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

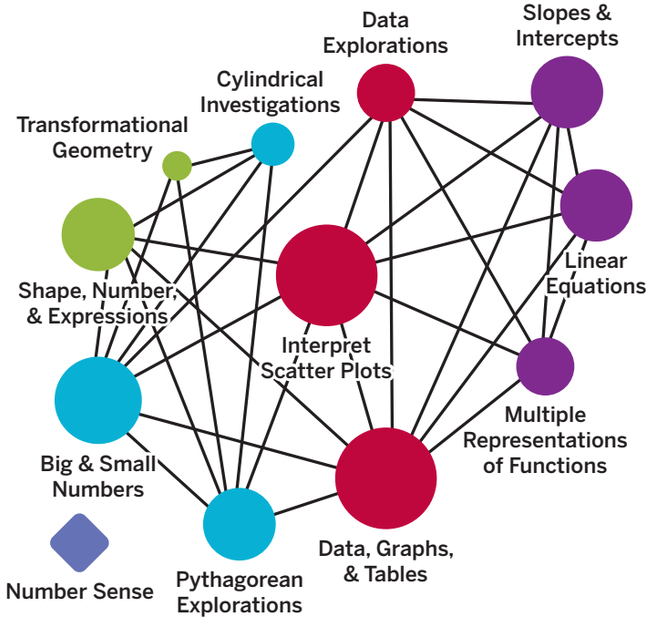
- CC1 Reasoning With Data
- CC2 Exploring Changing Quantities
- CC3 Taking Wholes Apart, Putting Parts Together
- CC4 Discovering Shape and Space

Meet the Big Ideas for Grade 8

Amplify Desmos Math California, Grade 8 is designed around the eleven California Big Ideas for Grade 8 as described in the California Mathematics Framework (Chapter 7, page 47). 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 Grade 8, 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 Grade 8, refer to the Progression of Big Ideas that precedes each sub-unit.

On the following pages, you can read more about the Grade 8 Big Ideas as outlined by the California Mathematics Framework (Chapter 7, pages 47–49) as well as how Amplify Desmos Math California develops each Big Idea and connects it to other Big Ideas.



CC1 Interpret Scatter Plots

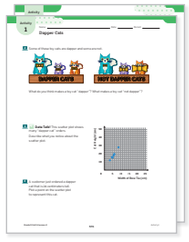
Construct and interpret data visualizations, including scatter plots for bivariate measurement data using two-way tables. Describe patterns noting whether the data appear in clusters, are linear or nonlinear, whether there are outliers, and if the association is negative or positive. Interpret the trend(s) in change of the data points over time. *This Big Idea is also categorized under CC2: Exploring Changing Quantities.* **8.SP.1, 8.SP.2, 8.SP.3, 8.EE.2, 8.EE.5, 8.F.1, 8.F.2, 8.F.3**

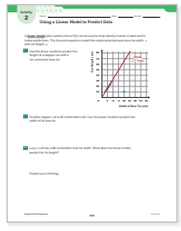
Developing the Big Idea

Students develop this Big Idea throughout **Unit 6**. They construct scatter plots using tables of bivariate data and interpret what a point on a scatter plot represents within the context of a real-world situation. Students fit lines to data, describing the features of a line that fits the data well, and use linear models to make predictions. They interpret the slope of a linear model in context and recognize patterns to determine possible types of associations. Students connect scatter plots to two-way tables.

Spotlight on . . .

In **Unit 6, Lesson 4, Activities 1 and 2**, students connect the Big Ideas *Interpret Scatter Plots, Multiple Representations of Functions,* and *Slopes and Intercepts.* Through the context of a Build-a-Cat workshop, interpret scatter plots that represent bow-tie width and cat height to understand what makes a cat "dapper." They use a linear model to identify trends in the data and make predictions.





