP.6: Attend to precision

Vocabulary		Resources	Assessment
continuous	discrete	enVision Algebra 1 – Volume 1 - Topic 3	Topic Review
function	one-to-one	Math modeling in 3 acts	Topic Readiness Assessment
range	relation	Vocabulary support	Topic Performance Assessment
function notation	sequence	Topic Review	Topic Assessment Forms A and B
transformation	translation	Graphing technology activities	Formative assessments (admit and exit tickets)
arithmetic sequence	residual	Formative assessments (admit and exit tickets)	Lesson quizzes
common difference		Reteach and build understandings	Topic assessment
explicit formula		Additional practice	
recursive formula		Readiness assessment	
linear function		Lesson quizzes	
term of sequence		Assessments Form A and B	
negative association		enVision STEM	
negative correlation			
no association			
positive association			
trend line			
causation			
correlation			
coefficient			
extrapolation			
interpolation			
line of best fit			
linear regression			

9th Grade Algebra Curriculum Map

Unit 4: Systems of Linear Equations and Inequalities

Pacing 12-13 Days (Nov and Dec.)

<table>
<tr><td colspan="2">From the previous year, students should have mastered:</td></tr>
<tr><td colspan="2">Solving linear equations with variables including those equations with variables on both sides and how to represent the solutions to linear inequalities in one variable graphically.</td></tr>
<tr><td>Enduring Understandings</td><td>Essential Questions</td></tr>
<tr><td>Solve linear equations within the context of a system of linear equations.
Understanding that the solution of the linear equations may have one solution, infinitely many solutions or no solution.
Expanding their knowledge of graphing and show that solutions of linear inequalities are regions on a graph and the shading of two or more inequalities may overlap.</td><td>How do we use systems of linear equations and inequalities to model situations and solve problems?</td></tr>
<tr><td colspan="2">By the end of this unit, students should be able to:</td></tr>
<tr><td colspan="2">Graph systems of linear equations in two variables to find an approximate solution.
Write a system of linear equations in two variables to represent real-world problems.
Use the substitution method to solve systems of equations.
Represent situations as a system of equations as viable/nonviable options for the situation.
Solve systems of linear equations and prove that the sum of the equation and the multiple of the other produces a system with the same solutions as the original system.
Represent constraints with a system of equations in a modeling context.
Graph solutions to linear inequalities in two variables.
Represent constraints with inequalities and interrupt solutions as viable or nonviable options in a modeling context.
Use mathematical modeling to represent a problem situation and to propose a solution.
Test and verify the appropriateness of their math models.
Explain why the results from a mathematical model might not align exactly with the problem situation.
Graph the solution set of a system of linear inequalities in two variables.
Interrupt solutions of linear inequalities in a modeling context.</td></tr>
<tr><td colspan="2">Learning Standards</td></tr>
<tr><td colspan="2">HSA.REI.C.6 – HSA.CED.A.3 - HSA.REI.C.5 – HSA.REI.D.12 - HSA.CED.A.2
MP.2: Reason abstractly and quantitatively and MP.8: Look for and express regularity in repeated reasoning.</td></tr>
</table>

Vocabulary	Resources	Assessment
linear inequality in two variables solution of an inequality in two variables solution of a system of linear inequalities system of linear inequalities	enVision Algebra 1 – Volume 1 - Topic 4 Math modeling in 3 acts Vocabulary support Topic Review Graphing technology activities Formative assessments (admit and exit tickets) Reteach and build understandings Additional practice Readiness assessment Lesson quizzes Assessments Form A and B enVision STEM	Topic Review Topic Readiness Assessment Topic Performance Assessment Topic Assessment Forms A and B Formative assessments (admit and exit tickets) Lesson quizzes Topic assessment

Algebra I Curriculum Map

Unit 5: Piecewise Functions

Pacing: 10-11 Days (December)

<table>
<tr><td colspan="3">From the previous year, students should have mastered:</td></tr>
<tr><td colspan="3">The definition of a function, the concepts of linear functions and their graphs and how to write linear functions in slope-intercept form and how to apply transformations to linear functions.</td></tr>
<tr><td colspan="2">Enduring Understandings</td><td>Essential Questions</td></tr>
<tr><td colspan="2">• Write piecewise-defined functions using slope-intercept form for each part of the function defined for a specific domain.
• Translating piecewise-defined functions vertically and horizontally, as well as vertically compress and stretch these functions.</td><td>How do you use piecewise-defined functions to model situations and solve problems?</td></tr>
<tr><td colspan="3">By the end of this unit, students should be able to:</td></tr>
<tr><td colspan="3">• Graph an absolute value function and identify the key features of the graph.
• Calculate and interpret the rate of change of an absolute value function over a specific interval.
• Use mathematical modeling to represent a problem situation and to propose a solution.
• Test and verify the appropriateness of their math models.
• Explain why the results from a mathematical model might not align exactly with the problem situation.
• Understand piecewise-defined functions.
• Analyze the key features of the graph of a piecewise-defined function.
• Write and interpret a piecewise-defined function to solve application problems.
• Graph step functions including ceiling functions and floor functions.
• Calculate and interrupt the average rate of change of step functions.
• Graph transformations of piecewise-defined functions.
• Identify the effect of changing constraints of coefficients of absolute value functions on their graphs.</td></tr>
<tr><td colspan="3">Learning Standards</td></tr>
<tr><td colspan="3">HSF.IF. B.4 - HSF.IF. B.6 - HSF.IF. C.7.B - HSF.IF. C.9 - HSF.BF.B.3
• F-BF.B. 3: edited to clarify the focus for writing functions (including linear, quadratic, and exponential) that model relationships and building new functions from existing functions (including linear, quadratic, exponential, and absolute value) for the model Algebra I course.

