ALGEBRA 1 ACTION PLAN

Overview	STANDARDS	FOCUS: STUDENTS…	RESOURCES	STRATEGIES BEST PRACTICES
SUB-CLAIM A: MAJOR CONTENT	A.SSE.A.1 A.SSE.A.2 A.CED.A.1 A.CED.A.2 A.CED.A.3 A.CED.A.4 A.REI.A.1 A.REI.B.3 A.REI.B.4 A.REI.D.10 A.REI.D.11 A.REI.D.12 A.APR.A.1 S.ID.C.7 S.ID.C.8 S.ID.C.9 F.IF.A.1 F.IF.A.2 F.IF.A.3 F.IF.B.4 F.IF.B.5 F.IF.B.6	Writes equivalent numerical and polynomial expressions in one variable, using addition, subtraction, multiplication and factoring. Interprets parts of exponential and quadratic expressions that represent a quantity in terms of its context. Determines if a given relation is a function. Evaluates with and uses function notation within a context. Given a context, writes a linear function. For linear and quadratic functions that model contextual relationships, determines key features and graphs the function. Determines the domain and relates it to the quantitative relationship it describes for linear, quadratic and exponential (limited to domains in the integers) functions. Calculates the average rate of change of linear, exponential and quadratic functions (presented symbolically or as a table) over a specified interval and estimate the rate of change from a graph. Algebraically solves linear equations, linear inequalities and quadratics in one variable (at complexity	A.SSE.A.1 Kitchen Floor Tiles A.SSE.A.1 Mixing Candies A.SSE.A.2 Equivalent Expressions A.CED.A.1 Planes and wheat A-CED.A.1 Paying the rent A.CED.A.2 Clea on an Escalator A.CED.A.3 Dimes and Quarters A.CED.A.4 Equations and Formulas A.REI.B.3, A.REI.A.1 Reasoning with linear inequalities A.REI.A.1 Zero Product Property 1 A.REI.B.4 Visualizing Completing the Square A.REI.B.4 Braking Distance A.REI.B.4 Two Squares are Equal A.REI.D.11 Introduction to Polynomials – College Fund A.REI.D.12 Fishing Adventures 3 S.ID.B.6,S.ID.C.7-9 Coffee and Crime F.IF.A.1 The Parking Lot F.IF.A.2 Yam in the Oven F.IF.B.4 Warming and Cooling F.IF.B.4, F.IF.B.5 Average Cost F.IF.B.4 Words – Tables - Graphs F.IF.B.4 The Aquarium F.IF.B.4 Containers F.IF.B.4-5 The Canoe Trip, Variation 2 F.IF.B.5 The restaurant F.IF.B.6 Temperature Change F.IF.B.6 Mathemafish Population https://prc.parcconline.org/system/files/Algebra%201%20-%20EOY%20-%20Alignment%20Document_March%202016_v2.pdf https://prc.parcconline.org/system/files/Algebra%201%20-%20EOY%20-%20Item%20Set_0.pdf	Clarification of Standards, Mathematical Practices, and limits, emphases, and other information intended to ensure appropriate variety in tasks can be found through the following links: file:///C:/Users/george.droste/Downloads/Algebra1-ES-Description-PBA-EOY-2%20(3).pdf http://www.state.nj.us/education/cccs/2016/math/standards.pdf http://www.insidemathematics.org/common-core-resources/mathematical-practice-standards https://www.louisianabelieves.com/docs/common-core-state-standards-resources/guide--teacher-planning-for-math-practice-implementation.pdf?sfvrsn=2 Departmental Practices: • Establish norms for collaboration. Establish math leadership teams. • Sharing in development of common lesson plans within PARCC tested areas. • Monthly submission of common assessments (Benchmarks; Unit/Chapter Assessments) for Algebra 1, Geometry, and Algebra 2 • Completion of EPP's (Electronic) for all students after the end of each Marking Period (4X). • Ensure that the mathematics curriculum is vertically and horizontally articulated. • Integrate the use of technology across all mathematics courses and provide students access to a variety of technology tools.

		appropriate to the course), including those with coefficients represented by letters. Graphs the solution sets of equations, linear inequalities and systems of linear equations and linear inequalities. Finds the solutions to two polynomial functions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations.	https://prc.parcconline.org/system/files/Algebra%201%20-%20EOY%20-%20Key_0706_2016.pdf https://prc.parcconline.org/system/files/Algebra%201%20-%20PBA%20-%20Alignment%20Document_March%202016_v2.pdf https://prc.parcconline.org/system/files/Algebra%201%20-%20PBA%20-%20Item%20Set_0.pdf https://prc.parcconline.org/system/files/Algebra%201%20-%20PBA%20-%20Key_March%202016_v2_0.pdf https://prc.parcconline.org/system/files/Integrated%20Math%201%20-%20EOY%20-%20Alignment%20Document_March%202016.pdf https://prc.parcconline.org/system/files/Integrated%20Math%201%20-%20EOY%20-%20Item%20Set.pdf https://prc.parcconline.org/system/files/Integrated%20Math%201%20-%20EOY%20-%20Released%20Answer%20Key.pdf https://parcc.pearson.com/resources/practice-tests/math/algebra-1/eoy/PC194891-001_ALG1TB_PT.pdf http://www.parcconline.org/files/142/Online%20EOY/307/Alg%201%20Practice%20Test%20w%20Integrated%20Alignment.pdf https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=7&cad=rja&uact=8&ved=0ahUKEwiw94SKr6jOAhUh_IMKHQRIC4YQFghGMAY&url=http%3A%2F%2Fnextgen.apps.sparcc.org%2Fmath%2F9-12&usg=AFQjCNH0dxFWbwClhbcb4c4BDwRID2J76Q&sig2=8lL1Lzm4qZTp0tEzL4rvsA	• Encourage students to seek extra help through the following venues: Helping Hands; Enrichment; Honor Society; Supplied Electronic Resources; Teacher. • Seek specialized professional development. PLC Practices: • Establish norms for collaboration. • Identifying/Sharing Best Practices & Curricular Concerns. • Identifying/Unpacking/Clarifying Standards and Mathematical Practices for both teachers & students. • Development of Common Assessments (Benchmarks; Unit/Chapter Assessments) with identified standards for Algebra 1, Geometry, and Algebra 2 • Data Analysis/Course of Action derived from examination of formative/summative assessments.

SUB-CLAIM B: SUPPORTING & ADDITIONAL CONTENT	A.SSE.B.3
	A.APR.B.3
	A.REI.C.5
	A.REI.C.6
	F.BF.A.1
	F.BF.B.3
	F.IF.C.7
	F.IF.C.8
	F.IF.C.9
	F.LE.A.1
	F.LE.A.2
	F.LE.A.3
	F.LE.B.5
	N.Q.A.1
	N.Q.A.2
	N.Q.A.3
	N.RN.B.3
	S.ID.A.1
	S.ID.A.2
	S.ID.A.3
	S.ID.B.5
	S.ID.B.6
		Identifies rational and irrational numbers.
		
		Calculates sums and products of two rational and/or irrational numbers.
		
		Determines equivalent forms of quadratic expressions and functions.
		
		Uses equivalent forms to reveal and explain zeros, extreme values and symmetry.
		
		Graphs linear, quadratic and cubic (in which linear and quadratic factors are available) functions, showing key features.
		
		Identifies the effects of a single transformation on graphs of linear and quadratic functions, including f(x)+k, kf(x), f(kx) and f(x+k), and finds the value of k given a transformed graph.
		
		Writes systems of linear equations in multi-step contextual problems.
		
		Represents linear and exponential (with domain in the integers) functions symbolically, graphically and with input-output pairs to solve mathematical problems.
		
		Compares the properties of two functions represented in different ways, limited to linear, quadratic, and exponential (with domains in the integers).
		
		Determines appropriate representations of categorical and quantitative data, summarizing the
			A.SSE.B.3 Profit of a company
			A.SSE.B.3 Rewriting a Quadratic Expression
			A.APR.B.3 Graphing from Factors 1
			A.REI.C.5 Solving Two Equations in Two Unknowns
			A.REI.C.6 Cash Box
			F.BF.A.1a Skeleton Tower
			F.BF.B.3 Identifying Even and Odd Functions
			F.BF.B.3 Transforming the graph of a function
			F.IF.C.7a Graphs of Quadratic Functions
			F.IF.C.7b Bank Account Balance
			F.IF.C.8a Springboard Dive
			F.IF.C.8a Which Function?
			F.IF.C.9 Throwing Baseballs
			F.LE.A.1 Finding Linear and Exponential Models
			F.LE.A.2 Interesting Interest Rates
			F.LE.A.3 Population and Food Supply
			F.LE.B.5 US Population 1982-1988
			N.Q.A.1 Runners' World
			N.Q.A.2 Giving Raises
			N.Q.A.3 Calories in a Sports Drink
			N.RN.B.3 Operations with Rational and Irrational Numbers
			S.ID.B.6,S.ID.C.7-9 Coffee and Crime
			S.ID.A.1-3 Haircut Costs
			S.ID.A.1-3 Speed Trap
			S.ID.A.2-3 Measuring Variability in a Data Set
			S.ID.A.3 Identifying Outliers
			S.ID.B.5 Support for a Longer School Day?
			S.ID.B.6 Laptop Battery Charge 2
			
			https://prc.parcconline.org/system/files/Algebra%201%20-%20EOY%20-%20Alignment%20Document_March%202016_v2.pdf
			
			https://prc.parcconline.org/system/files/Algebra%201%20-%20EOY%20-%20Item%20Set_0.pdf
			
			https://prc.parcconline.org/system/files/Algebra%201%20-%20EOY%20-%20Key_0706_2016.pdf
				Classroom Practices:
				