Connecting to Other Big Ideas

- CC1 **Data, Graphs, and Tables** Unit 6 (Lessons 9, 10)
- CC2 **Linear Equations** Unit 6 (Lesson 9)
- CC2 **Multiple Representations of Functions** Unit 6 (Lesson 4)
- CC2 **Slopes and Intercepts** Unit 6 (Lessons 1, 4–9)

CC1 Data, Graphs, and Tables

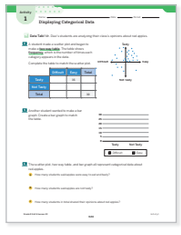
Construct graphs of relationships between two variables (bivariate data), displaying frequencies and relative frequencies in a two-way table. Use graphs with categorical data to help students describe events in their lives, looking at patterns in the graphs. **8.SP.3, 8.SP.4, 8.EE.2, 8.EE.5, 8.F.3, 8.F.4, 8.F.5**

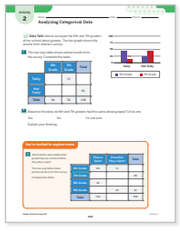
Developing the Big Idea

Students develop this Big Idea across multiple units. In **Unit 3**, they explore real-world linear relationships between two variables that are not proportional and describe how features of their graphs are similar to and different from graphs of proportional relationships. In **Unit 5**, they construct and interpret graphs of relationships between two variables to model real-world situations and compare representations of functions. In **Unit 6**, students create scatter plots and draw lines to fit to model bivariate data. They use patterns in the graphs to identify possible associations in the data, using them to make predictions. Students connect scatter plots to two-way tables and represent real-life bivariate categorical data by displaying frequencies in two-way tables.

Spotlight on . . .

In **Unit 6, Lesson 10, Activities 1 and 2**, students connect the Big Ideas *Data, Graphs,* and *Tables and Interpret Scatter Plots.* They explore the connections between scatter plots and two-way tables for bivariate, categorical data and display frequencies in two-way tables and bar graphs.





Connecting to Other Big Ideas

- CC1 **Interpret Scatter Plots** Unit 6 (Lessons 9, 10)
- CC2 **Linear Equations** Unit 3 (Lessons 4–7), Unit 5 (Lessons 5–7), Unit 6 (Lesson 9)
- CC2 **Multiple Representations of Functions** Unit 3 (Lessons 4–7), Unit 5 (Lessons 1, 3–7)
- CC2 **Slopes and Intercepts** Unit 6 (Lesson 9)

Keeping the Big Ideas at the Center (continued)

CC1 Data Explorations

Conduct data explorations, such as the consideration of seafloor spreading, involving large data sets and numbers expressed in scientific notation, including integer exponents for large and small numbers using technology. **8.SP.1, 8.SP.2, 8.SP.3, 8.SP.4, 8.EE.4, 8.EE.5, 8.F.1, 8.F.2, 8.F.3, 8.F.4, 8.F.5**

- Identify a large dataset and discuss the information it contains.
- Identify what rows and columns represent in a spreadsheet.

Developing the Big Idea

Students develop this Big Idea across multiple units. In **Unit 5**, they analyze data involving real-world situations and construct and interpret graphs of relationships between two variables that model those situations. In **Unit 7**, students investigate real-world data sets that involve data expressed in scientific notation and create a poster that summarizes their findings. They then use data sets to compare the net worths of various celebrities.

Spotlight on . . .

In **Unit 5, Lesson 9, Activities 1–3**, students connect the Big Ideas *Data Explorations* and *Linear Equations*. They analyze graphs that represent large real-world data sets involving cell phones, recycling, college costs, birth rates, life expectancy, and global temperature. They model these data sets using linear functions and use their functions to make predictions.

