Keeping the Big Ideas at the Center

Support your students in thinking about mathematics as an integrated and connected set of Big Ideas, rather than isolated topics.

To help you ensure deep, active learning for all of your students, the California Mathematics Framework centers instruction around the investigation of grade-level Big Ideas. These Big Ideas enfold clusters of standards together and are connected to each other and to authentic real-world and mathematical contexts. By designing instruction around student investigations that are focused on a set of interconnected Big Ideas, students are able to link many mathematical understandings into a coherent whole. (Chapter 1, pages 15–17)

Each Big Idea falls under one or more Content Connections (CC1, CC2, CC3, and CC4). These Content Connections help organize and connect each set of grade-level Big Ideas and provide mathematical coherence across the grades. (Chapter 1, page 24)

Content Connections

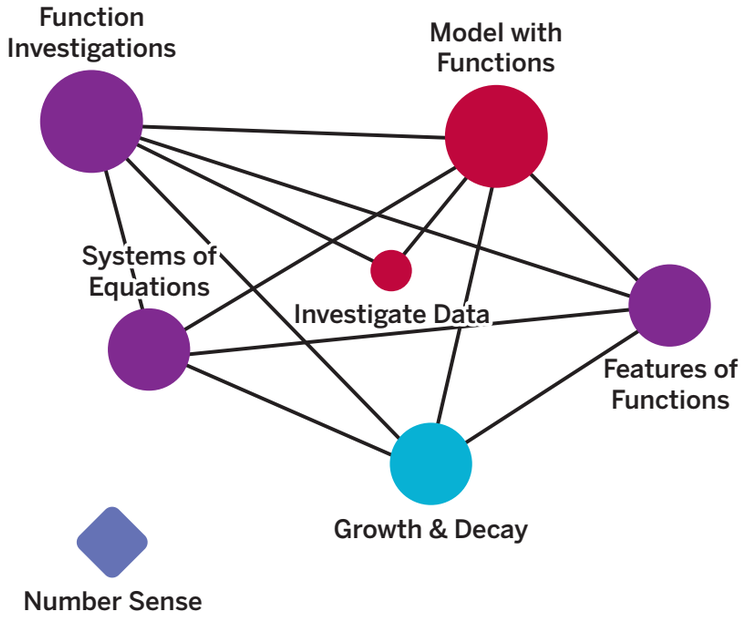
- CC1 Reasoning With Data
- CC2 Exploring Changing Quantities
- CC3 Taking Wholes Apart, Putting Parts Together
- CC4 Discovering Shape and Space

Meet the Big Ideas for Algebra 1

Amplify Desmos Math California, Algebra 1 is designed around the six California Big Ideas for Algebra 1 described in the California Mathematics Framework (Chapter 8, page 39). The Big Ideas are represented by circles of varying sizes, with the size of each circle indicating the relative importance of the Big Idea it represents. This is determined by the number of connections, represented by line segments, the Big Idea has with other Big Ideas. Big Ideas are considered to be connected to one another when they enfold two or more of the same standards. The color of each Big Idea indicates its associated Content Connection. (Chapter 1, page 15)

In Algebra 1, students spend the majority of their time investigating authentic problems that are structured to connect content standards, practice standards, and one or more Big Ideas. For more information about the development of the Big Ideas in Algebra 1, refer to the Progression of Big Ideas that precedes each sub-unit.

On the following pages, you can read more about the Algebra 1 Big Ideas as outlined by the California Mathematics Framework (Chapter 8, pages 39–42) as well as how Amplify Desmos Math California develops each Big Idea and connects it to other Big Ideas.



CC1 Investigate Data

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.

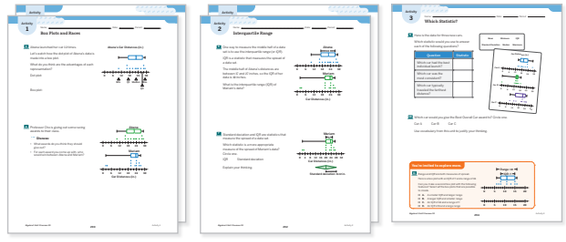
This Big Idea is also categorized under CC4: Discovering Shape and Space. **S-ID.1, S-ID.2, S-ID.3, S-ID.6**

Developing the Big Idea

Students develop this Big Idea throughout **Unit 3**. They analyze data sets using dot plots, histograms, and box plots, considering the benefits of each representation. They use statistics appropriate to the shape of the data to compare data sets (mean and standard deviation or median and IQR). Students investigate scatter plots and use lines of best fit and the correlation coefficient to describe trends and make predictions, considering whether the relationship represents causation or correlation.