MP.6: Attend to precision and MP.7: Look for and make use of structure</td></tr>
<tr><td>Vocabulary</td><td>Resources</td><td>Assessment</td></tr>
<tr><td>absolute value function</td><td>enVision Algebra 1 – Volume 1 - Topic 5</td><td>Topic Review</td></tr>
</table>

axis of symmetry vertex piecewise-defined function ceiling function floor function step function	Math modeling in 3 acts Vocabulary support Topic Review Graphing technology activities Formative assessments (admit and exit tickets) Reteach and build understandings Additional practice Readiness assessment Lesson quizzes Assessments Form A and B enVision STEM	Topic Readiness Assessment Topic Performance Assessment Topic Assessment Forms A and B Formative assessments (admit and exit tickets) Lesson quizzes Topic assessment

Algebra I Curriculum Map

Unit 6: Exponents and Exponential Functions

Pacing: 12 – 13 Days ()

<table>
<tr><td colspan="2">From the previous year, students should have mastered:</td></tr>
<tr><td colspan="2">Creating and solving linear equations. How to graph coordinate pairs and linear equations written in different forms.</td></tr>
<tr><td>Enduring Understandings</td><td>Essential Questions</td></tr>
<tr><td>• Solving equations with rational exponents.
• Writing formulas for geometric sequences.
• Creating and solving exponential models for real-world problems.
• Applying their knowledge when they graph exponential functions.
• Writing exponential functions using function notation and transform exponential functions.</td><td>• How do you use exponential functions to model situations and solve problems?</td></tr>
<tr><td colspan="2">By the end of this unit, students should be able to:</td></tr>
<tr><td colspan="2">• Extend the properties of integer exponents to rational exponents to rewrite radical expressions using rational exponents.
• Solve equations with rational exponents using the properties of exponents.
• Sketch graphs showing key features of exponential exponents.
• Write exponential functions using tables and graphs.
• Compare linear and exponential functions.
• Construct exponential growth and decay functions given a description of a relationship.
• Recognize if a situation can be modeled with exponential growth or exponential decay, and interpret the parameters of the model in context.
• Find explicit and recursive formulas for geometric sequences.
• Translate between recursive and explicit formulas for geometric sequences.
• Construct exponential functions to represent geometric sequences.
• Translate the graph of an exponential function vertically and horizontally, identifying the effect different values of h and k have on a graph of the function.
• Compare characteristics of two exponential functions represented in different ways, such as tables and graphs.
• Use mathematical modeling to represent a problem situation and to propose a solution.
• Test and verify the appropriateness of their math models.
• Explain why the results from a mathematical model might not align exactly with the problem situation.</td></tr>
</table>

Learning Standards

HSN.RN.A.1 – HSN.RN.A.2 – HSF.IF.B.4 - HSF.IF.B.5 – HSF.BF.A.1 – HSF.LE.A.1 - HSF.LE.A.1.A – HSN.Q.A.3 – HSA.SSE.A.1.B - HSA.SSE.B.3.C – HSA.CED.A.2 - HSF.LE.A.2 - HSF.LE.B.5 - HSF.IF.A.3 – HSF.BF.A.2 - HSF.LE.A.2 - HSF.IF.C.9 - HSA.SSE.B.3

- **F-IF.B:** edited the "Interpreting Functions" cluster heading to clarify the model Algebra I course is limited to interpreting linear, quadratic, and exponential functions.

MP.1: Make sense of problems and persevere in solving them and MP.8: Look for and express regularity and repeated reasoning.

Vocabulary	Resources	Assessment
rational exponent asymptote constant ratio exponential function component interest decay factor exponential decay exponential growth growth factor geometric sequence	enVision Algebra 1 – Volume 1 - Topic 6 Math modeling in 3 acts Vocabulary support Topic Review Graphing technology activities Formative assessments (admit and exit tickets) Reteach and build understandings Additional practice Readiness assessment Lesson quizzes Assessments Form A and B enVision STEM	Topic Review Topic Readiness Assessment Topic Performance Assessment Topic Assessment Forms A and B Formative assessments (admit and exit tickets) Lesson quizzes Topic assessment

Algebra I Curriculum Map

Unit 7: Polynomial and Factoring

Pacing: 16-17 Days (Jan thru Mid Feb.)

<table>
<tr><td colspan="2">From the previous year, students should have mastered:</td></tr>
<tr><td colspan="2">Factoring expressions by identifying the greatest common factor and using the distributive property and applying their knowledge that operations with integers and exponents are similar to the concept of adding and subtracting digits with the same place value.
The ability to identify the different types of polynomials</td></tr>
<tr><td>Enduring Understandings</td><td>Essential Questions</td></tr>
<tr><td>• Factoring polynomials, including trinomials and binominal factors.
• Recognizing that polynomials form a system that is similar to integers and use the same properties of equality to add, subtract and multiply polynomials.
• Applying the multiplication properties of exponents when multiplying polynomials and finding products of binomials.</td><td>• How do you work with polynomials to rewrite expressions and solve problems?</td></tr>
<tr><td colspan="2">By the end of this unit, students should be able to:
• Identify the parts of a polynomial and classify them by number of terms and by degree.
• Write a polynomial in standard form.
• Add and subtract two polynomials.
• Use the Distributive Property with polynomials, recognizing that polynomials are closed under multiplication.
• Multiply polynomials using a table and an area model.
• Determine the square of a binomial.
• Find the product of the sum and a difference of two squares.
• Solve real-world problems involving the square of a binomial.
• Find the greatest common factor of the terms of a polynomial.
• Use the structure of a polynomial to rewrite in a factored form.
• Factor polynomials that represent real-world problems.
• Factor a trinomial in the form x^2+bx+c by finding two binomial factors whose product is equal to the trinomial.
• Identify and use patterns in the signs of the coefficient of the terms of a trinomial expression.
• Use mathematical modeling to represent a problem situation and to propose a solution.
• Test and verify the appropriateness of their math models.
• Explain why the results from a mathematical model might not align exactly with the problem situation.
• Identify the common factor of the coefficients in the terms of a trinomial expression when a ≠ 1.
• Write a quadratic trinomial of a product of two binomial factors.
• Identify and factor a trinomial that is a perfect square or binomial that is a difference of two squares.
• Factor special cases of polynomials within the context of real-world problems.</td></tr>
</table>

... Learning Standards		
HSA.APR.A.1 – HSA.SSE.A.2 - HSA.SSE.A.1.A MP.3: Construct viable arguments and MP.7: Look for and make use of structure.		
Vocabulary	Resources	Assessment
Closure Property degree of a monomial degree of a polynomial monomial polynomial standard form of a polynomial difference of two squares perfect-square trinomial	enVision Algebra 1 – Volume 2 - Topic 7 Math modeling in 3 acts Vocabulary support Topic Review Graphing technology activities Formative assessments (admit and exit tickets) Reteach and build understandings Additional practice Readiness assessment Lesson quizzes Assessments Form A and B enVision STEM	Topic Review Topic Readiness Assessment Topic Performance Assessment Topic Assessment Forms A and B Formative assessments (admit and exit tickets) Lesson quizzes Topic assessment

Algebra I Curriculum Map

Unit 8: Quadratic Functions

Pacing: 12-13 Days (Feb. thru Mid-March)

