GVC Companion Guide: Algebra I

COURSE FOCUS: The manipulation of equations and the comparison of linear, quadratic, and exponential models.

- Set classroom norms and excitement for a great year of mathematics ahead! Start the school year with growth mindset work doing Week of Inspirational Math(s) - youcubed. Consider using these tasks throughout the year with a big kick off week one using parts of any of the "weeks" provided. Work with your PLC to collaborate together on which to use when.
- Use number talks/sense making routines and mini-lessons to bring back past math knowledge. Things to think about including:
    - "My Favorite No" – My favorite wrong answer/Error Analysis
    - Which one doesn't belong? (WODB)
    - Which would you rather?
    - Silent Board Game (How To)
    - Graphing Stories: Blog-why-how-samples; Desmos Stories; STEMlearning; sample search
    - Open Middle (open-ended questions)
    - Estimation 180
    - Number-Math Talks | Same but Different
    - Always, Sometimes, or Never | True-False … and why? | Give example(s) and/or counter-example(s) nrich.maths-ASN | true/false routine
    - Academic Talk protocol (English learners) | Partner A/Partner B (Academic Talk protocol)
    - Claims-Evidence Writing (graphic organizer support) | Problem-Evidence-Reasoning-Claim (PERC)
    - Mathematical Mindsets by Jo Boaler (Appendix A pgs. 217-268) Appendix A

Math Core 8 Milestones as background content knowledge and expectations with which students enter Algebra I

- Problem solving is done throughout the course in order to launch/explore/summarize and apply mathematics concepts.
- It is highly suggested to use the CME/PLC Unit Assessments to backwards plan for the unit at hand. This will help provide a roadmap for the critical standards and concepts to be emphasized as noted in Overview Critical Areas mentioned in the Detailed Curriculum Map.
- **Resources:**
    - OpenUp Resources
    - Desmos Activities for Algebra 1
    - Barbie Bungee Desmos
    - Barbie Bungee Quiz, Retake 1, Retake 2

Guiding Philosophy, CGI, Cognitively Guided Instruction:

- ❖ We invite you to consider the following:
    - Students need space and time to make sense of mathematics.
    - Students need time to explain their thinking.
    - Take time to notice, strategically share, and celebrate diverse student thinking.
    - Use questioning to elicit, support, and extend thinking.
    - Facilitate student-centered discussions to deepen understanding and create spaces for sense-making.

Seven Guiding Principles of Cognitively Guided Instruction, CGI:

We tie these principles to the Social Justice Standards, learning for justice anti-bias framework - [Learning for Justice Website](#)

1. Every student comes to math class knowing some mathematics
2. Every student is capable of extending their mathematical ideas
3. Knowing the development of children's thinking helps you know how to support learning– "What am I working toward?"
4. Details of children's thinking support instructional decision making
5. Must challenge our assumptions about what students know and are able to do
6. Must create space for the participation of each and honor the different ways in which students are participating
7. Identity shapes participation, so want to position students competently

SEMESTER 1 Fall FIAB Interpreting Functions		
Unit 1 Aug	**Unit 2 Sept-Oct**	**Unit 3 Oct-Nov/Dec**
YouCubed Inspirational Math Week Expressions/Equations **OpenUp Unit 4**	**Graphs, Relationships and Statistics** **OpenUp Unit 9**	**Lines–Linear Functions and Systems of Equations** **OpenUp Unit 5**

SEMESTER 1

Students should build on **prior knowledge** of…	Students should **master**…	Students should be **developing** and will continue to work on…
Order of operations. Solving linear equations. Graphing on a coordinate plane. Evaluating expressions. Slope or rate of change.	Solving multi-step equations. Interpreting graphs and modeling with graphs. Graphing linear equations. Finding a solution of a system of linear equations graphically.	Identifying domain and range of functions. Identifying and recognizing the shape of parent functions (linear, quadratic, absolute value, and square root). Finding a solution of a system of linear equations algebraically. Interpreting the meaning of discrete and continuous graphs in a real-world context.

District FIAB in October will be Interpreting Functions.

Things to be aware of:
- Expressions and Equations are done in middle school therefore Algebra activates prior knowledge AND embeds in all the Functions and Systems learning and tasks
- Reminder that work with linear equations and derivation of equations supports work in both algebra and science

- Systems of linear equations begin in semester 1 and tasks/applications continue to be posed in semester 2.
- Systems Problems will be embedded throughout semester 2 to do the math modeling and applications required in this course and for success in math studies. Unit 3 should emphasize linear functions and systems with a heavy emphasis on systems. It also includes some statistics i.e. linear modeling, inequalities, and some absolute value.