Spotlight on . . .

In **Unit 3, Lesson 10, Activities 1–3**, students work toward the Big Idea *Investigate Data*. They analyze data from two data sets represented in dot plots and box plots, comparing the centers and spreads and interpreting them within the context of the real-world situations. In Activity 3, students choose statistics appropriate to the shape of the data set to answer questions.



Connecting to Other Big Ideas

CC1 Model With Functions Unit 3 (Lessons 1, 19)

CC2 Function Investigations Unit 3 (Lessons 1, 13–19)

CC1 Model With Functions

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.

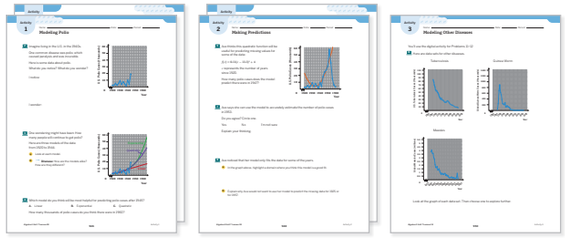
This Big Idea is also categorized under CC4: Discovering Shape and Space.
F-IF.1, F-IF.2, F-IF.4, F-IF.5, F-IF.6, F-IF.7, F-IF.8, F-IF.9, F-BF.1, F-BF.2, F-BF.4, F-LE.1, F-LE.2, S-ID.5, S-ID.6, S-ID.7, S-ID.8, S-ID.9

Developing the Big Idea

Students develop this Big Idea across multiple units. In **Unit 1**, they prepare to understand sequences as functions in a later unit. In **Unit 3**, students use correlation coefficients and lines of fit to model relationships in real-world bivariate data, assessing the fit of linear models using residual plots. In **Unit 4**, they determine whether a relationship is a function and use tables, graphs, and equations to describe and compare the key features of functions. In **Unit 6**, students construct and interpret linear and exponential functions that model real-world situations and data sets, assessing the fit of the function to the data. In **Unit 7**, they investigate situations that are modeled by quadratic functions, noticing key features and symmetries. Students move on to use quadratic functions to model real-world situations, make predictions, and solve problems. In **Unit 8**, they interpret key features of quadratic equations written in factored, standard, and vertex form, and understand the meaning of the vertex of a quadratic function within the context of the real-world situation the function models.

Spotlight on . . .

In **Unit 7, Lesson 18, Activities 1–3**, students connect the Big Ideas *Model With Functions, Function Investigations,* and *Growth and Decay.* They analyze data sets involving world diseases and select linear, quadratic, or exponential functions to model the data, using those functions to make predictions and answer questions.



Connecting to Other Big Ideas

CC1 Investigate Data Unit 3 (Lessons 1, 19)

CC2 Function Investigations Unit 3 (Lessons 1–3), Unit 4 (Lessons 1–12, 14, 15, 17), Unit 6 (Lessons 3, 4, 9, 16, 17), Unit 7 (Lessons 4, 5, 13–15, 18), Unit 8 (Lesson 13)

CC2 Systems of Equations Unit 4 (Lesson 7)

CC2 Features of Functions Unit 4 (Lesson 14), Unit 6 (Lessons 3, 8, 13), Unit 7 (Lessons 4, 5, 10, 13–15), Unit 8 (Lesson 13)

CC3 Growth and Decay Unit 1 (Lessons 4, 5, 7), Unit 4 (Lessons 6, 8, 12, 14), Unit 6 (Lessons 3, 4, 8, 9, 13, 16, 17), Unit 7 (Lessons 4, 5, 13, 18)

Connecting to Number Sense

NS Real and Complex Number Systems Unit 6 (Lesson 11)

NS Financial Literacy Unit 6 (Lessons 11, 13), Unit 7 (Lesson 13)

Keeping the Big Ideas at the Center (continued)

CC2 Systems of Equations

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.