From the previous year, students should have mastered:	
Comparing linear and nonlinear functions, learned about increasing and decreasing intervals, and sketched functions from a verbal description. How to apply the key features of linear functions including slope and rate of change as well as comparing and identifying key features of quadratic functions and sketching them on a graph.	
Enduring Understandings	Essential Questions
• Applying the key features of the graphs of quadratic functions when they solve quadratic equations graphically, algebraically and numerically in tables.	• How can you use sketches and equations of quadratic functions to model situations and make predictions?
By the end of this unit, students should be able to:	
• Identify the key functions of a graph of a quadratic function using graphs, tables and equations. • Explain the effect of the value of *a* on the quadratic parent function. • Identify key features of the graph of quadratic functions written in vertex form. • Graph quadratic functions in vertex form. • Graph quadratic functions in standard form and show intercepts, maxima and minima. • Determine how the values of a, b, and c affect the graph of $f(x) = ax^2+bx+c$. • Identify key features of parabolas. • Compare properties of quadratic functions presented in different forms (algebraically, in a table, graphically). • Use quadratic functions fitted to data to model real-world situations. • Use the vertical motion model to write an equation. • Compare a model to a data set by analyzing and evaluating residuals. • Use mathematical modeling to represent a problem situation and to propose a solution. • Test and verify the appropriateness of their math models. • Explain why the results from a mathematical model might not align exactly with the problem situation. • Determine which model – linear, exponential, or quadratic – best fits a set of data. • Use fitted functions to solve problems in the context of data.	
Learning Standards	
HSA.CED.A.2 – HSF.IF.B.6 - HSF.BF.B.3 - HSF.IF.C.7 - HSF.IF.B.4 - HSF.IF.C.7.A - HSF.IF.C.8 - HSF.IF.C.9 - HSF.IF.A.2 – HSF.BF.A.1 – HSS.ID.B.6.A – HSS.ID.B.6.B – HAS.REI.D.10 – HFS.LE.A.3 • **F-IF.A.2:** edited to provide a financial context for evaluating functions and interpreting statements that use function notation in the model Algebra I course.	

- **F-IF.B:** edited the "Interpreting Functions" cluster heading to clarify the model Algebra I course is limited to interpreting linear, quadratic, and exponential functions.
- **F-BF.B. 3:** edited to clarify the focus for writing functions (including linear, quadratic, and exponential) that model relationships and building new functions from existing functions (including linear, quadratic, exponential, and absolute value) for the model Algebra I course.

MP.4: Model with mathematics and MP.7: Look for and make use of structure.

Vocabulary	Resources	Assessment
parabola quadratic parent function vertex form of a quadratic function standard form of a quadratic function quadratic regression vertex motion model	enVision Algebra 1 – Volume 2 - Topic 8 Math modeling in 3 acts Vocabulary support Topic Review Graphing technology activities Formative assessments (admit and exit tickets) Reteach and build understandings Additional practice Readiness assessment Lesson quizzes Assessments Form A and B enVision STEM	Topic Review Topic Readiness Assessment Topic Performance Assessment Topic Assessment Forms A and B Formative assessments (admit and exit tickets) Lesson quizzes Topic assessment

Algebra I Curriculum Map

Unit 9: Solving Quadratic Equations

Pacing: 16-17 Days (March thru Mid-April)

From the previous year, students should have mastered:	
The methods for solving linear equations and how to solve systems of linear equations by graphing, substitution and elimination.	
Enduring Understandings	**Essential Questions**
• Using their knowledge of solving linear equations along with the Zero-Product Property, to solve the linear equations that result from factoring a quadratic equation.	• How do you use quadratic equations to model situations and solve problems?
By the end of this unit, students should be able to:	
• Use a graph to identify the x-intercepts as solutions of a quadratic equation. • Using a graphic calculator to make a table of values to approximate or solve a quadratic equation. • Use the Zero-Product Property and factoring to find the solutions of a quadratic equation. • Apply factoring to solve real-world problems. • Use the zeros of a quadratic equation to sketch a graph. • Write the factored form of a quadratic function from a graph. • Use the properties of exponents to rewrite radical expressions. • Multiply radical expressions. • Write a radical expression to model or represent a real-world problem. • Solve quadratic equations by finding square roots. • Determine reasonable solutions for real-world problems. • Solve a quadratic trinomial by completing the square to transform a quadratic equation into a perfect square trinomial. • Use completing the square to write a quadratic equation in vertex form. • Derive the quadratic formula by completing the square. • Solve quadratic equations in one variable by using the quadratic formula. • Use the discriminate to determine the number and type of solutions to a quadratic equation. • Use mathematical modeling to represent a problem situation and to propose a solution. • Test and verify the appropriateness of their math models. • Explain why the results from a mathematical model might not align exactly with the problem situation. • Describe a linear-quadratic system of equations. • Solve a linear-quadratic system of equations by graphing, estimation, or substitution.	

Learning Standards		
HSA.CED.A.2 – HSA.REI.D.11 – HSA.CED.A.1 – HSA.REI.B.4.B – HSA.SSE.B.3.A – HSA.APR.B.3 – HSF.IF.C.8.A – HSN.RN.A.2 – HSA.SSE.A.2 - HSA.SSE.B.3.B - HSA.REI.B.4.A - HSA.SSE.B.3 - HSA.CED.A.3 - HSA.REI.B.4 - HSA.REI.C.7 - HSA.REI.D.11 MP.1: make sense of problems and persevere in solving them and MP.2: Reason abstractly and quantitatively		
Vocabulary	Resources	Assessment
quadratic equation zeros of a function standard form of a quadratic equation Zero-Product Property Product Property of Square Roots completing the square discriminant quadratic formula root linear-quadratic system	enVision Algebra 1 – Volume 2 - Topic 9 Math modeling in 3 acts Vocabulary support Topic Review Graphing technology activities Formative assessments (admit and exit tickets) Reteach and build understandings Additional practice Readiness assessment Lesson quizzes Assessments Form A and B enVision STEM	Topic Review Topic Readiness Assessment Topic Performance Assessment Topic Assessment Forms A and B Formative assessments (admit and exit tickets) Lesson quizzes Topic assessment

Unit 10: Working with Functions

Pacing: 17 Days (Mid-April thru Mid-May)