Connecting to Other Big Ideas

CC2 **Linear Equations** Unit 5 (Lessons 8, 9)

CC3 **Big and Small Numbers** Unit 7 (Lessons 12, 14)

Connecting to Number Sense

NS **Generalized Numbers Leading to Algebra** Unit 7 (Lessons 12, 14)

CC2 Linear Equations

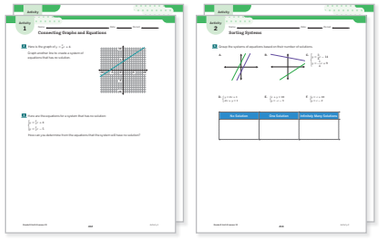
Analyze slope and intercepts and solve linear equations including pairs of simultaneous linear equations through graphing and tables and using technology. **8.EE.5, 8.EE.7, 8.EE.8, 8.F.2, 8.F.4, 8.F.5**

Developing the Big Idea

Students develop this Big Idea across multiple units. In **Unit 3**, they explore proportional and non-proportional linear relationships, making connections between unit rate and slope for proportional relationships. In **Unit 4**, they solve linear equations with variables on both sides of the equal sign and investigate systems of linear equations in two variables. They estimate solutions by graphing and solve systems using substitution. In **Unit 5**, they construct and interpret linear equations to represent and model relationships between two variables. In **Unit 6**, students interpret the slopes of linear models for scatter plots within context.

Spotlight on . . .

In **Unit 4, Lesson 13, Activities 1 and 2**, students work toward the Big Idea *Linear Equations*. They use digital technology to graph and solve systems of equations and analyze the slopes and intercepts of the lines graphed to help determine the number of solutions – including systems that have no solution or infinitely many solutions.



Connecting to Other Big Ideas

CC1 **Interpret Scatter Plots** Unit 6 (Lessons 7–9)

CC1 **Data, Graphs, and Tables** Unit 3 (Lessons 4–7), Unit 5 (Lessons 5–7), Unit 6 (Lesson 9)

CC1 **Data Explorations** Unit 5 (Lessons 8, 9)

CC2 **Multiple Representations of Functions** Unit 3 (Lessons 1–7), Unit 4 (Lesson 8), Unit 5 (Lessons 5–7), Unit 6 (Lesson 4)

CC2 **Slopes and Intercepts** Unit 3 (Lessons 1–3), Unit 6 (Lessons 7–9)

CC2 Multiple Representations of Functions

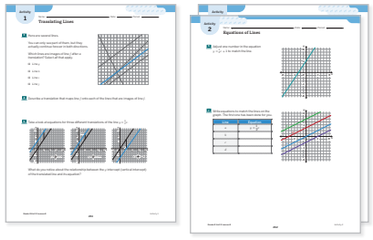
Move between different representations of linear functions (i.e., equation, graph, table, and context), sketch and analyze graphs, use similar triangles to visualize slope and rate of change with equations containing rational number coefficients. **8.EE.5, 8.EE.6, 8.EE.7**

Developing the Big Idea

Students develop this Big Idea across multiple units. In **Unit 2**, they use similar triangles to visualize the slope of a line. In **Unit 3**, students compare tables, graphs, and equations of proportional and non-proportional linear relationships, interpreting the slopes and intercepts in context. In **Unit 4**, students connect contexts to symbolic representations by writing and solving linear equations to model real-world problems. In **Unit 5**, they compare and construct tables, graphs, and equations that represent linear relationships between two variables. In **Unit 6**, students connect contexts to scatter plots and write linear equations to fit the data.

Spotlight on . . .

In **Unit 3, Lesson 8, Activities 1 and 2**, students connect the Big Ideas *Multiple Representations of Functions* and *Transformational Geometry*. They use tables, graphs, and equations to investigate what happens to the equations of lines when the lines are translated in the coordinate plane.



Connecting to Other Big Ideas

- CC1 **Interpret Scatter Plots** Unit 6 (Lesson 4)
- CC1 **Data, Graphs, and Tables** Unit 3 (Lessons 4–7), Unit 5 (Lessons 1, 3–7)
- CC2 **Linear Equations** Unit 3 (Lessons 1–7), Unit 4 (Lesson 8), Unit 5 (Lessons 5–7), Unit 6 (Lesson 4)
- CC2 **Slopes and Intercepts** Unit 3 (Lessons 1–3)
- CC3 **Cylindrical Investigations** Unit 5 (Lesson 12)
- CC4 **Shape, Number, and Expressions** Unit 5 (Lesson 12)
- CC4 **Transformational Geometry** Unit 2 (Lesson 9), Unit 3 (Lesson 8)