				• Utilize entrance/exit activities as a means to check for understanding and as a basis for building new knowledge.
				• Differentiate instruction through flexible grouping, individualizing lessons, compacting, using tiered assignments, and varying question level.
				• Have students discuss solve problem structures and solutions to make connections among strategies and reasoning. Questions to facilitate discussion of solve problems:
				  ○ What were the steps involved in solving the problem? Would they work in a different order?
				  ○ Can anyone think of a different way to solve this problem?
				  ○ Will this strategy always work? Why?
				• Select solved problems that reflect the lesson's instructional objective, including problems that illustrate common errors.
				  ○ Select problems with varying levels of difficulty and arrange them from the simplest to the most complex applications of the same concept.
				  ○ Display the multiple examples simultaneously to encourage students to recognize patterns in the solution steps across problems
				  ○ Alternatively, show the problems individually, one after the other, to facilitate more detailed discussion on each problem.
				  ○ Parallel correct and incorrect solved problems to facilitate discussion on each problem.
				• Use whole-class discussions, small-group work (Cooperative Learning), and independent practice

		data and characteristics of the representations.	https://prc.parcconline.org/system/files/Algebra%201%20-%20PBA%20-%20Alignment%20Document_March%202016_v2.pdf https://prc.parcconline.org/system/files/Algebra%201%20-%20PBA%20-%20Item%20Set_0.pdf https://prc.parcconline.org/system/files/Algebra%201%20-%20PBA%20-%20Key_March%202016_v2_0.pdf https://prc.parcconline.org/system/files/Integrated%20Math%201%20-%20EOY%20-%20Alignment%20Document_March%202016.pdf https://prc.parcconline.org/system/files/Integrated%20Math%201%20-%20EOY%20-%20Item%20Set.pdf https://prc.parcconline.org/system/files/Integrated%20Math%201%20-%20EOY%20-%20Released%20Answer%20Key.pdf https://parcc.pearson.com/resources/practice-tests/math/algebra-1/eoy/PC194891-001_ALG1TB_PT.pdf http://www.parcconline.org/files/142/Online%20EOY/307/Alg%201%20Practice%20Test%20w%20Integrated%20Alignment.pdf https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=7&cad=rja&uact=8&ved=0ahUKEwiw94SKr6jOAhUh_IMKHQRIC4YQFghGMAY&url=http%3A%2F%2Fnextgen.apps.sparcc.org%2Fmath%2F9-12&usg=AFQjCNH0dxFWbwClhbcb4c4BDwRID2J76Q&sig2=8lL1Lzm4qZTp0tEzL4rvsA	activities to introduce, elaborate on, and practice working with solved problems. ○ Think, write, pair, share. ○ Partner Coaching • Promote the use of language that reflects mathematical structure. ○ During whole-class instruction, teachers can rephrase student solutions and responses to questions using appropriate mathematical language instead of vague, non-mathematical language. • Encourage students to use reflective questioning to notice structure as they solve problems. Reflective questions for noticing structure: ○ How would I describe this problem using precise mathematical language? ○ How many variables are there? ○ What am I trying to solve for? • Teach students that different algebraic/geometric representations can convey different information about an algebra/geometry problem. • Teach students to recognize and generate strategies for solving problems. Reflective questions for selecting and considering solution strategies: ○ Of the strategies I know, which seem to best fit this particular problem? Why? ○ Is there anything special about this problem that suggests that a particular strategy is or is not applicable or a good idea? ○ Why did I choose this strategy to solve this problem? • Encourage students to articulate the reasoning behind their choice of strategy and mathematical validity of their strategy when solving problems. Ask students working collaboratively/independently to

				write out/discuss their strategic reasoning in addition to solving the problem. • Have students in small groups evaluate and compare different strategies for solving problems. **Principle of Instruction:** https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=2&cad=rja&uact=8&ved=0ahUKEwjCzcbpjOfOAhXBCMAKHfxkA1IQFggsMAE&url=https%3A%2F%2Fwww.aft.org%2Fsites%2Fdefault%2Ffiles%2Fperiodicals%2FRosenshine.pdf&usg=AFQjCNFubmVp1n5CkTQ5ZmnZH8lNREmySQ&sig2=EPja1dDvQ01v16KJR2DFnQ
SUB-CLAIM C: CONNECTIONS TO CONTENT: REASONING	Base explanations/ reasoning on the properties of rational and irrational numbers Content scope: N-RN.3 Given an equation or system of equations, reason about the number or nature of the solutions Content scope: A-REI.4a, A-REI.4b, limited to real solutions only.	In connection with the content knowledge, skills, and abilities described in Sub-claims A (Major Content) and B (Supporting Content), the student clearly constructs and communicates a response based on: • the principle that a graph of an equation in two variables is the set of all its solutions • reasoning about linear and exponential growth • properties of rational numbers of rational numbers or irrational numbers • transformations of functions • a chain of reasoning to justify or refute algebraic, function, or linear-equation propositions or conjectures • a given equation or system of equations	https://prc.parcconline.org/system/files/Algebra%201%20-%20PBA%20-%20Alignment%20Document_March%202016_v2.pdf https://prc.parcconline.org/system/files/Algebra%201%20-%20PBA%20-%20Item%20Set_0.pdf https://prc.parcconline.org/system/files/Algebra%201%20-%20PBA%20-%20Key_March%202016_v2_0.pdf https://prc.parcconline.org/system/files/Integrated%20Math%201%20-%20PBA%20-%20Alignment%20Document_March%202016_v2.pdf https://prc.parcconline.org/system/files/Integrated%20Math%201%20-%20PBA%20-%20Item%20Set.pdf https://prc.parcconline.org/system/files/Integrated%20Math%201%20-%20PBA%20-%20Released%20Answer%20Key_v2.pdf	**Mathematical Practice #3: Construct Viable Arguments** **Summary of Standard:** • Analyze problems and use stated mathematical assumptions, definitions, and established results in constructing arguments. • Justify conclusions with mathematical ideas. • Listen to the arguments of others and ask useful questions to determine if an argument makes sense. • Ask clarifying questions or suggest ideas to improve/revise the argument. • Compare two arguments and determine correct or flawed logic. **Questions to Develop Mathematical Thinking:** What mathematical evidence supports your solution? How can you be sure that...? / How could you prove that...? Will it still work if...? What were you considering when...? How did you decide to try that strategy? How did you test whether your approach worked? How did you decide what the problem was asking you to find? (What was unknown?) Did you try a method that did not work? Why didn't it work? Would

	Given a system of equations, reason about the number or nature of the solutions. Content scope: A-REI.5 Given an equation or system of equations, reason about the number or nature of the solutions. Content scope: A-REI.11, limited to equations of the form f(x) = g(x) where f and g are linear or quadratic. Base explanations/ reasoning on the principle that the graph of an equation and inequalities in two variables is the set of all its solutions plotted in the coordinate plane. Content scope: A-REI.D, excluding exponential and logarithmic functions.	• the number or nature of solutions by: • using a logical approach based on a conjecture and/or stated assumptions, utilizing mathematical connections (when appropriate) • providing a logical progression of steps or chain of reasoning with appropriate justification • performing precise calculations • using correct grade-level vocabulary, symbols and labels • providing a justification of a conclusion • evaluating, interpreting and critiquing the validity of others' responses, approaches and reasoning - utilizing mathematical connections (when appropriate)	https://parcc.pearson.com/resources/Practice_Tests/Algebra_I/Math/PC194882-001_AlgIOPTB_PT.pdf http://www.parcconline.org/files/141/Online%20PBA/300/Math-algebra1-online-pba-practicetest-answerkey.pdf https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=7&cad=rja&uact=8&ved=0ahUKEwiw94SKr6jOAhUh_IMKHQRIC4YQFghGMAY&url=http%3A%2F%2Fnextgen.apps.sparcc.org%2Fmath%2F9-12&usg=AFQjCNH0dxFWbwClhbcb4c4BDwRID2J76Q&sig2=8lL1Lzm4qZTp0tEzL4rvsA	it ever work? Why or why not? What is the same and what is different about...? How could you demonstrate a counter-example? **Implementation Characteristics; What does it look like in planning & delivery?** **TASK:** Is structured to bring out multiple representations, approaches, or error analysis. Embeds discussion and communication of reasoning and justification with others. Requires students to provide evidence to explain their thinking beyond merely using computational skills to find a solution. Expects students to give feedback and ask questions of others' solutions. **TEACHER:** Encourages students to use proven mathematical understandings, (definitions, properties, conventions, theorems, etc.), to support their reasoning. Questions students so they can tell the difference between assumptions and logical conjectures. Asks questions that require students to justify their solution and their solution pathway. Prompts students to respectfully evaluate peer arguments when solutions are shared. Asks students to compare and contrast various solution methods. Creates various instructional opportunities for students to engage in mathematical discussions (whole group, small group, partners, etc.) **Mathematical Practice #6:** **Attend to Precision** **Summary of Standard:** • Communicate precisely with others and try to use clear mathematical language when discussing their reasoning. • Understand meanings of symbols used in mathematics and can label quantities appropriately. • Express numerical answers with a degree of precision appropriate