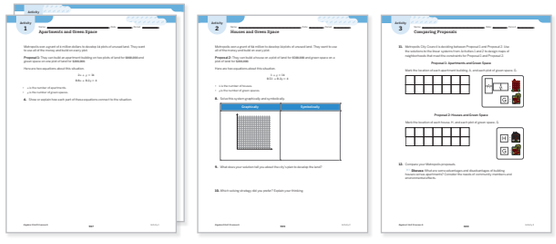
A-REI.1, A-REI.3, A-REI.4, A-REI.5, A-REI.6, A-REI.7, A-REI.10, A-REI.11, A-REI.12, N-Q.1, A-SSE.1, F-LE.1, F-LE.2

Developing the Big Idea

Students develop this Big Idea across multiple units. In **Unit 2**, they revisit strategies for solving one-variable equations including using inverse operations and making moves that keep the equation balanced. They justify whether a one-variable equation has one solution, no solution, or infinitely many solutions – which will aid them when they explore systems of equations in an upcoming unit. Students move on to investigate real-world situations that can be represented by two-variable equation linear models, paying attention to units as they interpret the meaning of the variables, including the intercepts of the graphs of equations in two-variables. They wrap up Unit 2 by modeling constraints of situations using one- and two-variable linear inequalities and absolute value equations and inequalities. Students use technology to graph inequalities and interpret the solutions and the solution region within context. They consider how inequalities that represent constraints of real-world situations can be used to analyze issues in society and make decisions. In **Unit 4**, students determine possible solutions for inputs and outputs of functions by solving equations and interpreting the results within the context of real-world situations. In **Unit 5**, students explore what the solution to a system of equations means using tables, graphs, and equations. They investigate and solve systems of linear equations using both graphing and algebraic strategies, such as elimination and substitution, and interpret solutions in context. Students compare these strategies and strategically choose which one to use, based on the structure of the equations in the system. They move on to model constraints in real-world problems by writing and solving systems of linear equations and interpret solutions in context. Students then graph systems of linear inequalities, by hand and by using technology, in order to identify solutions. They explain how to determine the solution region to a system of linear inequalities and interpret solutions in context. Students write systems of inequalities to represent constraints and use them to solve problems. They use systems of equations to meet financial and other constraints in the contexts of quilting and community meal preparation. In **Unit 8**, students explore a variety of strategies to solve quadratic equations, such as the zero-product property, reasoning, graphing, completing the square, and the quadratic formula. They wrap up Unit 8 by investigating and solving a system of linear and quadratic equations.

Spotlight on . . .

In **Unit 5, Lesson 6, Activities 1–3**, students connect the Big Ideas *Systems of Equations, Function Investigations*, and *Growth and Decay*. They investigate a real-world situation involving city development and green space, using systems of linear equations to model the situation. They solve the systems to answer questions within context.



Connecting to Other Big Ideas

- CC1 **Model With Functions** Unit 4 (Lesson 7)
- CC2 **Function Investigations** Unit 2 (Lessons 7, 14–16), Unit 4 (Lesson 7), Unit 5 (Lessons 6, 7, 10–12)
- CC2 **Features of Functions** Unit 8 (Lesson 7)
- CC3 **Growth and Decay** Unit 2 (Lessons 7, 15), Unit 5 (Lesson 6), Unit 8 (Lesson 16)

Connecting to Number Sense

- NS **Financial Literacy** Unit 2 (Lessons 7, 8, 13, 15)

CC2 Function Investigations

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.

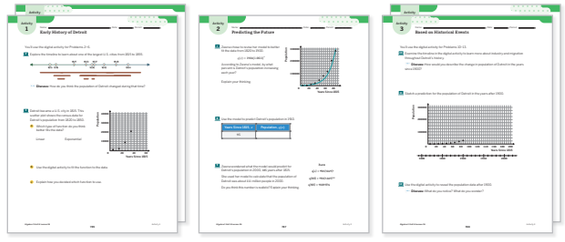
F-IF.1, F-IF.2, F-IF.4, F-IF.5, F-IF.6, F-IF.7, F-IF.8, F-IF.9, F-BF.1, F-BF.2, F-BF.4, S-ID.5, S-ID.6, S-ID.7, S-ID.8, S-ID.9, F-LE.1, F-LE.2

