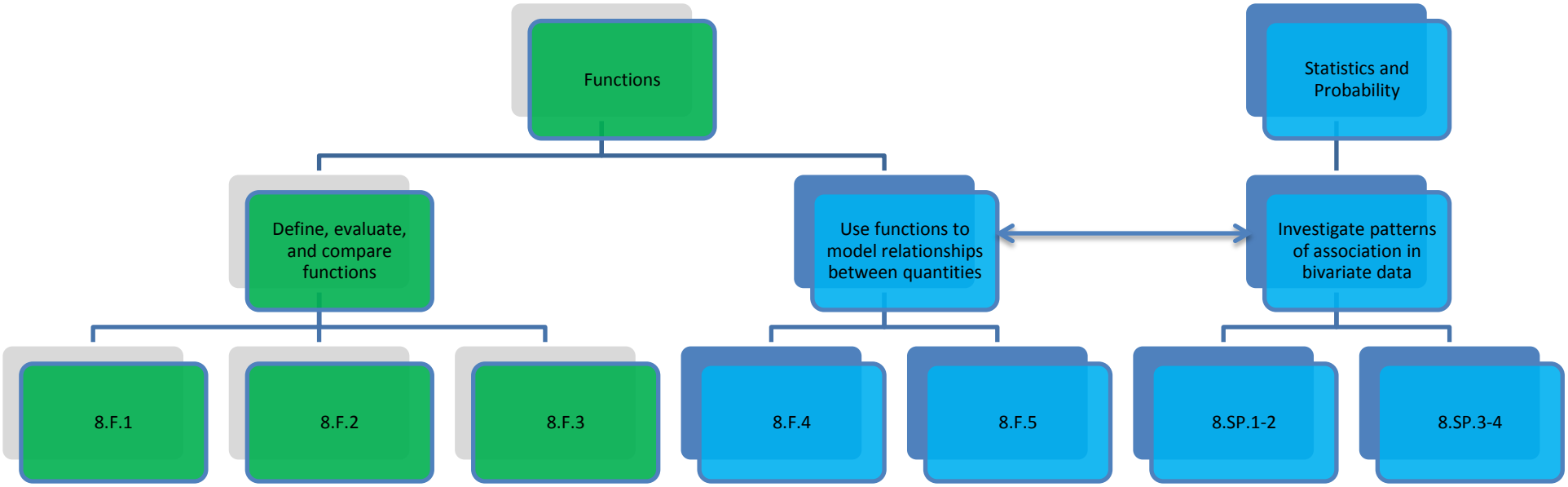
# Common Core Math 8
## Unit 3
## Function to Model Relationships between Quantities




Key: Major Clusters; Supporting Clusters; Additional Clusters

**COMMON CORE MATH 8 – UNIT 3**
**Function to Model Relationships between Quantities**

Students grasp the concept of a function as a rule that assigns to each input exactly one output. They understand that functions describe situations where one quantity determines another. They can translate among representations and partial representations of functions (noting that tabular and graphical representations may be partial representations), and they describe how aspects of the function are reflected in the different representations.

| CLUSTER | COMMON CORE STATE STANDARDS |
|---|---|
| Define, evaluate and compare functions.<br>MP 2,4, and 7 | **8.F.1.** Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output.<br><br>**8.F.2** Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has the greater rate of change.*<br><br>**8.F.3** Interpret the equation $y = mx + b$ as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. *For example, the function $A = s^2$ giving the area of a square as a function of its side length is not linear because its graph contains the points (1,1), (2,4) and (3,9), which are not on a straight line.* |
| Use functions to model relationships between quantities.<br>MP 1, 2, and, 4 | **8.F.4** Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two *(x, y)* values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values.<br><br>**8.F.5** Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally. |
| Investigate patterns of association in bivariate data.<br>MP 1, 4, 5, 6, and 7 | **8.SP.1** Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association. |