<table>
<tr><td colspan="2">From the previous year, students should have mastered:</td></tr>
<tr><td colspan="2">Translating functions of any kind including absolute value functions. Identifying the key features of exponential functions including square root and cube root functions. Calculating the average rate of change over an interval of a quadratic function, a square root and a cube root.</td></tr>
<tr><td>Enduring Understandings</td><td>Essential Questions</td></tr>
<tr><td>• Learning how to translate square root and cube root functions.
• Learning to graph and analyze translations of absolute value, exponential, quadratic and radical functions and transform them all as well by stretching and compressing their graphs.</td><td>• What are some operations on functions that you can use to create models and solve problems?</td></tr>
<tr><td colspan="2">By the end of this unit, students should be able to:</td></tr>
<tr><td colspan="2">• Graph translations of the square root functions.
• Calculate and interpret the average rate of change for a square root function over a specified interval.
• Identify key features of the graph of cube root functions and graph translations of them.
• Model real-world situations using the cube root function.
• Calculate and interpret the average rate of change of a cube root function over a specified interval.
• Relate the domain and range of a function to its graph.
• Analyze the key features of a graph of a function to identify the type of function it represents.
• Graph translations of absolute value, exponential, quadratic and radical functions.
• Determine how combining translations affects the key features of the graph of a function.
• Identify the effect on the graph of a function of multiplying the output by -1.
• Identify the effect on the graph of a function of replacing f(x) by kf(x) or f(kx) for specific values of k.
• Use mathematical modeling to represent a problem situation and to propose a solution.
• Test and verify the appropriateness of their math models.
• Explain why the results from a mathematical model might not align exactly with the problem situation.
• Combine functions using arithmetic operations including addition, subtraction, and multiplication.
• Combine functions to solve real-world problems.
• Write an equation for the inverse of a linear function.
• Write the inverse of a quadratic function after restricting the domain so the original function is one-to-one.</td></tr>
<tr><td colspan="2">Learning Standards</td></tr>
<tr><td colspan="2">HSF.IF.B.4 - HSF.IF.B.6 - HSF.IF.C.7.B - HSF.IF.B.5 - HSF.BF.B.3 - HSF.BF.A.1.B - HSF.BF.B.4 - HSF.BF.B.4.A</td></tr>
</table>

- **F-IF.B:** edited the "Interpreting Functions" cluster heading to clarify the model Algebra I course is limited to interpreting linear, quadratic, and exponential functions.
- **F-IF.B:** edited the "Interpreting Functions" cluster heading to clarify the model Algebra I course is limited to interpreting linear, quadratic, and exponential functions.
- **F-BF.B. 3:** edited to clarify the focus for writing functions (including linear, quadratic, and exponential) that model relationships and building new functions from existing functions (including linear, quadratic, exponential, and absolute value) for the model Algebra I course.

MP.5: Use appropriate tools strategically and MP.6: Attend to precision.

Vocabulary	Resources	Assessment
square root function cube root function inverse of a function	enVision Algebra 1 – Volume 2 - Topic 10 Math modeling in 3 acts Vocabulary support Topic Review Graphing technology activities Formative assessments (admit and exit tickets) Reteach and build understandings Additional practice Readiness assessment Lesson quizzes Assessments Form A and B enVision STEM	Topic Review Topic Readiness Assessment Topic Performance Assessment Topic Assessment Forms A and B Formative assessments (admit and exit tickets) Lesson quizzes Topic assessment

Algebra I Curriculum Map

Unit 11: Statistics

Pacing: 12-13 Days (Mid May thru June)

<table>
<tr><td colspan="2">From the previous year, students should have mastered:</td></tr>
<tr><td colspan="2">Using dot plots, box plots, and histograms to represent data and use these data displays to interpret and compare data.
Calculating measures of center and spread, including mean, median, mean absolute deviation(MAD), and interquartile range (IQR).</td></tr>
<tr><td>Enduring Understandings</td><td>Essential Questions</td></tr>
<tr><td>• Continuing to represent data using dot plots, box plots, and histograms and use them to make inferences about the data.
• Calculating measures of center and spread, including mean, median, mean absolute deviation(MAD), and interquartile range (IQR) and use them to make inferences based on the data.
• Relating the shape of data displays to measures such as mean, median and MAD.
• Using standard deviation to qualify and analyze the spread of data while calculating measures of frequency to also analyze and interpret categorical data using two-way frequency tables.</td><td>• How do you use statistics to model situations and solve problems?</td></tr>
<tr><td colspan="2">By the end of this unit, students should be able to:</td></tr>
<tr><td colspan="2">• Represent data using dot plots, box plots, and histograms and interpret data displayed in dot plots, box plots, and histograms within the context of the data that it represents.
• Use measures of center to interpret and compare data sets displayed in dot plots, box plots, and histograms.
• Explain and account for the effect of outliers on measures of center and variability.
• Use measures of variability such as the MAD and IQR to interpret and compare data sets.
• Interpret and compare differences in the shape, center and spread of data of different data sets.
• Determine the relationship between the mean and median of a data set when the shape of the data is evenly spread, skewed, right or skewed left.
• Interpret differences in the variability or spread in the context of a data set.
• Calculate the standard deviation of a set of data and use it to compare and interpret data sets.
• Organize and summarize categorical data by creating two-way frequency tables.
• Calculate and interpret joint and marginal frequencies, joint and marginal relative frequencies, and conditional relative frequencies, and use them to make inferences about a population.
• Use mathematical modeling to represent a problem situation and to propose a solution.
• Test and verify the appropriateness of their math models.
• Explain why the results from a mathematical model might not align exactly with the problem situation.</td></tr>
</table>

Learning Standards		
HSS.ID.A.1 - HSS.ID.A.2 - HSS.ID.A.3 - HSA.ID.A.3 - HSS.ID.B.5 MP.2: Reason abstractly and quantitatively and MP.7: Look for and make use of structure.		
Vocabulary	Resources	Assessment
normal distribution standard deviation variance conditional relative frequency joint frequency joint relative frequency marginal frequency marginal relative frequency	enVision Algebra 1 – Volume 2 - Topic 11 Math modeling in 3 acts Vocabulary support Topic Review Graphing technology activities Formative assessments (admit and exit tickets) Reteach and build understandings Additional practice Readiness assessment Lesson quizzes Assessments Form A and B enVision STEM	Topic Review Topic Readiness Assessment Topic Performance Assessment Topic Assessment Forms A and B Formative assessments (admit and exit tickets) Lesson quizzes Topic assessment Final exam (created by teacher or district)

Algebra I
Content Standards
2016

Compiled using the Arkansas Mathematics Standards

Course Title:	Algebra I
Course/Unit Credit:	1
Course Number:	430000
Teacher Licensure:	Please refer to the Course Code Management System (https://adedata.arkansas.gov/ccms/) for the most current licensure codes.
Grades:	9-12

Course Description: The fundamental purpose of this course is to formalize and extend the mathematics that students learned in the middle grades. Because it is built on the middle grades standards, this is a more ambitious version of Algebra I than has generally been offered. The critical areas, called units, deepen and extend understanding of linear and exponential relationships by contrasting them with each other and by applying linear models to data that exhibit a linear trend, and students engage in methods for analyzing, solving, and using quadratic functions.