SEMESTER 2 Winter IAB Algebra and Functions I			
Unit 4 Jan-Feb	**Unit 5 February**	**Unit 6 March-April**	**Unit 7 Apr-May/June**
Functions (includes recursive functions) **OpenUp Units 1, 3, 8**	**Exponents & Radicals** **OpenUp Unit 2**	**Polynomials Expressions and Functions** **OpenUp Unit 8**	**Quadratic Equations and Functions** **OpenUp Units 6-7**

SEMESTER 2

Students should build on **prior knowledge** of…	Students should **master**…	Students should be **developing** and will continue to work on…
Evaluating exponents. Evaluating square roots. Graphing Linear Functions.	Applying exponential properties. Adding, subtracting, and multiplying a square root. Identify key points and vocabulary dealing with quadratics (vertex, x-intercept, y-intercept, etc.). Factoring quadratics. Solving quadratics equations using various methods.	Understanding of the shape of exponential functions. Transformations of parent functions. Completing the square to manipulate a quadratic. Recognizing and applying functions to model real world situations. Identifying the effects of transformations on functions.

District IAB in February will be Algebra and Functions I – Linear Functions, Equations, and Inequalities

Things to be aware of:
- Functions = major, critical area of study. Activities such as Barbie Bungee or Zip Line can be used as either the main teaching activity in unit OR a culminating unit activity
- Must include F-IF.3 = recognition of sequences as functions, sometimes defined recursively, whose domain is a subset of the integers. **This is an algebra I, not Algebra II standard, so must be part of this course.**
- Be sure to apply the concepts of exponents and radicals within the factoring efforts.

For the Algebra I course, instructional time should focus on four <u>critical areas</u>:

(1) Deepen and extend understanding of linear and exponential relationships.

(2) Contrast linear and exponential relationships with each other and engage in methods for analyzing, solving, and using quadratic functions.

(3) Extend the laws of exponents to square and cube roots.

(4) Apply linear models to data that exhibit a linear trend.

<u>Math Core 8 Milestones</u> as background content knowledge and expectations with which students enter Algebra I

<u>Standards for Mathematical Practices</u> = the how-to of the content standards