	Construct, autonomously, chains of reasoning that will justify or refute algebraic propositions or conjectures. Content scope: A-APR.1 Express reasoning about transformations of functions. Content scope: F-BF.3, limited to linear and quadratic functions. Tasks will not involve ideas of even or odd functions. Express reasoning about linear and exponential growth. Content scope: F-LE.1a Construct, autonomously, chains of reasoning that will justify or refute propositions or			for the problem context. • Calculate efficiently and accurately. **Questions to Develop Mathematical Thinking:** What mathematical terms apply in this situation? How did you know your solution was reasonable? Explain how you might show that your solution answers the problem. Is there a more efficient strategy? How are you showing the meaning of the quantities? What symbols or mathematical notations are important in this problem? What mathematical language..., definitions..., properties can you use to explain...? How could you test your solution to see if it answers the problem? **Implementation Characteristics; What does it look like in planning & delivery?** **TASK:** Requires students to use precise vocabulary (in written and verbal responses) when communicating mathematical ideas. Expects students to use symbols appropriately. Embeds expectations of how precise the solution needs to be (some may more appropriately be estimates). **TEACHER:** Consistently demands and models precision in communication and in mathematical solutions. (uses and models correct content terminology). Expects students to use precise mathematical vocabulary during mathematical conversations. (identifies incomplete responses and asks students to revise their response). Questions students to identify symbols, quantities, and units in a clear manner

	conjectures about functions. Content scope: F-IF.8a Given an equation or system of equations, present the solution steps as a logical argument that concludes with the set of solutions (if any). Tasks are limited to quadratic equations. Content scope: A-REI.1, A-REI.4a, A-REI.4b, limited to real solutions only. Construct, autonomously, chains of reasoning that will justify or refute propositions or conjectures about linear equations in one or two variables. Content scope: 8.EE.B			
SUB-CLAIM D: CONNECTIONS TO CONTENT: MODELING	Solve multi-step contextual problems with	In connection with the content knowledge, skills, and abilities described in Sub-claims A (Major	https://prc.parcconline.org/system/files/Algebra%201%20-%20PBA%20-%20Alignment%20Document_March%202016_v2.pdf	**Mathematical Practice #4: Model with Mathematics**

	degree of difficulty appropriate to the course, requiring application of knowledge and skills articulated in **7.RP.A, 7.NS.3, 7.EE, and/or 8.EE.** Solve multi-step contextual word problems with degree of difficulty appropriate to the course, requiring application of course-level knowledge and skills articulated in **A-CED, N-Q, A-SSE.3, AREI.6, A-REI.12, A-REI.11-1,** limited to linear equations and exponential equations with integer exponents. Solve multi-step contextual word problems with degree of difficulty appropriate to	Content) and B (Supporting Content), the student devises and enacts a plan to apply mathematics in solving problems arising in everyday life, society and the workplace by: • using stated assumptions and making assumptions and approximations to simplify a real-world situation(include micromodels) • mapping relationships between important quantities • selecting appropriate tools to create models • analyzing relationships mathematically between important quantities to draw conclusions • interpreting mathematical results in the context of the situation • reflecting on whether the results make sense • improving the model if it has not served its purpose • writing a complete, clear and correct algebraic expression or equation to describe a situation • applying proportional reasoning and percentages • writing and using functions in any form to describe how one quantity of interest depends on another • using statistics • using reasonable estimates of known quantities in a chain of	https://prc.parcconline.org/system/files/Algebra%201%20-%20PBA%20-%20Item%20Set_0.pdf https://prc.parcconline.org/system/files/Algebra%201%20-%20PBA%20-%20Key_March%202016_v2_0.pdf https://prc.parcconline.org/system/files/Integrated%20Math%201%20-%20PBA%20-%20Alignment%20Document_March%202016_v2.pdf https://prc.parcconline.org/system/files/Integrated%20Math%201%20-%20PBA%20-%20Item%20Set.pdf https://prc.parcconline.org/system/files/Integrated%20Math%201%20-%20PBA%20-%20Released%20Answer%20Key_v2.pdf https://parcc.pearson.com/resources/Practice_Tests/Algebra_I/Math/PC194882-001_AlgIOPTB_PT.pdf http://www.parcconline.org/files/141/Online%20PBA/300/Math-algebra1-online-pba-practicetest-answerkey.pdf	**Summary of Standard:** • Understand this is a way to reason quantitatively and abstractly (able to decontextualize and contextualize). • Apply the math students know to solve problems in everyday life. • Able to simplify a complex problem and identify important quantities to look at relationships. • Represent mathematics to describe a situation either with an equation or a diagram and interpret the results of a mathematical situation. • Reflect on whether the results make sense, possibly improving/revising the model. • Ask themselves, "How can I represent this mathematically?" **Questions to Develop Mathematical Thinking:** What number model could you construct to represent the problem? What are some ways to represent the quantities? What's an equation or expression that matches the diagram? number line? chart? table? Where did you see one of the quantities in the task in your equation or expression? Would it help to create a diagram, graph, table, ...? What are some ways to visually represent...? What formula might apply in this situation? **Implementation Characteristics; What does it look like in planning & delivery?** **TASK:** Is structured so that students represent the problem situation and their solution symbolically, graphically, and/or pictorially (may include technological tools) appropriate to the context of the problem. Invites students to create a context (real-world situation) that explains numerical/symbolic representations. Asks students to take complex mathematics and make it simpler by creating a model that will represent the relationship between the quantities.

	the course, requiring application of course-level knowledge and skills articulated in **A-CED, N-Q.2, A-SSE.3, A-REI.6, A-REI.12, A-REI.11-1,** limited to linear and quadratic equations. Solve multi-step contextual word problems with degree of difficulty appropriate to the course, requiring application of course-level knowledge and skills articulated in **F-BF.1a, F-BF.3, ACED.1, A-SSE.3, F-IF.B, F-IF.7**, limited to linear functions and exponential functions with domains in the integers. Micro-models: Autonomously	reasoning that yields an estimate of an unknown quantity		Requires students to identify variables, compute and interpret results, report findings, and justify the reasonableness of their results and procedures within context of the task **TEACHER:** Demonstrates and provides student's experiences with the use of various mathematical models. Questions students to justify their choice of model and the thinking behind the model. Asks students about the appropriateness of the model chosen. Assists students in seeing and making connections among models. Give students opportunity to evaluate the appropriateness of the model.

	apply a technique from pure mathematics to a real-world situation in which the technique yields valuable results even though it is obviously not applicable in a strict mathematical sense (e.g., profitably applying proportional relationships to a phenomenon that is obviously nonlinear or statistical in nature). Content Scope: Knowledge and skills articulated in the Algebra 1 Type I, Sub-Claim A (Major Content) Standards Reasoned estimates: Use reasonable estimates of known quantities in a chain of reasoning that yields an estimate			

	of an unknown quantity. Content Scope: Knowledge and skills articulated in the Algebra 1 Type I, Sub-Claim A (Major Content) Standards			

ALGEBRA 2 ACTION PLAN

	STANDARDS	FOCUS: STUDENTS…	RESOURCES	STRATEGIES BEST PRACTICES
SUB-CLAIM A: MAJOR CONTENT	**A.SSE.A.2** **A.SSE.B.3** **A.SSE.B.4** **A.APR.B.2** **A.APR.B.3** **A.REI.A.1** **A.REI.A.2** **A.REI.D.11** **F.BF.A.** **F.BF.A.1** **F.BF.A.2** **F.IF.B.4** **F.IF.B.6** **N.RN.A.1** **N.RN.A.2** **S.IC.B.3** **S.IC.B.4** **S.IC.B.5** **S.IC.B.6**	Uses mathematical properties and structure of polynomial, exponential and rational expressions to create equivalent expressions. Rewrites exponential expressions to reveal quantities of interest that may be useful. Interprets key features of graphs and tables, and uses mathematical properties and relationships to reveal key features of polynomial, exponential and rational functions, using them to sketch graphs. Calculates the average rate of change of polynomial and exponential functions (presented symbolically or as a table) over a specified interval, and estimates the rate of change from a graph. Builds functions that model mathematical and contextual situations, including those requiring trigonometric functions, sequences and combinations of these and other functions, and uses the models to solve and interpret problems. Determines whether a sample survey, experiment or observational study is most appropriate.	F.BF.A.2 Snake on a Plane A.SSE.B.4 Course of Antibiotics A.SSE.B.3c Forms of exponential expressions N.RN.A.1 Evaluating Exponential Expressions N.RN.A.2 Rational or Irrational? A.APR.B.2 The Missing Coefficient A.SSE.A.2 A Cubic Identity A.APR.B.3 Graphing from Factors III A.REI.A.1 Products and Reciprocals A.REI.A.2 Radical Equations A.REI.A.2, A.CED.A.1 An Extraneous Solution A.REI.D.11 Ideal Gas Law F.IF.B.4, F.IF.C.7e Model air plane acrobatics F.BF.A.1b A Sum of Functions S.IC.B.3 Strict Parents S.IC.B.4 Margin of Error for Estimating a Population Mean https://prc.parcconline.org/system/files/Algebra%202%20-%20EOY%20-%20Alignment%20Document_Feb.2016.pdf https://prc.parcconline.org/system/files/Algebra%202%20-%20EOY%20-%20Item%20Set.pdf https://prc.parcconline.org/system/files/Algebra%202%20-%20EOY%20-%20Key.pdf https://prc.parcconline.org/system/files/Algebra%202%20-%20PBA%20-%20Alignment%20Document_Feb.2016.pdf https://prc.parcconline.org/system/files/Algebra%202%20-%20PBA%20-%20Item%20Set.pdf https://prc.parcconline.org/system/files/Algebra%202%20-%20PBA%20-%20Key_0.pdf https://prc.parcconline.org/system/files/Integrated%20Math%203%20-%20EOY%20-%20Alignment%20Document_March%202016.pdf	Clarification of Standards, Mathematical Practices, and limits, emphases, and other information intended to ensure appropriate variety in tasks can be found through the following links: file:///C:/Users/george.droste/Downloads/Algebra-II-ES-Description-PBA-EOY-2%20(1).pdf http://www.state.nj.us/education/cccs/2016/math/standards.pdf http://www.insidemathematics.org/common-core-resources/mathematical-practice-standards https://www.louisianabelieves.com/docs/common-core-state-standards-resources/guide--teacher-planning-for-math-practice-implementation.pdf?sfvrsn=2 Departmental Practices: • Establish norms for collaboration. Establish math leadership teams. • Sharing in development of common lesson plans within PARCC tested areas. • Monthly submission of common assessments (Benchmarks; Unit/Chapter Assessments) for Algebra 1, Geometry, and Algebra 2 • Completion of EPP's (Electronic) for all students after the end of each Marking Period (4X). • Ensure that the mathematics curriculum is vertically and horizontally articulated. • Integrate the use of technology across all mathematics courses and provide students access to a variety of technology tools. • Encourage students to seek extra help through the following venues: Helping Hands; Enrichment; Honor Society; Supplied Electronic Resources; Teacher. • Seek specialized professional development.