This document was created to delineate the standards for this course in a format familiar to the educators of Arkansas. For the state-provided Algebra A/B, Algebra I, Geometry A/B, Geometry, and Algebra II documents, the language and structure of the Arkansas Mathematics Standards (AMS) have been maintained. The following information is helpful to correctly read and understand this document.

> "**Standards** define what students should understand and be able to do.
> **Clusters** are groups of related standards. Note that standards from different clusters may sometimes be closely related, because mathematics is a connected subject.
> **Domains** are larger groups of related standards. Standards from different domains may sometimes be closely related." - http://www.corestandards.org/

Standards do not dictate curriculum or teaching methods. For example, just because topic A appears before topic B in the standards for a given grade, it does not necessarily mean that topic A must be taught before topic B. A teacher might prefer to teach topic B before topic A, or might choose to highlight connections by teaching topic A and topic B at the same time. Or, a teacher might prefer to teach a topic of his or her own choosing that leads, as a byproduct, to students reaching the standards for topics A and B.

Notes:

1. Teacher notes offer clarification of the standards.
2. The Plus Standards (+) from the Arkansas Mathematics Standards may be incorporated into the curriculum to adequately prepare students for more rigorous courses (e.g., Advanced Placement, International Baccalaureate, or concurrent credit courses).
3. Italicized words are defined in the glossary.
4. All items in a bulleted list must be taught.
5. Asterisks (*) identify potential opportunities to integrate content with the modeling practice.

The following abbreviations are for the conceptual categories and domains for the Arkansas Mathematics Standards. For example, the standard HSN.RN.B.3 is in the High School Number and Quantity conceptual category and in The Real Number System domain.

High School Number and Quantity – HSN
- The Real Number System – RN
- Quantities – Q
- The Complex Number System – CN
- Vectors and Matrix Quantities – VM

High School Algebra – HSA
- Seeing Structure in Expressions – SSE
- Arithmetic with Polynomials and Rational Expressions – APR
- Creating Equations – CED
- Reasoning with Equations and Inequalities – REI

High School Functions – HSF
- Interpreting Functions – IF
- Building Functions – BF
- Linear, Quadratic and Exponential Models – LE
- Trigonometric Functions – TF

High School Geometry – HSG
- Congruence – CO
- Similarity, Right Triangles, and Trigonometry – SRT
- Circles – C
- Expressing Geometric Properties with Equations – GPE
- Geometric Measurement and Dimension – GMD
- Modeling with Geometry – MG

High School Statistics and Probability – HSS
- Interpreting Categorical and Quantitative Data – ID
- Making Inferences and Justifying Conclusions – IC
- Conditional Probability and the Rules of Probability – CP
- Using Probability to Make Decisions – MD

Domain	Cluster
The Real Number System	
	1. Use properties of rational and irrational numbers
Quantities*	
	2. Reason quantitatively and use units to solve problems
Seeing Structure in Expressions	
	3. Interpret the structure of expressions
	4. Write expressions in equivalent forms to solve problems
Arithmetic with Polynomials and Rational Expressions	
	5. Perform arithmetic operations on polynomials
	6. Understand the relationship between zeros and factors of polynomials
	7. Use polynomial identities to solve problems
	8. Rewrite rational expressions
Creating Equations*	
	9. Create equations that describe numbers or relationships
Reasoning with Equations and Inequalities	
	10. Understand solving equations as a process of reasoning and explain the reasoning
	11. Solve equations and inequalities in one variable
	12. Solve systems of equations and inequalities graphically
	13. Solve systems of equations
Interpreting Functions	
	14. Understand the concept of a function and use function notation
	15. Interpret functions that arise in applications in terms of the context
	16. Analyze functions using different representations
Building Functions	
	17. Build a function that models a relationship between two quantities
	18. Build new functions from existing functions
Linear, Quadratic, and Exponential Models*	
	19. Construct and compare linear, quadratic, and exponential models and solve problems
	20. Interpret expressions for functions in terms of the situation they model
Interpreting categorical and quantitative data	
	21. Summarize, represent, and interpret data on a single count or measurement variable
	22. Summarize, represent, and interpret data on two categorical and quantitative variables
	23. Interpret linear models

Domain: The Real Number System

Cluster(s): 1. Use properties of rational and irrational numbers

HSN.RN.B.3	1	Explain why: • The sum/difference or product/quotient (where defined) of two *rational numbers* is *rational* • The sum/difference of a *rational number* and an *irrational number* is *irrational* • The product/quotient of a nonzero *rational number* and an *irrational number* is *irrational* • The product/quotient of two nonzero *rational numbers* is a nonzero *rational*
HSN.RN.B.4	1	• Simplify *radical expressions* • Perform operations (add, subtract, multiply, and divide) with *radical expressions* • Rationalize denominators and/or numerators

Domain: Quantities*

Cluster(s): 2. Reason quantitatively and use units to solve problems

HSN.Q.A.1	2	• Use units as a way to understand problems and to guide the solution of multi-step problems • Choose and interpret units consistently in formulas • Choose and interpret the scale and the origin in graphs and data displays
HSN.Q.A.2	2	Define appropriate quantities for the purpose of descriptive modeling (i.e., use units appropriate to the problem being solved) Limitation: This standard will be assessed in Algebra I by ensuring that some modeling tasks (involving Algebra I content or securely held content from grades 6-8) require the student to create a quantity of interest in the situation being described (i.e., a quantity of interest is not selected for the student by the task). For example, in a situation involving data, the student might autonomously decide that a measure of center is a key variable in a situation, and then choose to work with the mean.
HSN.Q.A.3	2	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities

Domain: Seeing Structure in Expressions
Cluster(s): 3. Interpret the structure of expressions
4. Write expressions in equivalent forms to solve problems