Connecting to Number Sense

- NS **Number Sense** Unit 3 (Lessons 10–15)

CC2 Slopes and Intercepts

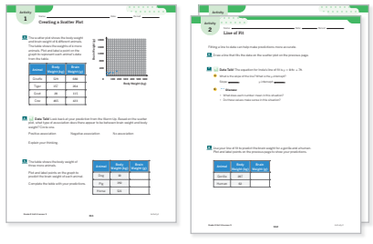
Construct graphs using bivariate data, comparing the meaning of parallel and non-parallel slopes with the same or different y-intercepts using technology. **8.EE.5, 8.SP.1, 8.SP.2, 8.SP.3**

Developing the Big Idea

Students develop this Big Idea across multiple units. In **Unit 3**, they make connections between the unit rate of a proportional relationship and the slope of its line. In **Unit 6**, students fit lines to data and interpret the slopes of these linear models in context and determine the types of associations shown on scatter plots, using these associations to make predictions.

Spotlight on . . .

In **Unit 6, Lesson 9, Activities 1 and 2**, students connect the Big Ideas *Slopes and Intercepts, Interpret Scatter Plots, Data, Graphs, and Tables, and Linear Equations*. Through a real-world context involving the weights of animal brains, they investigate a set of bivariate data, construct a scatter plot, and fit a line to the data, and interpret the slope and y-intercept of lines of fit within context.



Connecting to Other Big Ideas

- CC1 **Interpret Scatter Plots** Unit 6 (Lessons 1, 4–9)
- CC1 **Data, Graphs, and Tables** Unit 6 (Lessons 9)
- CC2 **Linear Equations** Unit 3 (Lessons 1–3), Unit 6 (Lessons 7–9)
- CC2 **Multiple Representations of Functions** Unit 3 (Lessons 1–3), Unit 6 (Lesson 4)

Keeping the Big Ideas at the Center (continued)

CC3 Cylindrical Investigations

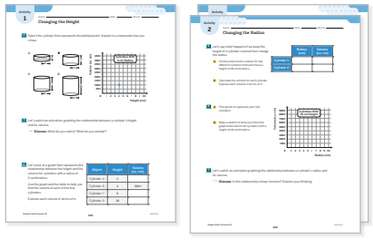
Solve real world problems with cylinders, cones, and spheres. Connect volume and surface area solutions to the structure of the figures themselves (e.g., why and how is the area of a circle formula used to find the volume of a cylinder?). Show visual proofs of these relationships, through modeling, building, and using computer software. *This Big Idea is also categorized under CC4: Discovering Shape and Space.* **8.G.9, 8.G.6, 8.G.7, 8.G.8, 8.NS.1, 8.NS.2**

Developing the Big Idea

Students develop this Big Idea throughout **Unit 5**. They explore the volume of a cylinder as a function of its radius and investigate why the formula for the area of a circle is part of the formula for the volume of a cylinder, connecting this reasoning to volume of prisms ($V = Bh$) where the base of a cylinder is a circle. Students use visual models to prove the formula for the volume of a cylinder and relate the volume of a cylinder to the volume of a cone with the same base area and height. They solve real-world problems involving the volume of cylinders, cones, and spheres.

Spotlight on . . .

In **Unit 5, Lesson 12, Activities 1 and 2**, students connect the Big Ideas *Cylindrical Investigations, Multiple Representations of Functions,* and *Shape, Number, and Expressions*. They use tables and graphs to investigate what happens to a cylinder's volume as the radius is scaled and learn that, while the relationship between a cylinder's volume and its height is proportional and linear, the relationship between a cylinder's volume and its radius is non-proportional and non-linear.