| CLUSTER | COMMON CORE STATE STANDARDS |
|---|---|
| | **8.SP.2** Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line.<br><br>**8.SP.3** Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept. *For example, in a linear model for a biology experiment, interpret a slope of 1.5 cm/hr as meaning that an additional hour of sunlight each day is associated with an additional 1.5 cm in mature plant height.*<br><br>**8.SP.4** Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects.<br>Use relative frequencies calculated for rows or columns to describe possible association between the two variables. *For example, collect data from students in your class on whether or not they have a curfew on school nights and whether or not they have assigned chores at home. Is there evidence that those who have a curfew also tend to have chores?* |
| MATHEMATICAL PRACTICES | LEARNING PROGRESSIONS |
| 1. Make sense of problems and persevere in solving them.<br><br>2. Reason abstractly and quantitatively.<br><br>3. Construct viable arguments and critique the reasoning of others.<br><br>4. Model with mathematics.<br><br>5. Use appropriate tools strategically.<br><br>6. Attend to precision.<br><br>7. Look for and make use of structure.<br><br>8. Look for and express regularity in repeated reasoning. | http://ime.math.arizona.edu/progressions/#committee.<br><br>CDE Progress to Algebra K-8<br>www.cde.ca.gov/be/cc/cd/documents/updateditem12catt3.doc |

| ENDURING UNDERSTANDINGS | ESSENTIAL QUESTIONS | KEY VOCABULARY |
|---|---|---|
| • Students understand that a function is a relationship with a unique output for each input.<br>• Students develop their ability to make connections between multiple representations of functions and interpret the features of functions in terms of real world contexts.<br>• Students are able to construct a function to model a linear relationship.<br>• Students identify (from a graph, table, $y= mx+b$, etc.) and interpret the rate of change and initial value of a linear function in terms of the situation. | How would you determine that a relationship is a function?<br><br>What are some characteristics of a (linear) (non-linear) function?<br><br>How would you interpret the features (e.g. rate of change, initial value, increasing/decreasing) of a function, in a real world context?<br><br>How would you determine, depict, and describe "patterns of association" between two quantities, in bivariate data? | • Bivariate measurement<br>• Data<br>• Function<br>• Graph<br>• Input<br>• Intercept<br>• Line of best fit<br>• Ordered pair<br>• Output<br>• Rate of change<br>• Relative frequency<br>• Rule<br>• Scatter plot<br>• Slope<br>• Table of values<br>• Variable |

| RESOURCES | INSTRUCTIONAL STRATEGIES | ASSESSMENT |
|---|---|---|
| **Illustrative Mathematics**<br>• 8.F.1: Foxes and Rabbits<br>• 8.SP.4: Music and Sports<br>• 8.F.2: Battery Charging<br><br>**Inside Mathematics**<br>• 8.F.4 and 8.SP.1: House Prices<br><br>**LAUSD Concept Lesson**<br>• 8.SP: The Power of Diversity<br>• 8.SP.1, 8.SP.2: Through the Grapevine<br><br>**LAUSD Adopted Textbooks and Programs**<br>• Houghton Mifflin Harcourt, 2013 Go Math!<br>• McGraw-Hill, 2013, California Math, Courses 3<br>• College Preparatory Mathematics, 2013, Core Connections, Courses 3<br>• Pearson, 2013, Common Core System of Courses | • Use the function machine to introduce the basic idea and understanding of function.<br>• Have student complete the "Surround the Pool" concept task to generate sets of bivariate data in a table to compare properties of functions algebraically, graphically, and verbally.<br>• Use a different task to show students how to write linear equation of the form $y=mx+b$.<br>• Have students collect real-world data such as students test scores and the number of hours they watch television each week. Using the bivariate data, they would investigate and describe patterns of association.<br>• Involve students in conducting an experiment where they would generate linear model to solve problems in the context of bivariate measurement data.<br>• Engage students to describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, | **Formative Assessment**<br>SBAC - http://www.smarterbalanced.org/<br>ITEM #'S 42906 8 NS1-2, 8 EE 1-2<br>43208, 8 SP 1, 8 SP 3, 8 F 5<br><br>SBAC Sample Items:<br>8 F 1: MAT.08.CR.1.0000F.E.135<br>MAT.08.TE.1.0000F.E.140<br>8 F 5: MAT.08.CR.1.0000F.F.090<br><br>**LAUSD Periodic Assessment**<br>District assessments can be accessed through:<br>http://achieve.lausd.net/math<br>http://achieve.lausd.net/ccss<br><br>Use your Single Sign On to access the Interim Assessments<br><br>California will be administering the SMARTER Balance Assessment as the end of course for grades 3-8 and 11. There is no assessment for Algebra 1. |