HSA.SSE.A.1	3	Interpret *expressions* that represent a quantity in terms of its context* • Interpret parts of an *expression* using appropriate vocabulary, such as *terms*, *factors*, and *coefficients* • Interpret complicated *expressions* by viewing one or more of their parts as a single entity For example: Interpret $P(1 + r)^n$ as the product of P and a factor not depending on P.
HSA.SSE.A.2	3	Use the structure of an *expression* to identify ways to rewrite it For example: See that $(x + 3)(x + 3)$ is the same as $(x + 3)^2$ or $x^4 - y^4$ as $(x^2)^2 - (y^2)^2$, thus recognizing it as a difference of squares that can be factored as $(x^2 - y^2)(x^2 + y^2)$. Limitation: i) Tasks are limited to numerical expressions and polynomial expressions in one variable. ii) Examples: Recognize $53^2 - 47^2$ as a difference of squares and see an opportunity to rewrite it in the easier-to-evaluate form $(53 + 47)(53 - 47)$. See an opportunity to rewrite $a^2 + 9a + 14$ as $(a + 7)(a + 2)$.
HSA.SSE.B.3	4	Choose and produce an equivalent form of an *expression* to reveal and explain properties of the quantity represented by the *expression** • Factor a quadratic expression to reveal the *zeros* of the function it defines • Complete the square in a quadratic expression to reveal the *maximum* or *minimum* value of the function it defines Note: Students should be able to identify and use various forms of a quadratic expression to solve problems. o Standard Form: $ax^2 + bx + c$ o Factored Form: $a(x - r_1)(x - r_2)$ o Vertex Form: $a(x - h)^2 + k$ Limitation: i) Tasks have a real-world context. As described in the standard, there is an interplay between the mathematical structure of the expression and the structure of the situation such that choosing and producing an equivalent form of the expression reveals something about the situation. ii) Tasks are limited to exponential expressions with integer exponents.

Domain: Arithmetic with Polynomials and Rational Expressions

Cluster(s): 5. Perform arithmetic operations on polynomials
6. Understand the relationship between zeros and factors of polynomials
7. Use polynomial identities to solve problems
8. Rewrite rational expressions

HSA.APR.A.1	5	• Add, subtract, and multiply *polynomials* • Understand that *polynomials*, like the integers, are closed under addition, subtraction, and multiplication Note: If p and q are polynomials $p + q$, $p - q$, and pq are also polynomials.
HSA.APR.B.3	6	• Identify *zeros* of *polynomials* (linear, quadratic only) when suitable factorizations are available • Use the *zeros* to construct a rough graph of the function defined by the *polynomial*
HSA.APR.C.4	7	Prove polynomial identities and use them to describe numerical relationships Note: Examples of Polynomial Identities may include but are not limited to the following: • $(a + b)^2 = a^2 + 2ab + b^2$ (Algebra 1) • $a^2 - b^2 = (a - b)(a + b)$ (Algebra 1)
HSA.APR.D.7	8	• Add, subtract, multiply, and divide by nonzero rational expressions • Understand that rational expressions, like the integers, are closed under addition, subtraction, and multiplication

Domain: Creating Equations*

Cluster(s): 9. Create equations that describe numbers or relationships

HSA.CED.A.1	9	Create *equations* and *inequalities* in one *variable* and use them to solve problems Note: Including but not limited to *equations* arising from: • *Linear functions* • *Quadratic functions* • *Exponential functions* • *Absolute value functions*
HSA.CED.A.2	9	• Create *equations* in two or more *variables* to represent relationships between quantities • Graph equations, in two *variables*, on a *coordinate plane*
HSA.CED.A.3	9	• Represent and interpret constraints by *equations* or *inequalities*, and by *systems of equations* and/or *inequalities* • Interpret solutions as viable or nonviable options in a modeling and/or real-world context
HSA.CED.A.4	9	Rearrange *literal equations* using the properties of equality

Domain: Reasoning with Equations and Inequalities

Cluster(s): 10. Understand solving equations as a process of reasoning and explain the reasoning
11. Solve equations and inequalities in one variable
12. Solve systems of equations and inequalities graphically
13. Solve systems of equations

HSA.REI.A.1	10	Assuming that *equations* have a solution, construct a solution and justify the reasoning used Note: Students are not required to use only one procedure to solve problems nor are they required to show each step of the process. Students should be able to justify their solution in their own words. (limited to quadratics)
HSA.REI.A.2	10	Solve simple rational and radical equations in one *variable*, and give examples showing how *extraneous solutions* may arise For example: The area of a square equals 49 square inches. The length of the side is 7 inches. Although -7 is a solution to the equation, $x^2 = 49$, -7 is an extraneous solution.
HSA.REI.B.3	11	Solve linear equations, inequalities and *absolute value equations* in one *variable*, including *equations* with *coefficients* represented by letters
HSA.REI.B.4	11	Solve quadratic equations in one *variable* • Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x - p)^2 = q$ that has the same solutions Note: This would be a good opportunity to demonstrate/explore how the quadratic formula is derived. This standard also connects to the transformations of *functions* and identifying key features of a graph (F-BF3). Introduce this with a leading coefficient of 1 in Algebra I. Finish mastery in Algebra II. • Solve quadratic equations (as appropriate to the initial form of the equation) by: o Inspection of a graph o Taking square roots o Completing the square o Using the quadratic formula o Factoring Recognize complex solutions and write them as $a \pm bi$ for real numbers a and b (Algebra 2 only) Limitation: i) Tasks do not require students to write solutions for quadratic equations that have roots with nonzero imaginary parts. However, tasks can require the student to recognize cases in which a quadratic equation has no real solutions. Note: Solving a quadratic equation by factoring relies on the connection between *zeros* and *factors* of polynomials (cluster A-APR.B). Cluster A-APR.B is formally assessed in Algebra II.

Domain: Reasoning with Equations and Inequalities

Cluster(s): 10. Understand solving equations as a process of reasoning and explain the reasoning
11. Solve equations and inequalities in one variable
12. Solve systems of equations and inequalities graphically
13. Solve systems of equations

HSA.REI.C.5	12	• Solve *systems of equations* in two variables using substitution and elimination • Understand that the solution to a system of equations will be the same when using substitution and elimination
HSA.REI.C.6	12	Solve *systems of equations* algebraically and graphically Limitation: i) Tasks have a real-world context. ii) Tasks have hallmarks of modeling as a mathematical practice (less defined tasks, more of the modeling cycle).
HSA.REI.C.7	12	Solve *systems of equations* consisting of linear equations and nonlinear equations in two variables algebraically and graphically For example: Find the points of intersection between $y = -3x$ and $y = x^2 + 2$.
HSA.REI.D.10	13	Understand that the graph of an equation in two variables is the set of all its solutions plotted in the *coordinate plane*
HSA.REI.D.11	13	Explain why the *x*-coordinates of the points where the graphs of the *equations* $y = f(x)$ and $y = g(x)$ intersect are the solutions of the equation $f(x) = g(x)$; Find the solutions approximately by: • Using technology to graph the *functions* • Making tables of values • Finding successive approximations Include cases (but not limited to) where $f(x)$ and/or $g(x)$ are: • Linear • Polynomial • Absolute value • Exponential (Introduction in Algebra 1, Mastery in Algebra 2) Teacher notes: Modeling should be applied throughout this standard.
HSA.REI.D.12	13	Solve linear inequalities and systems of linear inequalities in two variables by graphing