Connecting to Other Big Ideas

CC2 Multiple Representations of Functions
Unit 5 (Lesson 12)

CC4 Shape, Number, and Expressions
Unit 5 (Lessons 10–15)

CC3 Pythagorean Explorations

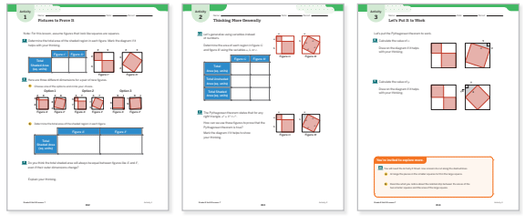
Conduct investigations in the coordinate plane with right triangles to show that the areas of the squares of each leg combine to create the square of the hypotenuse and name this as the Pythagorean Theorem. Using technology, use the Pythagorean Theorem to solve real world problems that include irrational numbers. *This Big Idea is also categorized under CC4: Discovering Shape and Space.* **8.G.7, 8.G.8, 8.NS.1, 8.NS.2, 8.EE.1, 8.EE.2**

Developing the Big Idea

Students develop this Big Idea throughout **Unit 8**. They develop strategies to determine the area of a titled square with vertices on the intersections of grid lines. They identify patterns between the areas of the squares of legs on triangles and notice that $a^2 + b^2 = c^2$ is true for right triangles. They work through an algebraic proof to reason that the theorem is true for right triangles. Students calculate the distance between two points on the coordinate plane using the Pythagorean theorem. They move on to determine whether a triangle is a right triangle using the converse of the Pythagorean theorem and then apply the Pythagorean theorem to solve problems in context.

Spotlight on . . .

In **Unit 8, Lesson 7, Activities 1–3** students connect the Big Ideas *Pythagorean Explorations* and *Shape, Number, and Expressions*. They work through an area-based algebraic proof of the Pythagorean theorem, reasoning about the areas of two squares to show the theorem is true for right triangles. Students connect this algebraic proof to determine unknown side lengths in right triangles.



Connecting to Other Big Ideas

CC4 Shape, Number, and Expressions
Unit 7 (Lessons 1, 6, 7, 11)

Connecting to Number Sense

NS Generalized Numbers Leading to Algebra
Unit 2 (Lesson 6)

CC3 Big and Small Numbers

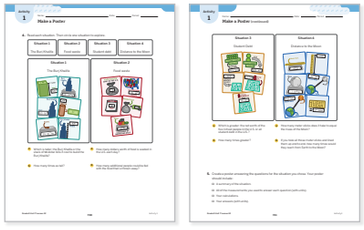
Use scientific notation to investigate problems that include measurements of very large and very small numbers. Develop number sense with integer exponents (e.g., $1/27 = 1/3^3 = 3^{-3}$). **8.EE.1, 8.EE.2, 8.EE.3, 8.EE.4, 8.NS.1, 8.NS.2**

Developing the Big Idea

Students develop this Big Idea across multiple units. In **Unit 7**, they use patterns and reasoning to identify and create equivalent expressions involving positive and negative exponents and exponents of zero. They move on to develop strategies for rewriting very large and very small numbers as combinations of powers of 10, recognizing the need for a standard system to represent these numbers (scientific notation). They use scientific notation to perform operations with very large and very small numbers and solve real-world problems involving numbers written in both standard notation and scientific notation.

Spotlight on . . .

In **Unit 7, Lesson 12, Activity 1**, students connect the Big Ideas *Big and Small Numbers* and *Data Explorations*. They select a real-world situation to explore that involves data, including measurements written in scientific notation. They create a poster of their summaries and findings.