Developing the Big Idea

Students develop this Big Idea across multiple units. In **Unit 3**, they investigate data sets by first distinguishing between the types of questions that generate categorical data and quantitative data. Students explore how to organize categorical data in two-way frequency tables and conditional relative frequency tables, interpreting the values they calculate in context and using that information to analyze situations and make decisions. They use correlation coefficients and lines of fit to describe relationships between two variables, assessing the fit of a linear model using residual plots. In **Unit 4**, students explore functions by first determining whether a relationship is a function and beginning to use function notation as a way of describing the inputs and outputs of functions. They use multiple representations (tables, graphs, and equations) of linear, absolute value, and piece-wise defined functions (tables, graphs, and equations) to interpret and describe key features and use those key features to compare properties of functions. Students interpret the domain and range of a function in context, expressing and restricting them to fit the context. In **Unit 5**, they construct linear functions to model real-world situations using systems of linear equations and inequalities. In **Unit 6**, they investigate exponential functions, connecting the parameters of exponential equations to the situations they represent. Students explore and describe key features of exponential functions, including their domains and ranges and interpreting them in context. They construct exponential growth and decay functions to model real-world situations involving percent increase and decrease. Students move on to fit linear and exponential functions to data sets, assessing the fit of the model to the data. In **Unit 7**, they expand their knowledge of functions to now include quadratic functions, comparing quadratic growth to linear growth and exponential growth. Students use tables, graphs, and equations to recognize key features of quadratic functions, including the intercepts, the vertex, and the line of symmetry. They investigate data sets that can be modeled by quadratic functions and interpret these key features within context. Students use quadratic functions to make sense of real-world situations, make predictions, and solve problems. In **Unit 8**, they interpret information from different forms of quadratic equations, noticing key features such as intercepts and the vertex.

Spotlight on . . .

In **Unit 6, Lesson 16, Activities 1–3**, students connect the Big Ideas *Function Investigations, Model With Functions,* and *Growth and Decay*. They investigate data sets involving the population of a U.S. city and construct a function to model the data. They interpret key features from the data and their function within the context of the data.



Connecting to Other Big Ideas

CC1 Model With Functions Unit 3 (Lessons 1–3), Unit 4 (Lessons 1–12, 14, 15, 17), Unit 6 (Lessons 3, 4, 9, 16, 17), Unit 7 (Lessons 4, 5, 13–15, 18), Unit 7 (Lessons 4, 5, 9–15, 18), Unit 8 (Lesson 13)

CC1 Investigate Data Unit 3 (Lessons 1, 13–19)

CC2 Systems of Equations Unit 2 (Lesson 7, 14–16), Unit 4 (Lesson 7), Unit 5 (Lessons 6,7, 10–12)

CC2 Features of Functions Unit 4 (Lesson 14), Unit 6 (Lessons 2, 3, 6), Unit 7 (Lessons 4, 5, 10, 13–15), Unit 8 (Lessons 6, 13)

CC3 Growth and Decay Unit 2 (Lessons 7, 15), Unit 4 (Lessons 6, 8, 12, 14, 18, 19), Unit 5 (Lesson 6), Unit 6 (Lessons 2–5, 9, 15–17), Unit 7 (Lessons 1–6, 13, 17, 18)

Connecting to Number Sense

NS Parallels Between Numbers and Functions Unit 8 (Lessons 1, 6)

NS Financial Literacy Unit 2 (Lessons 7, 15), Unit 5 (Lesson 12), Unit 6 (Lesson 15), Unit 7 (Lesson 13)

Keeping the Big Ideas at the Center (continued)

CC2 Features of Functions

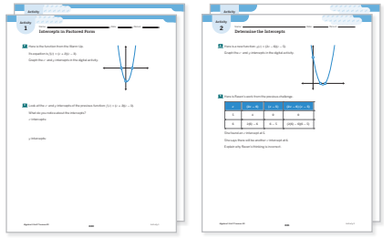
Students investigate changing situations that are modeled by quadratic and exponential forms of expressions and create equivalent expressions to reveal features that help understand the meaning of the problem and situation being investigated. (driver of investigation 1, making sense of the world). Investigate patterns, such as the Fibonacci sequence and other mathematical patterns, that reveal recursive functions. **A-SSE.3, F-IF.3, F-IF.4, F-LE.1, F-LE.2, F-LE.6**

Developing the Big Idea

Students develop this Big Idea across multiple units. In **Unit 4**, they describe sequences as functions and write recursive definitions of sequences using function notation, including the Fibonacci sequence. Students use tables, graphs, and equations to describe and compare the key features of linear, absolute value, and piece-wise defined functions. In **Unit 6**, they distinguish between situations that can be modeled by linear functions or exponential functions. Students connect the parameters of exponential functions to the situations they represent, including translated exponential functions. They compare and contrast key features, such as growth factor, using different representations. In **Unit 7**, students investigate quadratic growth. They create equivalent algebraic expressions resulting from quadratic functions and use those to identify key features of quadratic functions. In **Unit 8**, students create equivalent expressions by converting between the factored form, standard form, and vertex form of a quadratic equation, interpreting key features from the different forms.