Domain: Interpreting Functions

Cluster(s): 14. Understand the concept of a function and use function notation
15. Interpret functions that arise in applications in terms of the context
16. Analyze functions using different representations

HSF.IF.A.1	14	• Understand that a *function* from one set (called the *domain*) to another set (called the *range*) assigns to each element of the *domain* exactly one element of the *range* • Understand that if *f* is a *function* and *x* is an element of its *domain*, then *f(x)* denotes the output of *f* corresponding to the input *x* • Understand that the graph of *f* is the graph of the equation $y = f(x)$
HSF.IF.A.2	14	In terms of a real-world context: • Use *function notation* • Evaluate *functions* for inputs in their *domains* • Interpret statements that use *function notation*
HSF.IF.A.3	14	Recognize that sequences are functions, sometimes defined recursively, whose *domain* is a subset of the integers For example: The Fibonacci sequence is defined recursively by $f(0) = f(1) = 1$, $f(n + 1) = f(n) + (n - 1)$ *for* $n \geq 1$.
HSF.IF.B.4	15	For a *function* that models a relationship between two quantities: • Interpret key features of graphs and tables in terms of the quantities, and • Sketch graphs showing key features given a verbal description of the relationship Note: Key features may include but not limited to: *intercepts*; intervals where the *function* is increasing, decreasing, positive, or negative; relative *maximums* and *minimums*; symmetries; *end behavior*; and periodicity.* Limitation: i) Tasks have a real-world context. ii) Tasks are limited to linear functions, quadratic functions, square root functions, cube root functions, piecewise-defined functions (including *step functions* and absolute value functions), and exponential functions with domains in the integers. Compare note (ii) with standard F-IF.7. The function types listed here are the same as those listed in the Algebra I column for standards F-IF.6 and F-IF.9.
HSF.IF.B.5	15	• Relate the *domain* of a *function* to its graph • Relate the *domain* of a *function* to the quantitative relationship it describes For example: If the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate *domain* for the *function*.*

Domain: Interpreting Functions

Cluster(s): 14. Understand the concept of a function and use function notation
15. Interpret functions that arise in applications in terms of the context
16. Analyze functions using different representations

HSF.IF.B.6	15	• Calculate and interpret the average *rate of change* of a *function* (presented algebraically or as a table) over a specified interval* • Estimate the *rate of change* from a graph* Limitation: i) Tasks have a real-world context. ii) Tasks are limited to linear functions, quadratic functions, square root functions, cube root functions, piecewise-defined functions (including *step functions* and absolute value functions), and exponential functions with domains in the integers. The function types listed here are the same as those listed in the Algebra I column for standards F-IF.4 and F-IF.9.
HSF.IF.C.7	16	Graph *functions* expressed algebraically and show key features of the graph, with and without technology • Graph *linear* and *quadratic functions* and, when applicable, show *intercepts*, maxima, and minima • Graph square root, cube root, and *piecewise-defined functions*, including *step functions* and *absolute value functions* • Graph *exponential functions*, showing *intercepts* and end behavior
HSF.IF.C.8	16	Write *expressions* for *functions* in different but equivalent forms to reveal key features of the *function* • Use the process of factoring and completing the square in a *quadratic function* to show *zeros*, extreme values (vertex), and symmetry of the graph, and interpret these in terms of a context. Note: Connection to A.SSE.B.3
HSF.IF.C.9	16	Compare properties of two *functions* each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions) Limitation: i) Tasks are limited to linear functions, quadratic functions, square root functions, cube root functions, piecewise-defined functions (including step functions and absolute value functions), and exponential functions with domains in the integers. The function types listed here are the same as those listed in the Algebra I column for standards F-IF.4 and F-IF.6.

Domain: Building Functions

Cluster(s): 17. Build a function that models a relationship between two quantities
18. Build new functions from existing functions

HSF.BF.A.1	17	Write a *function* that describes a relationship between two quantities* • From a context, determine an explicit expression, a recursive process, or steps for calculation Limitation: i) Tasks have a real-world context. ii) Tasks are limited to linear functions, quadratic functions, and exponential functions with domains in the integers.
HSF.BF.B.3	18	• Identify the effect on the graph of replacing *f(x)* by *f(x) + k*, *kf(x)*, *f(kx)* and *f(x + k)* for specific values of *k* (*k*, a *constant* both positive and negative) • Find the value of *k* given the graphs of the transformed *functions* • Experiment with multiple transformations and illustrate an explanation of the effects on the graph with or without technology Note: Include recognizing *even* and *odd functions* from their graphs and algebraic expressions for them. Limitation: i) Identifying the effect on the graph of replacing *f(x)* by *f(x) + k*, *kf(x)*, *f(kx)* and *f(x + k)* for specific values of *k* (both positive and negative) is limited to linear and quadratic functions. ii) Experimenting with cases and illustrating an explanation of the effects on the graph using technology is limited to linear functions, quadratic functions, square root functions, cube root functions, piecewise-defined functions (including step functions and absolute value functions), and exponential functions with domains in the integers. iii) Tasks do not involve recognizing even and odd functions. The function types listed in note (ii) are the same as those listed in the Algebra I column for standards F-IF.4, F-IF.6, and F-IF.9.

Domain: Linear, Quadratic, and Exponential Models*

Cluster(s): 19. Construct and compare linear, quadratic, and exponential models and solve problems

20. Interpret expressions for functions in terms of the situation they model

HSF.LE.A.1	19	Distinguish between situations that can be modeled with *linear functions* and with *exponential functions* • Show that *linear functions* grow by equal differences over equal intervals, and that *exponential functions* grow by equal factors over equal intervals • Recognize situations in which one quantity changes at a constant rate per unit interval relative to another • Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another
HSF.LE.A.2	19	Construct linear and exponential equations, including arithmetic and geometric sequences,: • given a graph • a description of a relationship • two input-output pairs (include reading these from a table) Limitation: i) Tasks are limited to constructing linear and exponential functions in simple context (not multi-step).
HSF.LE.A.3	19	Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or any polynomial function Note: The study of polynomial functions, in general, is reserved for Algebra 2. This standard leads to discussions of relative rates of growth in further coursework.
HSF.LE.B.5	20	In terms of a context, interpret the parameters (rates of growth or decay, *domain* and *range* restrictions where applicable, etc.) in a *function* Limitation: i) Tasks have a real-world context. ii) Exponential functions are limited to those with domains in the integers.