			https://prc.parcconline.org/system/files/Integrated%20Math%203%20-%20EOY%20-%20Item%20Set.pdf https://prc.parcconline.org/system/files/Integrated%20Math%203%20-%20EOY%20-%20Released%20Answer%20Key.pdf https://prc.parcconline.org/system/files/Integrated%20Math%203%20-%20PBA%20-%20Alignment%20Document_March%202016.pdf https://prc.parcconline.org/system/files/Integrated%20Math%203%20-%20PBA%20-%20Item%20Set.pdf https://prc.parcconline.org/system/files/Integrated%20Math%203%20-%20PBA%20-%20Released%20Answer%20Key.pdf https://parcc.pearson.com/practice-tests/math/ http://nextgen.apps.sparcc.org/math/9-12	PLC Practices: • Establish norms for collaboration. • Identifying/Sharing Best Practices & Curricular Concerns. • Identifying/Unpacking/Clarifying Standards and Mathematical Practices for both teachers & students. • Development of Common Assessments (Benchmarks; Unit/Chapter Assessments) with identified standards for Algebra 1, Geometry, and Algebra 2 • Data Analysis/Course of Action derived from examination of formative/summative assessments.
SUB-CLAIM B: SUPPORTING & ADDITIONAL CONTENT	**A.REI.B.4** **A.REI.C.6** **A.REI.C.7** **A.APR.C.4** **A.APR.D.6** **A.CED.A.1** **F.LE.A.2** **F.LE.A.4** **F.LE.B.5** **F.IF.C.7** **F.IF.C.8** **F.IF.C.9** **F.BF.B.3** **F.BF.B.4** **F.TF.A.1**	Given functions represented algebraically, graphically, numerically and by verbal description, writes multiple equivalent versions of the functions and identifies key features. Graphs exponential and polynomial functions, showing key features. Uses commutative, associative and distributive properties to perform operations with complex numbers. Rewrites simple rational expressions using inspection.	N.CN.A.1 Complex number patterns N.CN.A.2 Powers of a complex number N.CN.C.7, A.REI.B.4b Completing the square A.REI.C.7 Linear and Quadratic System A.REI.C.6 Pairs of Whole Numbers F.LE.A.2 Rumors F.LE.B.5, F.LE.A.2 Exponential Parameters F.IF.C.8b Carbon 14 dating in practice I F.LE.A.4 Carbon 14 dating F.IF.C.7c Graphs of Power Functions A.APR.C.4 Trina's Triangles A.APR.D.6 Combined Fuel Efficiency A.REI.A.2, A.CED.A.1 An Extraneous Solution G.GPE.A.2 Defining Parabolas Geometrically F.IF.C.7e Logistic Growth Model F.TF.A.1 Bicycle Wheel F.TF.A.2 What exactly is a radian?	Classroom Practices: • Utilize entrance/exit activities as a means to check for understanding and as a basis for building new knowledge. • Differentiate instruction through flexible grouping, individualizing lessons, compacting, using tiered assignments, and varying question level. • Have students discuss solve problem structures and solutions to make connections among strategies and reasoning. Questions to facilitate discussion of solve problems: ○ What were the steps involved in solving the problem? Would they work in a different order?

	F.TF.A.2 **F.TF.B.5** **F.TF.C.8** **G.GPE.A.2** **N.CN.A.1** **N.CN.A.2** **N.CN.C.7** **N.Q.A.2** **S.ID.A.4** **S.IC.A.1** **S.IC.A.2** **S.ID.B.6** **S.CP.A.1** **S.CP.A.2** **S.CP.A.3** **S.CP.A.4** **S.CP.A.5** **S.CP.B.6** **S.CP.B.7**	Identifies the effects of a single transformation on graphs of polynomial, exponential, logarithmic and trigonometric function - including f(x)+k, kf(x), f(kx), and f(x+k) – and determines if the resulting function is even or odd. Given a trigonometric value and quadrant for an angle, utilizes the structure and relationships of trigonometry, including relationships in the unit circle, to identify other trigonometric values for that angle. Solves problems involving linear, exponential, quadratic (with real or complex solutions) and trigonometric equations and systems of equations, using inverses where appropriate. Constructs linear and exponential function models in multi-step contextual problems with mathematical prompting. Uses the means and standard deviations of data sets to fit them to normal distributions. Fits exponential functions to data in order to solve multi-step contextual problems. Uses sample data to make inferences about the corresponding population . Recognizes, determines and uses conditional probability and independence in contextual problems, using appropriate set language and appropriate	F.TF.A.2 Trigonometric functions for arbitrary angles (radians) F.TF.A.2 Trig Functions and the Unit Circle F.IF.B.4, F.IF.C.7e Model air plane acrobatics F.TF.B.5 As the Wheel Turns F.TF.C.8 Trigonometric Ratios and the Pythagorean Theorem F.IF.C.9 Throwing Baseballs F.BF.B.3 Exploring Sinusoidal Functions F.BF.B.3 Transforming the graph of a function **F.BF.B.4a Temperatures in degrees Fahrenheit and Celsius** https://prc.parcconline.org/system/files/Algebra%202%20-%20EOY%20-%20Alignment%20Document_Feb.2016.pdf https://prc.parcconline.org/system/files/Algebra%202%20-%20EOY%20-%20Item%20Set.pdf https://prc.parcconline.org/system/files/Algebra%202%20-%20EOY%20-%20Key.pdf https://prc.parcconline.org/system/files/Algebra%202%20-%20PBA%20-%20Alignment%20Document_Feb.2016.pdf https://prc.parcconline.org/system/files/Algebra%202%20-%20PBA%20-%20Item%20Set.pdf https://prc.parcconline.org/system/files/Algebra%202%20-%20PBA%20-%20Key_0.pdf https://prc.parcconline.org/system/files/Integrated%20Math%203%20-%20EOY%20-%20Alignment%20Document_March%202016.pdf https://prc.parcconline.org/system/files/Integrated%20Math%203%20-%20EOY%20-%20Item%20Set.pdf https://prc.parcconline.org/system/files/Integrated%20Math%203%20-%20EOY%20-%20Released%20Answer%20Key.pdf	○ Can anyone think of a different way to solve this problem? ○ Will this strategy always work? Why? • Select solved problems that reflect the lesson's instructional objective, including problems that illustrate common errors. ○ Select problems with varying levels of difficulty and arrange them from the simplest to the most complex applications of the same concept. ○ Display the multiple examples simultaneously to encourage students to recognize patterns in the solution steps across problems ○ Alternatively, show the problems individually, one after the other, to facilitate more detailed discussion on each problem. ○ Parallel correct and incorrect solved problems to facilitate discussion on each problem. • Use whole-class discussions, small-group work (Cooperative Learning), and independent practice activities to introduce, elaborate on, and practice working with solved problems. ○ Think, write, pair, share. ○ Partner Coaching • Promote the use of language that reflects mathematical structure. ○ During whole-class instruction, teachers can rephrase student solutions and responses to questions using appropriate mathematical language instead of vague, non-mathematical language. • Encourage students to use reflective questioning to notice structure as they solve problems. Reflective questions for noticing structure:

		representations, including two-way frequency tables.	https://prc.parcconline.org/system/files/Integrated%20Math%203%20-%20PBA%20-%20Alignment%20Document_March%202016.pdf https://prc.parcconline.org/system/files/Integrated%20Math%203%20-%20PBA%20-%20Item%20Set.pdf https://prc.parcconline.org/system/files/Integrated%20Math%203%20-%20PBA%20-%20Released%20Answer%20Key.pdf https://parcc.pearson.com/practice-tests/math/ http://nextgen.apps.sparcc.org/math/9-12	○ How would I describe this problem using precise mathematical language? ○ How many variables are there? ○ What am I trying to solve for? • Teach students that different algebraic/geometric representations can convey different information about an algebra/geometry problem. • Teach students to recognize and generate strategies for solving problems. Reflective questions for selecting and considering solution strategies: ○ Of the strategies I know, which seem to best fit this particular problem? Why? ○ Is there anything special about this problem that suggests that a particular strategy is or is not applicable or a good idea? ○ Why did I choose this strategy to solve this problem? • Encourage students to articulate the reasoning behind their choice of strategy and mathematical validity of their strategy when solving problems. Ask students working collaboratively/independently to write out/discuss their strategic reasoning in addition to solving the problem. • Have students in small groups evaluate and compare different strategies for solving problems. **Principle of Instruction:** https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=2&cad=rja&uact=8&ved=0ahUKEwjCzcbpjOfOAhXBCMAKHfxkA1IQFggsMAE&url=https%3A%2F%2Fwww.aft.org%2Fsites%2Fdefault%2Ffiles%2Fperiodicals%2FRosenshine.pdf&usg=AFQjCNFubmVp1n5CkTQ5ZmnZH8lNREmySQ&sig2=EPja1dDvQ01v16KJR2DFnQ

SUB-CLAIM C: CONNECTIONS TO CONTENT: REASONING	Construct, autonomously, chains of reasoning that will justify or refute propositions or conjectures about numbers or number systems. Content Scope: **N-RN, N-CN** Base explanations/reasoning on the properties of exponents. Content Scope: **N-RN.A** Derive and use a formula. Content Scope: **A-SSE.4** Given an equation or system of equations, reason about the number or nature of the solutions. Content Scope: **A-REI.2.** Given an equation or system of equations, reason about the number or nature of the solutions.	In connection with the content knowledge, skills, and abilities described in Sub-claims A (Major Content) and B (Supporting Content), the student clearly constructs and communicates a response based on: • a response to a given equation or system of equations • a chain of reasoning to justify or refute algebraic, function or number system propositions or conjectures, • a response based on data • a response based on the graph of an equation in two variables, the principle that a graph is a solution set or the relationship between zeros and factors of polynomials • a response based on trigonometric functions and the unit circle • a response based on transformations of functions OR • a response based on properties of exponents by: • using a logical approach based on a conjecture and/or stated assumptions, utilizing	https://prc.parcconline.org/system/files/Algebra%202%20-%20PBA%20-%20Alignment%20Document_Feb.2016.pdf https://prc.parcconline.org/system/files/Algebra%202%20-%20PBA%20-%20Item%20Set.pdf https://prc.parcconline.org/system/files/Algebra%202%20-%20PBA%20-%20Key_0.pdf https://prc.parcconline.org/system/files/Integrated%20Math%203%20-%20PBA%20-%20Alignment%20Document_March%202016.pdf https://prc.parcconline.org/system/files/Integrated%20Math%203%20-%20PBA%20-%20Item%20Set.pdf https://prc.parcconline.org/system/files/Integrated%20Math%203%20-%20PBA%20-%20Released%20Answer%20Key.pdf https://parcc.pearson.com/practice-tests/math/ http://nextgen.apps.sparcc.org/math/9-12	**Mathematical Practice #3: Construct Viable Arguments** **Summary of Standard:** • Analyze problems and use stated mathematical assumptions, definitions, and established results in constructing arguments. • Justify conclusions with mathematical ideas. • Listen to the arguments of others and ask useful questions to determine if an argument makes sense. • Ask clarifying questions or suggest ideas to improve/revise the argument. • Compare two arguments and determine correct or flawed logic. **Questions to Develop Mathematical Thinking:** What mathematical evidence supports your solution? How can you be sure that...? / How could you prove that...? Will it still work if...? What were you considering when...? How did you decide to try that strategy? How did you test whether your approach worked? How did you decide what the problem was asking you to find? (What was unknown?) Did you try a method that did not work? Why didn't it work? Would it ever work? Why or why not? What is the same and what is different about...? How could you demonstrate a counter-example? **Implementation Characteristics; What does it look like in planning & delivery?** **TASK:** Is structured to bring out multiple representations, approaches, or error analysis. Embeds discussion and communication of reasoning and justification with others. Requires students to provide evidence to explain their thinking beyond merely using computational skills to find a solution. Expects students to give feedback and ask questions of others' solutions. **TEACHER:** Encourages students to use proven mathematical understandings, (definitions, properties, conventions, theorems, etc.), to support

	Content Scope: **A-REI.11,**involving any of the function types measured in the standards. Base explanations/reasoning on the principle that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane. Content Scope: **A-REI.D** Base explanations/reasoning on the principle that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane. Content Scope: **G-GPE.2** Base explanations/reasoning on the relationship between zeros and factors of polynomials.	mathematical connections (when appropriate) • providing a logical progression of steps or chain of reasoning with appropriate justification • performing precise calculations • using correct grade- level vocabulary, symbols and labels • providing a justification of a conclusion • evaluating, interpreting and critiquing the validity of others' responses, approaches and reasoning – utilizing mathematical connections (when appropriate)		their reasoning. Questions students so they can tell the difference between assumptions and logical conjectures. Asks questions that require students to justify their solution and their solution pathway. Prompts students to respectfully evaluate peer arguments when solutions are shared. Asks students to compare and contrast various solution methods. Creates various instructional opportunities for students to engage in mathematical discussions (whole group, small group, partners, etc.) **Mathematical Practice #6:** **Attend to Precision** **Summary of Standard:** • Communicate precisely with others and try to use clear mathematical language when discussing their reasoning. • Understand meanings of symbols used in mathematics and can label quantities appropriately. • Express numerical answers with a degree of precision appropriate for the problem context. • Calculate efficiently and accurately. **Questions to Develop Mathematical Thinking:** What mathematical terms apply in this situation? How did you know your solution was reasonable? Explain how you might show that your solution answers the problem. Is there a more efficient strategy? How are you showing the meaning of the quantities? What symbols or mathematical notations are important in this problem? What mathematical language..., definitions..., properties can you use to explain...? How could you test your solution to see if it answers the problem? **Implementation Characteristics; What does it look like in planning & delivery?** **TASK:**

	Content Scope: **A-APR.B** Construct, autonomously, chains of reasoning that will justify or refute algebraic propositions or conjectures. Content Scope: **A-APR.4** Construct, autonomously, chains of reasoning that will justify or refute algebraic propositions or conjectures. Content Scope: **A-APR** Express reasoning about transformations of functions. Content scope: **F-BF.3**, which may involve polynomial, exponential, logarithmic or trigonometric functions. Tasks also may involve even and odd functions.			Requires students to use precise vocabulary (in written and verbal responses) when communicating mathematical ideas. Expects students to use symbols appropriately. Embeds expectations of how precise the solution needs to be (some may more appropriately be estimates). **TEACHER:** Consistently demands and models precision in communication and in mathematical solutions. (uses and models correct content terminology). Expects students to use precise mathematical vocabulary during mathematical conversations. (identifies incomplete responses and asks students to revise their response). Questions students to identify symbols, quantities, and units in a clear manner.

	Express reasoning about trigonometric functions and the unit circle. Content scope: **F-TF.2, F-TF.8** Construct, autonomously, chains of reasoning that will justify or refute propositions or conjectures about functions. Content scope: **F-IF.8b** Given an equation or system of equations, present the solution steps as a logical argument that concludes with the set of solutions (if any). Tasks are limited to simple rational or radical equations. Content scope: **A-REI.1** Make inferences and justify conclusions from data.			

	Content scope: **S-IC.** Make inferences and justify conclusions from data. Content scope: **S-IC.3** Make inferences and justify conclusions from data. Content scope: **S-IC.5** Make inferences and justify conclusions from data. Content scope: **S-IC.6** Construct, autonomously, chains of reasoning that will justify or refute propositions or conjectures about polynomials, rational expressions, or rational exponents. Content scope: **N-RN, A-APR.(2, 3, 4, 6)**			

	Solve multi-step mathematical problems requiring extended chains of reasoning and drawing on a synthesis of the knowledge and skills articulated across: **7-RP.A.3, 7-NS.A.3, 7-EE.B.3, 8-EE.C.7B, 8-EE.C.8c, N-RN.A.2, ASSE.A.1b, A-REI.A.1, A-REI.B.3, A-REI.B.4b, F-IF.A.2, F-IF.C.7a, F-IF.C.7e, G-SRT.B.5 and G-SRT.C.7.**			
SUB-CLAIM D: CONNECTIONS TO CONTENT: MODELING	Solve multi-step contextual problems with degree of difficulty appropriate to the course that require writing an expression for an inverse function, as articulated in **F.BF.4a** Solve multi-step contextual word problems with	In connection with the content knowledge, skills, and abilities described in Sub-claims A (Major Content) and B (Supporting Content), the student devises and enacts a plan to apply mathematics in solving problems arising in everyday life, society and the workplace by: • using stated assumptions and approximations to simplify a real-world situation • mapping relationships between important quantities	https://prc.parcconline.org/system/files/Algebra%202%20-%20PBA%20-%20Alignment%20Document_Feb.2016.pdf https://prc.parcconline.org/system/files/Algebra%202%20-%20PBA%20-%20Item%20Set.pdf https://prc.parcconline.org/system/files/Algebra%202%20-%20PBA%20-%20Key_0.pdf https://prc.parcconline.org/system/files/Integrated%20Math%203%20-%20PBA%20-%20Alignment%20Document_March%202016.pdf	**Mathematical Practice #4:** **Model with Mathematics** **Summary of Standard:** • Understand this is a way to reason quantitatively and abstractly (able to decontextualize and contextualize). • Apply the math students know to solve problems in everyday life. • Able to simplify a complex problem and identify important quantities to look at relationships. • Represent mathematics to describe a situation either with an equation or a diagram and interpret the results of a mathematical situation. • Reflect on whether the results make sense, possibly improving/revising the model.