| RESOURCES | INSTRUCTIONAL STRATEGIES | ASSESSMENT |
|---|---|---|
| | linear or nonlinear) | The 11th grade assessment will include ítems from Algebra 1, Geometry, and Algebra 2 standards. For examples, visit the SMARTER Balance Assessment at:<br>http://www.smarterbalanced.org/<br><br>SBAC Content Specs<br>http://www.smarterbalanced.org/wordpress/wp-content/uploads/2011/12/Math-Content-Specifications.pdf<br><br>8 F 1, 8 F2: CR 10: Shelves<br>8 SP 1: CR 7: Bird and Dinosaur Eggss<br>8 EE 8, 8 F4: CR 4: Baseball Jerseys |

LANGUAGE GOALS for **low achieving, high achieving, students with disabilities and English Language Learners**

Students will compare and contrast two functions with different representations.
Students will draw conclusions based on different representations of functions.
Students will write a comparison of the characteristics of linear and nonlinear functions using various representations and explain orally.
Students will recognize and explain that a linear function is graphed as a straight line.
*Example*: An example of nonlinear functions is_____. It is nonlinear because_____.

PERFORMANCE TASK

**Mathematics Assessment Project**

- 8 F 4, 8 F 5: Lines and Linear Equations
- 8.F.4: Interpreting Distance-Time Graphs
- 8.EE, 8.F: Generalizing Patterns: The Difference of Two Squares
- 8.F.2, 8.F.4: Modeling Situations with Linear Equations

DIFFERENTIATION 🕮

| UDL/ FRONT LOADING | ACCELERATION | INTERVENTION |
|---|---|---|
| **Statistics and Probability:**<br>• Students have enough experience with coordinate geometry and linear functions to plot bivariate data as points on a plane and to make use of the equation of a line in analyzing the relationship between two points.<br>• Students build on their experience with | Acceleration for high achieving students:<br>• Have students design a plan for collection and production of data relevant to questions of interest. Working collaboratively students apply their experience with the coordinate plane and linear functions in the study of association between two variables related to a question of interest. | Intervention for low achieving students and students with disabilities:<br>• Engage students in gathering bivariate data and have a discussion regarding variability. Collect and plot data on a coordinate system. Students can collect their shoe sizes and heights as a group and make a plot of heath versus shoe size to determine if there is a correlation. |

| DIFFERENTIATION 🕮 | | |
|---|---|---|
| UDL/ FRONT LOADING | ACCELERATION | INTERVENTION |
| decimals and percent, and the ideas of association between measurement variables, students now take a more careful look at possible association between categorical variables<br>**Functions:**<br>• Students extend and apply their understanding of expressions, equations and graphing, tabular representations and how these relate to each other to semi-formally describe a function: a rule that assigns to each input exactly one output.<br>• Students use function machine to introduce to idea of function. | Acceleration for high achieving students:<br>• As in the univariate case, analysis of bivariate measurement data graphed on a scatterplot proceeds by describing shape, center, and spread. Students determine the correlation of the graph – whether the association of the bivariate data is positive, negative, or a cloud of points on a plane, "center" based on the line of best fit.<br>• 8.F.5, Inside Mathematics Problem of the Month, "Growing Staircases," http://insidemathematics.org/problems-of-the-month/pom-growingstaircases.pdf | Intervention for low achieving students and students with disabilities:<br>• The teacher explains dependent and independent variable based on the plot. Also the association between shoe size and height if any can be discussed.<br>• Have students use a manipulative, such as tiles, paper clips, or toothpick to construct patterns that are growing at constant rate. Have them write the data on a table of values as well as graph the points. Engage them in a discussion of dependent and independent variables, etc. |

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