Domain: Interpreting categorical and quantitative data

Cluster(s): 21. Summarize, represent, and interpret data on a single count or measurement variable
22. Summarize, represent, and interpret data on two categorical and quantitative variables
23. Interpret linear models

HSS.ID.A.1	21	Represent data with plots on the real number line (dot plots, histograms, and box plots)
HSS.ID.A.2	21	Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets
HSS.ID.A.3	21	Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers) For example: Be able to explain the effects of extremes or outliers on the measures of center and spread.
HSS.ID.B.5	22	• Summarize categorical data for two categories in two-way frequency tables • Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). • Recognize possible associations and trends in the data
HSS.ID.B.6	22	Represent data on two quantitative variables on a *scatter plot*, and describe how the variables are related • Fit a *function* to the data; use *functions* fitted to data to solve problems in the context of the data Note: Use given *functions* or choose a *function* suggested by the context. Emphasize linear, quadratic, and exponential models. The focus of Algebra I should be on linear and exponential models while the focus of Algebra II is more on quadratic and exponential models.
HSS.ID.C.7	23	Interpret the *slope* (*rate of change*) and the *intercept* (constant term) of a linear model in the context of the data
HSS.ID.C.8	23	Compute (using technology) and interpret the *correlation coefficient* of a linear fit
HSS.ID.C.9	23	Distinguish between *correlation* and *causation*

Absolute value equation	Any equation with absolute value symbols; $\|2x - 7\| = 21$
Absolute value function	Any function in the family with parent function $f(x) = \|x\|$
Absolute value inequality	Any inequality with absolute value symbols; $\|x + 2\| < 5$
Algebraic expression	A symbolic representation of mathematical operations that can involve both numbers and variables
Average rate of change	The difference between two output values divided by the difference between corresponding input values
Binomial	A polynomial with exactly two terms
Causation	A relationship in which changes in one variable cause changes in another variable
Coefficient	A number by which a variable is multiplied
Constant	A value that does not change
Coordinate plane	A plane spanned by the x- and y-axis
Correlation	An association between two variables that may or may not imply causation
Correlation Coefficient	A measure of how nearly a scatter plot falls on a straight line; the correlation coefficient is always between – 1 and +1
Cube root function	Any function in the family with parent function $f(x) = \sqrt[3]{x}$
Domain	The set of input values for a function
End behavior	The behavior of a graph of $f(x)$ as x approaches positive or negative infinity
Equation	A statement that has one value or algebraic expressions equal to another number or algebraic expression
Even function	A function symmetric with respect to the y-axis; $f(-x) = f(x)$ for all x in the domain of f
Exponential function	A function in which a variable appears in the exponent; $f(x) = 2^x$
Expression	A mathematical phrase consisting of numbers, variables, and operations
Extraneous solutions	A solution that emerges from the process of solving an equation but is not a valid solution to the original problem
Factor	One of the numbers, variables or expressions multiplied to obtain a product
Function	A rule or relationship in which there is exactly one output value for each input value
Function notation	The f(x) notation can be thought of as another way of representing the y-value in a function; for example $f(x) = 3x$
Inequality	A statement that has one quantity less than or greater than another; $<$, $>$, $\leq$, $\leq$
Intercept	Where the graph crosses the x-axis (x-intercept) or the y-axis (y-intercept)
Irrational number	A number that cannot be expressed as a fraction p/q for any integers p and q; have decimal expansions that neither terminate nor become periodic
Linear function	A function characterized by a constant rate of change
Literal equation	An equation where variables represent known values; $V=lwh$, $C=2\pi r$, $d=rt$
Maximum	The greatest value of a function
Minimum	The least value of a function
Monomial	A polynomial with only one term
Odd function	A function symmetric with respect to the origin; $f(-x) = -f(x)$
Piece-wise function	A function that consists of two or more functions defined on different intervals
Polynomial	A sum of terms that have positive integer exponents
Quadratic function	Any function in the family with parent function $f(x) = x^2$

Radical	The symbol used to represent a root; $\sqrt{}$
Radical expression	An expression containing a root symbol; $\sqrt{}$
Radicand	The quantity under a radical sign
Range	The set of output values for a function
Rational expression	A ratio of two polynomial expressions with a non-zero denominator; $\frac{3x+1}{x+2}$
Rational number	A number that can be written as a ratio of two integers
Scatter plot	A two-variable data display in which values on a horizontal axis represent value of one variable and values on a vertical axis represent values of the other variable
Slope	The ratio of the vertical change to the horizontal change between two points on a line
Square root function	Any function in the family with parent function $f(x)=\sqrt{x}$
Step function	A function whose graph consists of a series of horizontal line segments
Systems of equations	A set of two or more equations with the same variables
Term	An algebraic expression that represents only multiplication and division between variables and constants
Trinomial	A polynomial with exactly three terms
Variable	A symbol used to represent an unknown or undetermined value in an expression or equation
Zeros	The values of the independent variable (*x*-value) that make the corresponding values of the function equal to zero

Table 1: Properties of Operations

Associative property of addition	(a + b) + c = a + (b + c)
Commutative property of addition	a + b = b + a
Additive identity property of 0	a + 0 = 0 + a = a
Existence of additive inverses	For every a there exists –a so that *a + (-a) = (-a) + a = 0*
Associative property of multiplication	(a x b) x c = a x (b x c) *
Commutative property of multiplication	a x b = b x a *
Multiplicative identity property 1	a x 1 = 1a = a *
Existence of multiplication inverses	For every a ≠ 0 there exists 1/*a* so that a x 1/a = 1/a x a = 1 *
Distributive property of multiplication over addition	a x (b + c) = a x b + a x c *

*The x represents multiplication not a variable.

Table 2: Properties of Equality

Reflexive property of equality	a = a
Symmetric property of equality	If a = b, then b = a.
Transitive property of equality	If a = b and b = c, then a = c.
Addition property of equality	If a = b, then a + c = b + c.
Subtraction property of equality	If a = b, then a – c = b – c.
Multiplication property of equality	If a = b, then a x c = b x c. *
Division property of equality	If a = b and c ≠ 0, then a ÷ c = b ÷ c.
Substitution property of equality	If a = b, then b may be substituted for a in any expression containing a.

*The x represents multiplication not a variable.

Table 3: Properties of Inequality

Exactly one of the following is true: a < b, a = b, a > b.
If a > b and b > c, then a > c.
If a > b, b < a.
If a > b, then a ± c > b ± c.
If a > b and c > 0, then a x c > b x c. *
If a > b and c < 0, then a x c < b x c. *
If a > b and c > 0, then a ÷ c > b ÷ c.
If a > b and c < 0, then a ÷ c < b ÷ c.

*The x represents multiplication not a variable.