	degree of difficulty appropriate to the course, requiring application of course-level knowledge and skills articulated in **A-CED, N-Q.2, A-SSE.3, AREI.6, A-REI.7, A-REI.12, A-REI.11-2.** Solve multi-step contextual word problems with degree of difficulty appropriate to the course, requiring application of course-level knowledge and skills articulated in **F-BF.A, F-BF.3, F-IF.3, ACED.1, A-SSE.3, F-IF.B, F-IF.7.** Solve multi-step contextual word problems with degree of difficulty appropriate to the course, requiring	• selecting appropriate tools to create the appropriate model • analyzing relationships mathematically between important quantities (either given or created) to draw conclusions • interpreting mathematical results in the context of the situation • reflecting on whether the results make sense • improving the model if it has not served its purpose • writing a complete, clear and correct expression, equation or function to describe a situation • using geometry to solve design problems • using securely held content, briefly, but accurately reporting the conclusion • identifying and using relevant data from a data source • making an appropriate evaluation or recommendation	https://prc.parcconline.org/system/files/Integrated%20Math%203%20-%20PBA%20-%20Item%20Set.pdf https://prc.parcconline.org/system/files/Integrated%20Math%203%20-%20PBA%20-%20Released%20Answer%20Key.pdf https://parcc.pearson.com/practice-tests/math/ http://nextgen.apps.sparcc.org/math/9-12	• Ask themselves, "How can I represent this mathematically?" **Questions to Develop Mathematical Thinking:** What number model could you construct to represent the problem? What are some ways to represent the quantities? What's an equation or expression that matches the diagram? number line? chart? table? Where did you see one of the quantities in the task in your equation or expression? Would it help to create a diagram, graph, table, ...? What are some ways to visually represent...? What formula might apply in this situation? **Implementation Characteristics; What does it look like in planning & delivery?** **TASK:** Is structured so that students represent the problem situation and their solution symbolically, graphically, and/or pictorially (may include technological tools) appropriate to the context of the problem. Invites students to create a context (real-world situation) that explains numerical/symbolic representations. Asks students to take complex mathematics and make it simpler by creating a model that will represent the relationship between the quantities. Requires students to identify variables, compute and interpret results, report findings, and justify the reasonableness of their results and procedures within context of the task **TEACHER:** Demonstrates and provides student's experiences with the use of various mathematical models. Questions students to justify their choice of model and the thinking behind the model. Asks students about the appropriateness of the model chosen. Assists students in seeing and making connections among models. Give students opportunity to evaluate the appropriateness of the model.

	application of course-level knowledge and skills articulated in **S-ID and S-IC.** Decisions from data: Identify relevant data in a data source, analyze it, and draw reasonable conclusions from it. Content scope: Knowledge and skills articulated in Algebra 2 Full models: Identify variables in a situation, select those that represent essential features, formulate a mathematical representation of the situation using those variables, analyze the representation and perform			

	operations to obtain a result, interpret the result in terms of the original situation, validate the result by comparing it to the situation, and either improve the model or briefly report the conclusions. **Content scope:** Knowledge and skills articulated in the Standards in grades 6-8, Algebra 1 and Math 1 (excluding statistics) Solve problems using modeling: Identify variables in a situation, select those that represent essential features, formulate a			

	mathematical representation of the situation using those variables, analyze the representation and perform operations to obtain a result, interpret the result in terms of the original situation, validate the result by comparing it to the situation, and either improve the model or briefly report the conclusions. **Content scope:** Knowledge and skills articulated in the Standards as described in previous courses and grades, with a particular emphasis on **7-RP, 8 – EE, 8 – F, N-Q, A-CED, A-REI, F-BF, GMG,**			

	Modeling, and S-ID			

GEOMETRY ACTION PLAN

Overview	STANDARDS	FOCUS: STUDENTS…	RESOURCES	STRATEGIES BEST PRACTICES
SUB-CLAIM A: MAJOR CONTENT	**G.CO.B.6** **G.CO.B.7** **G.CO.B.8** **G.CO.C.9** **G.CO.C.10** **G.CO.C.11** **G.SRT.A.1** **G.SRT.A.2** **G.SRT.A.3** **G.SRT.B.4** **G.SRT.B.5** **G.SRT.C.6** **G.SRT.C.7** **G.SRT.C.8** **G.GPE.B.4** **G.GPE.B.5** **G.GPE.B.6** **G.GPE.B.7** **G.MG.A.1** **G.MG.A.2** **G.MG.A.3**	Uses given geometric theorems and properties of rigid motions, lines, angles, triangles and parallelograms to solve routine problems and prove statements about angle measurement, triangles, distance, line properties and congruence. Uses transformations to determine relationships among simple geometric figures and to solve problems. Uses trigonometric ratios, the Pythagorean Theorem and the relationship between sine and cosine to solve right triangles in applied problems. Uses geometric relationships in the coordinate plane to solve problems involving area, perimeter and ratios of lengths. Applies geometric concepts to describe, model and solve applied problems related to the Pythagorean Theorem, geometric shapes, their measures and properties.	G.CO.B.7 Properties of Congruent Triangles G.CO.B.8 Why does SAS work? G.CO.B.8 Why does SSS work? G.CO.B.8 Why does ASA work? G.CO.C.9 Congruent Angles made by parallel lines and a transverse G.CO.C.9 Points equidistant from two points in the plane G.CO.C.10 Midpoints of Triangle Sides G.CO.C.10 Sum of angles in a triangle G.CO.C.11 Midpoints of the Sides of a Parallelogram G.CO.C.11 Is this a parallelogram? G.SRT.A.1 Dilating a Line G.SRT.A.2 Are They Similar? G.SRT.A.2 Similar Triangles G.SRT.A.3 Similar Triangles G.SRT.B.4 Joining two midpoints of sides of a triangle G.SRT.B.4 Pythagorean Theorem G.SRT.B.5 Tangent Line to Two Circles G.SRT.C.6 Defining Trigonometric Ratio G.SRT.C.7 Sine and Cosine of Complimentary Angles G.SRT.C.8 Constructing Special Angles G.GPE.B.4,5 A Midpoint Miracle G.GPE.B.5 Slope Criterion for Perpendicular G.GPE.B.7 Triangle Perimeters G.MG.A.1Toilet Roll G.MG.A.2 How many cells are in the human body? G.MG.A.3 Ice Cream Cone https://prc.parcconline.org/system/files/Geometry%20-%20PBA%20-%20Alignment%20Document_Feb.2016.pdf https://prc.parcconline.org/system/files/Geometry%20-%20PBA%20-%20Item%20Set_July%202016.pdf	Clarification of Standards, Mathematical Practices, and limits, emphases, and other information intended to ensure appropriate variety in tasks can be found through the following links: file:///C:/Users/george.droste/Downloads/Algebral-ES-Description-PBA-EOY-2%20(3).pdf http://www.state.nj.us/education/cccs/2016/math/standards.pdf http://www.insidemathematics.org/common-core-resources/mathematical-practice-standards https://www.louisianabelieves.com/docs/common-core-state-standards-resources/guide--teacher-planning-for-math-practice-implementation.pdf?sfvrsn=2 Departmental Practices: • Establish norms for collaboration. Establish math leadership teams. • Sharing in development of common lesson plans within PARCC tested areas. • Monthly submission of common assessments (Benchmarks; Unit/Chapter Assessments) for Algebra 1, Geometry, and Algebra 2 • Completion of EPP's (Electronic) for all students after the end of each Marking Period (4X). • Ensure that the mathematics curriculum is vertically and horizontally articulated. • Integrate the use of technology across all mathematics courses and provide students access to a variety of technology tools.

			https://prc.parcconline.org/system/files/Geometry%20-%20PBA%20-%20Key_0.pdf https://prc.parcconline.org/system/files/Geometry%20-%20EOY%20-%20Alignment%20Document_Feb.2016.pdf https://prc.parcconline.org/system/files/Geometry%20-%20EOY%20-%20Item%20Set.pdf https://prc.parcconline.org/system/files/Geometry%20-%20EOY%20-%20Key_0.pdf https://prc.parcconline.org/system/files/Integrated%20Math%202%20-%20EOY%20-%20Alignment%20Document_March%202016.pdf https://prc.parcconline.org/system/files/Integrated%20Math%202%20-%20EOY%20-%20Item%20Set.pdf https://prc.parcconline.org/system/files/Integrated%20Math%202%20-%20EOY%20-%20Released%20Answer%20Key.pdf https://prc.parcconline.org/system/files/Integrated%20Math%202%20-%20PBA%20-%20Alignment%20Document_March%202016.pdf https://prc.parcconline.org/system/files/Integrated%20Math%202%20-%20PBA%20-%20Item%20Set.pdf https://prc.parcconline.org/system/files/Integrated%20Math%202%20-%20PBA%20-%20Released%20Answer%20Key.pdf https://parcc.pearson.com/practice-tests/math/ http://nextgen.apps.sparcc.org/math/9-12	• Encourage students to seek extra help through the following venues: Helping Hands; Enrichment; Honor Society; Supplied Electronic Resources; Teacher. • Seek specialized professional development. PLC Practices: • Establish norms for collaboration. • Identifying/Sharing Best Practices & Curricular Concerns. • Identifying/Unpacking/Clarifying Standards and Mathematical Practices for both teachers & students. • Development of Common Assessments (Benchmarks; Unit/Chapter Assessments) with identified standards for Algebra 1, Geometry, and Algebra 2 • Data Analysis/Course of Action derived from examination of formative/summative assessments.