MP1: Make sense of problems and persevere in solving them

MP2: Reason abstractly and quantitatively

MP3: Construct viable arguments and critique the reasoning of others
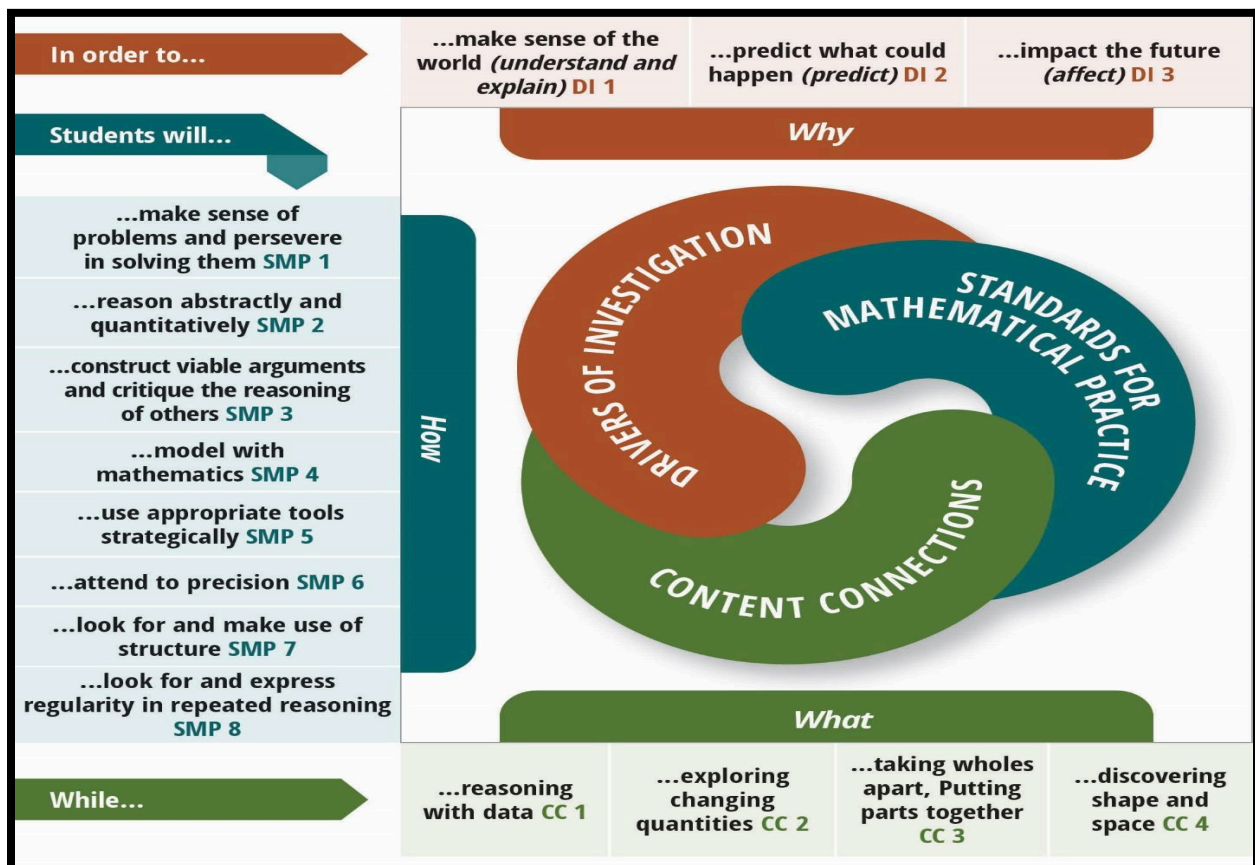
MP4: Model with mathematics
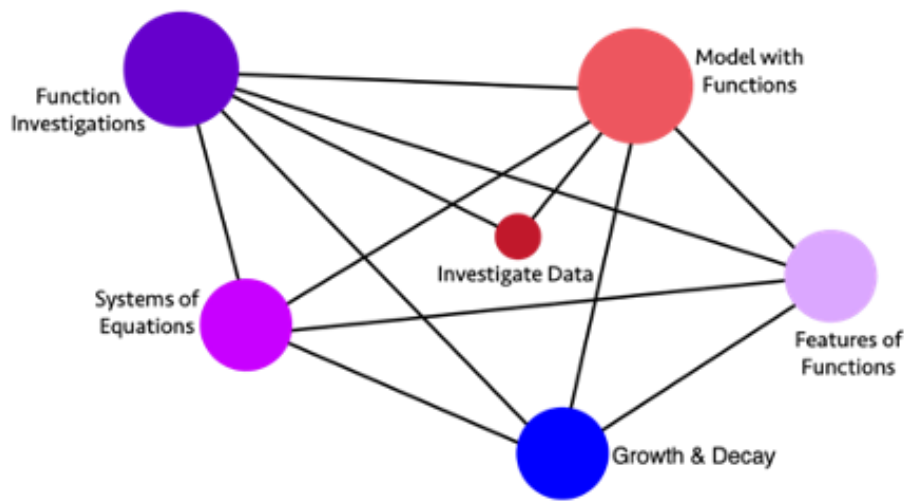
MP5: Use appropriate tools

MP6: Attend to precision

MP7: Look for and make use of structure

MP8: Look for and express regularity in repeated reasoning

Mathematical Practices 1-3-6 = connections to EL/ELD and NGSS standards: See <u>Critical Areas</u> for details of grade expectations

ALGEBRA I BIG IDEAS from 2023 CA MATH FRAMEWORK chapter 8

· Model with Functions directly connects to: Features of Functions, Growth & Decay, Investigate Data, Systems of Equations, Function Investigations

· Features of Functions directly connects to: Growth & Decay, Systems of Equations, Function Investigations, Model with Functions

· Growth & Decay directly connects to: Features of Functions, Model with Functions, Function Investigations, Systems of Equations

· Systems of Equations directly connects to: Growth & Decay, Features of Functions, Model with Functions, Function Investigations

· Function Investigations directly connects to: Model with Functions, Features of Functions, Growth & Decay, Investigate Data, Systems of Equations

· Investigate Data directly connects to: Model with Functions, Function Investigations

CONTENT CONNECTIONS ~ BIG IDEAS ~ CONTENT STANDARDS
CC1~reasoning with data   CC2~exploring changing quantities
CC3~taking wholes apart, putting parts together   CC4~discovering shape and space