Spotlight on . . .

In **Unit 7, Lesson 10, Activities 1–3**, students connect the Big Ideas *Features of Functions, Model With Functions,* and *Function Investigations*. They make connections between equivalent expressions (standard form and factored form) resulting from quadratic functions and the x- and y-intercepts of their corresponding graphs.



Connecting to Other Big Ideas

CC1 Model With Functions Unit 4 (Lesson 14), Unit 6 (Lessons 3, 8, 13), Unit 7 (Lessons 4, 5, 10, 13–15), Unit 8 (Lesson 13)

CC2 Systems of Equations Unit 8 (Lesson 7)

CC2 Function Investigations Unit 4 (Lesson 14), Unit 6 (Lessons 2, 3, 6), Unit 7 (Lessons 4, 5, 10, 13–15), Unit 8 (Lessons 6, 13)

CC3 Growth and Decay Unit 4 (Lesson 14), Unit 6 (Lessons 2, 3, 6, 8, 9, 13, 14), Unit 7 (Lessons 2, 4, 5, 13)

Connecting to Number Sense

NS Parallels Between Numbers and Functions Unit 8 (Lessons 2–6)

NS Financial Literacy Unit 6 (Lesson 13)

CC3 Growth and Decay

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.

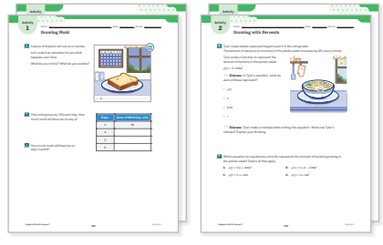
F-LE.1, F-LE.2, F-LE.3, F-LE.5, F-LE.6, F-BF.1, F-BF.2, F-BF.3, F-BF.4, F-IF.4, F-IF.5, F-IF.9, N-Q.1, A-SSE.1

Developing the Big Idea

Students develop this Big Idea across multiple units. In **Unit 1**, they investigate patterns of growth using arithmetic and geometric sequences. In **Unit 2**, students investigate situations that involve linear growth and decrease, recognizing that a linear relationship grows by equal differences over equal intervals. In **Unit 4**, they investigate functions and develop strategies for finding and interpreting the inverse of a linear function. In **Unit 5**, they expand their understanding of linear functions by making sense of systems of linear equations, constructing and solving systems that model real-world situations. In **Unit 6**, students generalize how linear functions grow by equal differences over equal intervals and exponential functions grow by equal factors over equal intervals. They construct and interpret exponential growth and decay functions to model situations involving percent increase or decrease. In **Unit 7**, students investigate linear, quadratic, and exponential relationships in patterns, tables, and equations. They recognize that quadratic functions have constant second differences over equal intervals. They use quadratic functions to model quadratic growth, make predictions, and solve problems. In **Unit 8**, they investigate situations involving quadratic models to solve problems and interpret solutions within context.

Spotlight on . . .

In **Unit 6, Lesson 7, Activities 1 and 2,** students connect the Big Ideas *Growth and Decay* and *Features of Functions*. They investigate situations involving growing mode and model the situations using exponential growth functions. Students interpret key features of the functions using tables, graphs, and equations.



Connecting to Other Big Ideas

CC1 Model With Functions Unit 1 (Lessons 4, 5, 7), Unit 4 (Lessons 6, 8, 12, 14), Unit 6 (Lessons 3, 4, 8, 9, 13, 16, 17), Unit 7 (Lessons 4, 5, 13, 18)

CC2 Function Investigations Unit 2 (Lessons 7, 15), Unit 4 (Lessons 6, 8), Unit 4 (Lessons 6, 8, 12, 14, 18, 19), Unit 5 (Lesson 6), Unit 6 (Lessons 2–5, 9, 15–17), Unit 7 (Lessons 1, 3–6, 13, 17, 18)

CC2 Systems of Equations Unit 2 (Lessons 7, 15), Unit 5 (Lesson 6), Unit 8 (Lesson 16)

CC2 Function Investigations Unit 4 (Lesson 14), Unit 6 (Lessons 2, 3, 6–8, 9, 13, 14), Unit 7 (Lessons 2, 4, 5, 13)

Connecting to Number Sense

NS Financial Literacy Unit 2 (Lessons 7, 15), Unit 6 (Lessons 13–15)