SUB-CLAIM B: SUPPORTING & ADDITIONAL CONTENT	G.CO.A.1
	G.CO.A.2
	G.CO.A.3
	G.CO.A.4
	G.CO.A.5
	G.CO.D.12
	G.CO.D.13
	G.GPE.A.1
	G.C.A.1
	G.C.A.2
	G.C.A.3
	G.C.B.5
	G.GMD.A.1
	G.GMD.A.3
	G.GMD.B.4
		Given a figure and a transformation, draws the transformed figure.
		
		Specifies a sequence of transformations that will carry a figure onto another.
		
		Understands geometric constructions: copying a segment, copying an angle, bisecting an angle, bisecting a segment, including the perpendicular bisector of a line segment.
		
		Given a line and a point not on the line, constructs perpendicular and parallel lines.
		
		Applies properties and theorems of angles, segments and arcs in circles to solve problems.
		
		Completes the square to find the center and radius of a circle given by an equation
		
		Using formulas, determines the volume of cylinders, pyramids, cones and spheres.
		
		Gives an informal argument for the formula for the circumference of a circle and area of a circle, including dissection arguments.
		
		Identifies the shapes of two-dimensional cross-sections of three-dimensional objects
			G.CO.A.1 Defining Parallel Lines
			G.CO.A.1 Defining Perpendicular Lines
			G.CO.A.2 Horizontal Stretch of the Plane
			G.CO.A.3 Seven Circles II
			G.CO.A.3 Symmetries of rectangles
			G.CO.A.4 Defining Rotations
			G.CO.A.5 Showing a triangle congruence
			G.CO.D.12 Bisecting an angle
			G.CO.D.12 Angle bisection and midpoints of line segments
			G.CO.D.13 Inscribing an equilateral triangle in a circle
			G.GPE.A.1 Explaining the equation for a circle
			G.C.A.1 Similar circles
			G.C.A.2 Right triangles inscribed in circles I
			G.C.A.3 Circumscribed Triangles
			G.GMD.A.1 Area of a circle
			G.GMD.A.3 The Great Egyptian Pyramids
			G.GMD.B.4 Tennis Balls in a Can
			
			https://prc.parcconline.org/system/files/Geometry%20-%20EOY%20-%20Alignment%20Document_Feb.2016.pdf
			
			https://prc.parcconline.org/system/files/Geometry%20-%20EOY%20-%20Item%20Set.pdf
			
			https://prc.parcconline.org/system/files/Geometry%20-%20EOY%20-%20Key_0.pdf
			
			https://prc.parcconline.org/system/files/Geometry%20-%20PBA%20-%20Alignment%20Document_Feb.2016.pdf
			
			https://prc.parcconline.org/system/files/Geometry%20-%20PBA%20-%20Item%20Set_July%202016.pdf
			
			https://prc.parcconline.org/system/files/Geometry%20-%20PBA%20-%20Key_0.pdf
				Classroom Practices:
				
				• Utilize entrance/exit activities as a means to check for understanding and as a basis for building new knowledge.
				• Differentiate instruction through flexible grouping, individualizing lessons, compacting, using tiered assignments, and varying question level.
				• Have students discuss solve problem structures and solutions to make connections among strategies and reasoning. Questions to facilitate discussion of solve problems:
				  ○ What were the steps involved in solving the problem? Would they work in a different order?
				  ○ Can anyone think of a different way to solve this problem?
				  ○ Will this strategy always work? Why?
				• Select solved problems that reflect the lesson's instructional objective, including problems that illustrate common errors.
				  ○ Select problems with varying levels of difficulty and arrange them from the simplest to the most complex applications of the same concept.
				  ○ Display the multiple examples simultaneously to encourage students to recognize patterns in the solution steps across problems
				  ○ Alternatively, show the problems individually, one after the other, to facilitate more detailed discussion on each problem.

			https://prc.parcconline.org/system/files/Integrated%20Math%202%20-%20EOY%20-%20Alignment%20Document_March%202016.pdf https://prc.parcconline.org/system/files/Integrated%20Math%202%20-%20EOY%20-%20Item%20Set.pdf https://prc.parcconline.org/system/files/Integrated%20Math%202%20-%20EOY%20-%20Released%20Answer%20Key.pdf https://prc.parcconline.org/system/files/Integrated%20Math%202%20-%20PBA%20-%20Alignment%20Document_March%202016.pdf https://prc.parcconline.org/system/files/Integrated%20Math%202%20-%20PBA%20-%20Item%20Set.pdf https://prc.parcconline.org/system/files/Integrated%20Math%202%20-%20PBA%20-%20Released%20Answer%20Key.pdf https://parcc.pearson.com/practice-tests/math/ http://nextgen.apps.sparcc.org/math/9-12	○ Parallel correct and incorrect solved problems to facilitate discussion on each problem. • Use whole-class discussions, small-group work (Cooperative Learning), and independent practice activities to introduce, elaborate on, and practice working with solved problems. ○ Think, write, pair, share. ○ Partner Coaching • Promote the use of language that reflects mathematical structure. ○ During whole-class instruction, teachers can rephrase student solutions and responses to questions using appropriate mathematical language instead of vague, non-mathematical language. • Encourage students to use reflective questioning to notice structure as they solve problems. Reflective questions for noticing structure: ○ How would I describe this problem using precise mathematical language? ○ How many variables are there? ○ What am I trying to solve for? • Teach students that different algebraic/geometric representations can convey different information about an algebra/geometry problem. • Teach students to recognize and generate strategies for solving problems. Reflective questions for selecting and considering solution strategies: ○ Of the strategies I know, which seem to best fit this particular problem? Why? ○ Is there anything special about this problem that suggests that a particular strategy is or is not applicable or a good idea?

				○ Why did I choose this strategy to solve this problem? • Encourage students to articulate the reasoning behind their choice of strategy and mathematical validity of their strategy when solving problems. Ask students working collaboratively/independently to write out/discuss their strategic reasoning in addition to solving the problem. • Have students in small groups evaluate and compare different strategies for solving problems. **Principle of Instruction:** https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=2&cad=rja&uact=8&ved=0ahUKEwjCzcbpjOfOAhXBCMAKHfxkA1IQFggsMAE&url=https%3A%2F%2Fwww.aft.org%2Fsites%2Fdefault%2Ffiles%2Fperiodicals%2FRosenshine.pdf&usg=AFQjCNFubmVp1n5CkTQ5ZmnZH8lNREmySQ&sig2=EPja1dDvQ01v16KJR2DFnQ
SUB-CLAIM C: CONNECTIONS TO CONTENT: REASONING	Apply geometric reasoning in a coordinate setting, and/or use coordinates to draw geometric conclusions. Content scope: G-GPE.6, G-GPE.7 Apply geometric reasoning in a coordinate setting, and/or use coordinates to draw geometric conclusions.	In connection with the content knowledge, skills, and abilities described in Sub-claims A (Major Content) and B (Supporting Content), the student clearly constructs and communicates a response based on: • a chain of reasoning to justify or refute algebraic and/or geometric propositions or conjectures • geometric reasoning in a coordinate setting, OR • a response to a multi-step	https://prc.parcconline.org/system/files/Geometry%20-%20PBA%20-%20Alignment%20Document_Feb.2016.pdf https://prc.parcconline.org/system/files/Geometry%20-%20PBA%20-%20Item%20Set_July%202016.pdf https://prc.parcconline.org/system/files/Geometry%20-%20PBA%20-%20Key_0.pdf https://prc.parcconline.org/system/files/Integrated%20Math%202%20-%20PBA%20-%20Alignment%20Document_March%202016.pdf https://prc.parcconline.org/system/files/Integrated%20Math%202%20-%20PBA%20-%20Item%20Set.pdf	**Mathematical Practice #3: Construct Viable Arguments** **Summary of Standard:** • Analyze problems and use stated mathematical assumptions, definitions, and established results in constructing arguments. • Justify conclusions with mathematical ideas. • Listen to the arguments of others and ask useful questions to determine if an argument makes sense. • Ask clarifying questions or suggest ideas to improve/revise the argument. • Compare two arguments and determine correct or flawed logic. **Questions to Develop Mathematical Thinking:** What mathematical evidence supports your solution? How can you be sure that...? / How could you prove that...? Will it still work if...?