Connecting to Other Big Ideas

CC1 **Data Explorations** Unit 7 (Lessons 12, 14)

Connecting to Number Sense

NS **Generalized Numbers Leading to Algebra** Unit 7 (Lessons 9–14)

CC4 Shape, Number, and Expressions

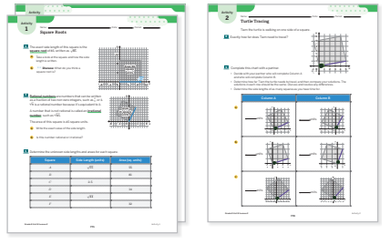
Compare shapes containing circular measures to prisms. Note that cubes and squares represent unit measures for volume and surface area. See and use the connections between integer exponents and area and volume. **8.G.9, 8.G.6, 8.G.7, 8.G.8, 8.EE.1, 8.EE.2, 8.NS.1, 8.NS.2**

Developing the Big Idea

Students develop this Big Idea across multiple units. In **Unit 5**, they investigate why the formula for the area of a circle is part of the formula for the volume of a cylinder, connecting this reasoning to volume of prisms ($V = Bh$) where the base of a cylinder is a circle. Students use visual models to prove the formula for the volume of a cylinder and relate the volume of a cylinder to the volume of a cone with the same base area and height. They connect squares and cubes to area and volume as they use cubic units to measure volume and square units to measure area. In **Unit 8**, they develop strategies to determine the area of a titled square with vertices on the intersections of grid lines. Students come to understand that a square root is related to the side length of a square and a cube root is related to the edge length of a cube. They approximate the values of square roots and cube roots by representing them as points on a number line and identify which two whole numbers a square root or cube root fall between.

Spotlight on . . .

In **Unit 8, Lesson 2, Activities 1 and 2**, students work toward the Big Idea *Shape, Number, and Expressions*. They use squares and tilted squares graphed on the coordinate plane to model and describe the relationship between the side length and the area of a square using square roots.



Connecting to Other Big Ideas

CC2 **Multiple Representations of Functions** Unit 5 (Lesson 12)

CC3 **Cylindrical Investigations** Unit 5 (Lessons 10–15)

CC3 **Pythagorean Explorations** Unit 7 (Lessons 1, 6, 7, 11)

Connecting to Number Sense

NS **Number Line Understanding** Unit 7 (Lessons 2–5)

Keeping the Big Ideas at the Center (continued)

CC4 Transformational Geometry

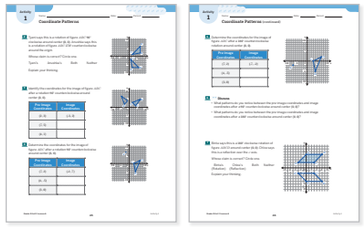
Plot two dimensional figures on a coordinate plane, using geometry software, noting similarity when dilations are performed and the corresponding angle measures maintain congruence. Perform translations, rotations, and reflections and notice when shapes maintain congruence. **8.G.1, 8.G.2, 8.G.3, 8.G.4, 8.G.5, 8.G.6, 8.G.7, 8.G.8**

Developing the Big Idea

Students develop this Big Idea across multiple units. In **Unit 1**, they visualize, describe, and perform translations, reflections, and rotations on and off a grid and on a coordinate plane. Students learn and use the word congruent and come to understand that two figures are congruent if one figure can be mapped onto the other using a sequence of rigid transformations. They build on this understanding in **Unit 2** as they visualize and perform dilations using scale factors and centers of dilation on and off a grid. They determine how the size of a scale factor affects the size of an image. Students develop and describe strategies for performing dilations. They identify such figures as similar. Students also identify similarity in triangles using congruent corresponding angles and explore how equivalent ratios represent corresponding side lengths in similar triangles. Students use these ratios to help determine missing side lengths of similar triangles. They explore the connection between similar triangles and the slope of a line. They explain why all slope triangles on the same line are similar and they develop strategies for calculating slope using the height-to-base ratio of these triangles. Then in **Unit 3**, students apply transformations as they derive the equation $y = mx + b$ by translating the graph of $y = mx$.

Spotlight on . . .

In **Unit 1, Lesson 6, Activity 1**, students work toward the Big Idea *Transformational Geometry*. They use geometry software to analyze the effects of rotations of two-dimensional figures on a coordinate plane, noticing how the coordinates of the image are related to the pre-image.



Connecting to Number Sense

CC2 Multiple Representations of Functions
Unit 2 (Lesson 9), Unit 3 (Lesson 8)