Big Ideas	Content Connection	Algebra I Content Standards
Investigate Data	Reasoning with Data and Discovering Shape and Space	**S-ID.1, S-ID.2, S-ID.3, S-ID.6:** Represent data from two or more data sets with plots, dot plots, histograms, and box plots, comparing and analyzing the center and spread, using technology, and interpreting the results. Interpret and compare data distributions using center (median, mean) and spread (interquartile range, standard deviation) through the use of technology. • Students have opportunities to explore and research a topic of interest and meaning to them, using the statistical methods, tools, and representations. • Have students consider how different, competing interpretations can be made from different audiences, histories, and perspectives. • Allow students to develop follow-up questions to investigate, spurred by the original data set.
Model with Functions	Reasoning with Data and Discovering Shape and Space	**F-IF.1, F-IF.2, F-IF.4, F-IF.5, F-IF.6, F-IF.7, F-IF.8, F-IF.9, F-BF.1, F-BF.2, F-BF.4, F-LE.1, F-LE.2, S-ID.5, S-ID.6, S-ID.7, S-ID.8, S-ID.9:** Investigate data sets by table and graph and using technology; fit and interpret functions** to model the data between two quantities. Interpret information from the functions, noticing key features* and symmetries. Develop understanding of the meaning of the function and how it represents the data that it is modeling: recognizing possible associations and trends in the data - including consideration of the correlation coefficients of linear models. • Students can disaggregate data by different characteristics of interest (populations for example), and compare slopes to examine questions of fairness and bias among groups. • Students have opportunities to consider how to communicate relevant concerns to stakeholders and/or community members. • Students can identify both extreme values (true outliers) and data errors, and how the inclusion or exclusion of these observations may change the function that would most appropriately model the data. *intercepts, slope, increasing or decreasing, positive or negative ** functions include linear, quadratic and exponential
Systems of Equations	Exploring Changing Quantities	**A-REI.1, A-REI.3, A-REI.4, A-REI.5, A-REI.6, A-REI.7, A-REI.10, A-REI.11, A-REI.12, NQ.1, A-SSE.1, F-LE.1, F-LE.2:** Students investigate real situations that include data for which systems of 1 or 2 equations or inequalities are helpful, paying attention to units. Investigations include linear, quadratic, and absolute value. Students use technology tools strategically to find their solutions and approximate solutions, constructing viable arguments, interpreting the meaning of the results, and communicating them in multidimensional ways.

Big Ideas	Content Connection	Algebra I Content Standards
Function investigations	Exploring Changing Quantities	**F-IF.1, F-IF.2, F-IF.4, F-IF.5, F-IF.6, F-IF.7, F-IF.8, F-IF.9, F-BF.1, F-BF.2, F-BF.4, S-ID.5, S-ID.6, S-ID.7, S-ID.8, S-ID.9, F-LE.1, F-LE.2:** Students investigate data sets by table and graph and using technology; such as earthquake data in the region of the school; they fit and interpret functions to model the data between two quantities and consider the meaning of inverse relationships. Students interpret information from the functions, noticing key features* and symmetries. Students develop understanding of the meaning of the function and how it represents the data that it is modeling; they recognize possible associations and trends in the data - including consideration of the correlation coefficients of linear models. *one to one correspondence, intercepts, slope, increasing or decreasing, positive or negative
Features of Functions	Exploring Changing Quantities	**A-SSE.3, F-IF.3, F-IF.4, F-LE.1, F-LE.2, F-LE.6:** Students investigate changing situations that are modeled by quadratic and exponential forms of expressions and create equivalent expressions to reveal features* that help understand the meaning of the problem and situation being investigated. (driver of investigation 1, making sense of the world) Investigate patterns, such as the Fibonacci sequence and other mathematical patterns, that reveal recursive functions. *Factored form to reveal zeros of a quadratic function, standard form to reveal the y-intercept, vertex form to reveal a maximum or minimum.
Growth and Decay	Taking Wholes Apart, Putting Parts Together	**F-LE.1, F-LE.2, F-LE.3, F-LE.5, F-LE.6, F-BF.1, F-BF.3, F-BF.4, F-IF.4, F-IF.5, F-IF.9, NQ.1, A-SSE.1:** Investigate situations that involve linear, quadratic, and exponential models, and use these models to solve problems. Recognize linear functions grow by equal differences over equal intervals; exponential functions grow by equal factors over equal intervals, and functions grow or decay by a percentage rate per unit interval. Interpret the inverse of functions, and model the inverse in graphs, tables, and equations.

Drivers of Investigation. Unifying reasons that both elicit curiosity and provide the motivation for deeply engaging with authentic mathematics.

D1~make sense of the world (understand and explain)

D2~predict what could happen (predict)

D3~impact the future (affect)