	Content scope: G-GPE.4 Apply geometric reasoning in a coordinate setting, and/or use coordinates to draw geometric conclusions. Content scope: G-GPE.5 Construct, autonomously, chains of reasoning that will justify or refute geometric propositions or conjectures. Content scope: G-CO.9, G-CO.10 Construct, autonomously, chains of reasoning that will justify or refute geometric propositions or conjectures. Content scope: G-CO.A, G-CO.B Construct, autonomously, chains of	problem, by: • using a logical approach based on a conjecture and/or stated assumptions, utilizing mathematical connections (when appropriate) • providing a logical progression of steps or chain of reasoning with appropriate justification • performing precise calculations • using correct grade-level vocabulary, symbols and labels • providing a justification of a conclusion • evaluating, interpreting and critiquing the validity of others' responses, approaches and reasoning – utilizing mathematical connections (when appropriate).	https://prc.parcconline.org/system/files/Integrated%20Math%202%20-%20PBA%20-%20Released%20Answer%20Key.pdf https://parcc.pearson.com/practice-tests/math/ http://nextgen.apps.sparcc.org/math/9-12	What were you considering when...? How did you decide to try that strategy? How did you test whether your approach worked? How did you decide what the problem was asking you to find? (What was unknown?) Did you try a method that did not work? Why didn't it work? Would it ever work? Why or why not? What is the same and what is different about...? How could you demonstrate a counter-example? **Implementation Characteristics; What does it look like in planning & delivery?** **TASK:** Is structured to bring out multiple representations, approaches, or error analysis. Embeds discussion and communication of reasoning and justification with others. Requires students to provide evidence to explain their thinking beyond merely using computational skills to find a solution. Expects students to give feedback and ask questions of others' solutions. **TEACHER:** Encourages students to use proven mathematical understandings, (definitions, properties, conventions, theorems, etc.), to support their reasoning. Questions students so they can tell the difference between assumptions and logical conjectures. Asks questions that require students to justify their solution and their solution pathway. Prompts students to respectfully evaluate peer arguments when solutions are shared. Asks students to compare and contrast various solution methods. Creates various instructional opportunities for students to engage in mathematical discussions (whole group, small group, partners, etc.) **Mathematical Practice #6:** **Attend to Precision**

	reasoning that will justify or refute geometric propositions or conjectures. Content scope: G-CO.D Construct, autonomously, chains of reasoning that will justify or refute geometric propositions or conjectures. Content scope: G-SRT.A Construct, autonomously, chains of reasoning that will justify or refute geometric propositions or conjectures. Content scope: G-SRT.B Present solutions to multi-step problems in the form of valid chains of reasoning, using symbols such as equals			**Summary of Standard:** • Communicate precisely with others and try to use clear mathematical language when discussing their reasoning. • Understand meanings of symbols used in mathematics and can label quantities appropriately. • Express numerical answers with a degree of precision appropriate for the problem context. • Calculate efficiently and accurately. **Questions to Develop Mathematical Thinking:** What mathematical terms apply in this situation? How did you know your solution was reasonable? Explain how you might show that your solution answers the problem. Is there a more efficient strategy? How are you showing the meaning of the quantities? What symbols or mathematical notations are important in this problem? What mathematical language..., definitions..., properties can you use to explain...? How could you test your solution to see if it answers the problem? **Implementation Characteristics; What does it look like in planning & delivery?** **TASK:** Requires students to use precise vocabulary (in written and verbal responses) when communicating mathematical ideas. Expects students to use symbols appropriately. Embeds expectations of how precise the solution needs to be (some may more appropriately be estimates). **TEACHER:** Consistently demands and models precision in communication and in mathematical solutions. (uses and models correct content terminology). Expects students to use precise mathematical vocabulary during mathematical conversations. (identifies incomplete responses and asks students to revise their response).

	signs appropriately (for example, rubrics award less than full credit for the presence of nonsense statements such as 1 + 4 = 5 + 7 = 12, even if the final answer is correct), or identify or describe errors in solutions to multi-step problems and present corrected solutions. Content scope: G-SRT.C Use a combination of algebraic and geometric reasoning to construct, autonomously, chains of reasoning that will justify or refute propositions or conjectures about geometric figures. Content scope: Algebra content from Algebra 1 course; geometry			Questions students to identify symbols, quantities, and units in a clear manner.

	content from the Geometry course			
SUB-CLAIM D: CONNECTIONS TO CONTENT: MODELING	Solve multi-step contextual problems with degree of difficulty appropriate to the course, requiring application of knowledge and skills articulated in **7.RP.A, 7.NS.3, 7.EE, and/or 8.EE.** Solve multi-step contextual word problems with degree of difficulty appropriate to the course, requiring application of course-level knowledge and skills articulated in **A-CED, N-Q, A-SSE.3, AREI.6, A-REI.12, A-REI.11-**	In connection with the content knowledge, skills, and abilities described in Sub-claims A (Major Content) and B (Supporting Content), the student devises and enacts a plan to apply mathematics in solving problems arising in everyday life, society and the workplace by: • using stated assumptions and making assumptions and approximations to simplify a real-world situation(include micromodels) • mapping relationships between important quantities • selecting appropriate tools to create models • analyzing relationships mathematically between important quantities to draw conclusions • interpreting mathematical results in the context of the situation • reflecting on whether the results make sense	https://prc.parcconline.org/system/files/Algebra%201%20-%20PBA%20-%20Alignment%20Document_March%202016_v2.pdf https://prc.parcconline.org/system/files/Algebra%201%20-%20PBA%20-%20Item%20Set_0.pdf https://prc.parcconline.org/system/files/Algebra%201%20-%20PBA%20-%20Key_March%202016_v2_0.pdf https://prc.parcconline.org/system/files/Integrated%20Math%201%20-%20PBA%20-%20Alignment%20Document_March%202016_v2.pdf https://prc.parcconline.org/system/files/Integrated%20Math%201%20-%20PBA%20-%20Item%20Set.pdf https://prc.parcconline.org/system/files/Integrated%20Math%201%20-%20PBA%20-%20Released%20Answer%20Key_v2.pdf https://parcc.pearson.com/resources/Practice_Tests/Algebra_I/Math/PC194882-001_AlgIOPTB_PT.pdf http://www.parcconline.org/files/141/Online%20PBA/300/Math-algebra1-online-pba-practicetest-answerkey.pdf	**Mathematical Practice #4:** **Model with Mathematics** **Summary of Standard:** • Understand this is a way to reason quantitatively and abstractly (able to decontextualize and contextualize). • Apply the math students know to solve problems in everyday life. • Able to simplify a complex problem and identify important quantities to look at relationships. • Represent mathematics to describe a situation either with an equation or a diagram and interpret the results of a mathematical situation. • Reflect on whether the results make sense, possibly improving/revising the model. • Ask themselves, "How can I represent this mathematically?" **Questions to Develop Mathematical Thinking:** What number model could you construct to represent the problem? What are some ways to represent the quantities? What's an equation or expression that matches the diagram? number line? chart? table? Where did you see one of the quantities in the task in your equation or expression? Would it help to create a diagram, graph, table, ...?

	1, limited to linear equations and exponential equations with integer exponents. Solve multi-step contextual word problems with degree of difficulty appropriate to the course, requiring application of course-level knowledge and skills articulated in **A-CED, N-Q.2, A-SSE.3, A-REI.6, A-REI.12, A-REI.11-1,** limited to linear and quadratic equations. Solve multi-step contextual word problems with degree of difficulty appropriate to the course, requiring application of course-level knowledge and	• improving the model if it has not served its purpose • writing a complete, clear and correct algebraic expression or equation to describe a situation • applying proportional reasoning and percentages • writing and using functions in any form to describe how one quantity of interest depends on another • using statistics • using reasonable estimates of known quantities in a chain of reasoning that yields an estimate of an unknown quantity		What are some ways to visually represent…? What formula might apply in this situation? **Implementation Characteristics; What does it look like in planning & delivery?** **TASK:** Is structured so that students represent the problem situation and their solution symbolically, graphically, and/or pictorially (may include technological tools) appropriate to the context of the problem. Invites students to create a context (real-world situation) that explains numerical/symbolic representations. Asks students to take complex mathematics and make it simpler by creating a model that will represent the relationship between the quantities. Requires students to identify variables, compute and interpret results, report findings, and justify the reasonableness of their results and procedures within context of the task **TEACHER:** Demonstrates and provides student's experiences with the use of various mathematical models. Questions students to justify their choice of model and the thinking behind the model. Asks students about the appropriateness of the model chosen. Assists students in seeing and making connections among models. Give students opportunity to evaluate the appropriateness of the model.

	skills articulated in **F-BF.1a, F-BF.3, ACED.1, A-SSE.3, F-IF.B, F-IF.7,** limited to linear functions and exponential functions with domains in the integers. Micro-models: Autonomously apply a technique from pure mathematics to a real-world situation in which the technique yields valuable results even though it is obviously not applicable in a strict mathematical sense (e.g., profitably applying proportional relationships to a phenomenon that is obviously nonlinear or statistical in nature). Content Scope: Knowledge and skills articulated			

	in the Algebra 1 Type I, Sub-Claim A (Major Content) Standards Reasoned estimates: Use reasonable estimates of known quantities in a chain of reasoning that yields an estimate of an unknown quantity. Content Scope: Knowledge and skills articulated in the Algebra 1 Type I, Sub-Claim A (Major Content) Standards			