

Achievement Level Descriptors (ALDs)

Mathematics

Grade 9

# Achievement Level Descriptors (ALDs) Mathematics Grade 9

The achievement level descriptors describe what a typical student scoring at each achievement level can do. A student who scores at a level would be expected to also be able to demonstrate the skills described in previous levels. A student would not necessarily demonstrate all the skills listed at a particular achievement level on a particular test in order to score at that level.

## Achievement Level Definitions

**Needs Support** – Student may partially meet the standards but needs support to master the knowledge and skills of current grade-level content.

**Approaching Proficient** – Student partially meets the standards and may have gaps in knowledge and skills but is approaching mastery of some grade level content.

**Proficient** – Student meets the standards and demonstrates mastery of the knowledge and skills of most grade level content.

**Advanced** – Student meets the standards and demonstrates mastery of the knowledge and skills on a range of complex grade level content.

## Number and Quantity—The Real Number System

| Alaska Standard | **Needs Support**  **A student at this level:** | **Approaching Proficient**  **A student at this level:** | **Proficient**  **A student at this level:** | **Advanced**  **A student at this level:** |
| --- | --- | --- | --- | --- |
| N-RN.1 | Identifies equivalent expressions where fractional exponents with a numerator of 1 are expressed using radicals (e.g., 6(1/4) = ⁴√(6), 3(-1/2) = 1/√3 ). | Identifies an explanation of how expressions with fractional exponents are equivalent to radicals where the fractional exponent has a numerator of one (e.g., 6(1/4) = ⁴√(6), 3(-1/2) = 1/√3). | Uses rules of exponents to explain why expressions with fractional exponents are equivalent to radicals where the fractional exponent has a numerator other than one  (e.g., 4(2/3) = ³√(16) = 2\*³√(2),  3(-3/2) = 1/(√27) = 1/(3\*√3)). | Explains how to rewrite expressions involving powers with different bases (e.g., explains how to rewrite 9(1/3) as 3(2/3)). |
| N-RN.2 | Identifies equivalent expressions involving integer powers with the same base using the properties of exponents. Exponents are not negative (e.g., *x*(*x*⁵) = *x*⁶, *y*³/*y*⁵ = 1/*y* = *y*⁻²). | Rewrites expressions involving integer powers with the same base using the properties of exponents. Note: At least one negative exponent is required (e.g., x(x⁵) = x⁶, y³/y⁵ = 1/y = y⁻² ). | Rewrites expressions involving fractional powers or radicals with the same base using the properties of exponents. No more than one operation may be used (e.g., ( x⁻¹)(x4/5) = x-1/5 = 1/(x1/5). | Rewrites expressions involving fractional powers with the same base using multiple properties of exponents. |
| N-RN.3 | Classifies numerical expressions involving a single radical as rational or irrational (e.g., √(2) is irrational, √(25/9) is rational). | Classifies numerical expressions involving the sum or product of square roots as rational or irrational (e.g., 2\*√(3)(√3) = 6, (√5) + (√5) = 2\*√5). | Evaluates claims about rational and irrational numbers, identifying counterexamples to false claims (e.g., the sum of two irrational numbers is always, sometimes, or never irrational). | Justifies claims about rational and irrational numbers, identifying counterexamples to false claims (e.g., explain why the result of a mathematical operation involving radicals is either irrational or rational). |

## Number and Quantity—Quantities

| Alaska Standard | **Needs Support**  **A student at this level:** | **Approaching Proficient**  **A student at this level:** | **Proficient**  **A student at this level:** | **Advanced**  **A student at this level:** |
| --- | --- | --- | --- | --- |
| N-Q.1 | Chooses an appropriate scale for graphs and data displays. | Calculates a unit rate.  Converts rates by changing one of the two units (e.g., converts miles per hour to miles per minute). | Converts rates by changing both units (e.g., converts miles per hour to feet per minute, converts dollars per pound to cents per ounce).  Shows the process for using fractions equivalent to 1 (e.g., 60 mins/1 hr) to convert rates to different units. | Uses unit analysis in the process of solving a real-world problem. |
| N-Q.2 | Identifies appropriate units given a real-world situation (e.g., using feet squared as unit for an area problem, meters per hour for a motion problem). | Determines the units for a rate of change presented graphically. | Determines the units for a rate of change presented algebraically. | Analyzes and explains which quantities are needed to calculate a given value in a real-world scenario. (e.g., a car driving at 25 mph for 3 minutes does not cover a distance of 25 x 3 miles). |
| N-Q.3 | Expresses the solution to a problem using a given level of accuracy. | Identifies the level of precision needed in measurements to result in a given level of precision of the result of a calculation with those units. | Determines the level of precision needed in measurements to result in a given level of precision of the result of a calculation with those units. | Explains the limitations on measurement when reporting quantities. |

## Algebra—Seeing Structure in Expressions

| Alaska Standard | **Needs Support**  **A student at this level:** | **Approaching Proficient**  **A student at this level:** | **Proficient**  **A student at this level:** | **Advanced**  **A student at this level:** |
| --- | --- | --- | --- | --- |
| A.SSE.1 | Identifies and interprets the meaning of a term in a linear equation without a real-world scenario. | Identifies and interprets the meaning of a term in a linear equation that represents a real-world scenario. | Identifies and interprets key features of an exponential expression or quadratic expression (e.g., growth rate, decay rate). | Rewrites expressions to reveal key features within the expression (e.g., P = P0(1.10)t = P0(1+0.10)t ). |
| A.SSE.2 | Identify special case polynomials that are a difference of squares or perfect square trinomials. | Rewrites an expression by factoring out a monomial to reveal a simplified expression and be able to factor a simple difference of squares or perfect square trinomials with a degree of 2 and leading coefficient of one (e.g., 3x³ + 30x² + 75x = 3x(*x*² + 10x + 25). | Rewrites and recognizes higher power expressions with leading coefficients that could be greater than 1 as a difference of squares or perfect square trinomials (e.g., x⁴ – 16 = (x² – 4)(x² + 4) and 9*x*6 – 4 = (3*x*3 – 2)(3*x*3 + 2). | Rewrites an expression to show the structure and can consider a binomial as a factor of an expression (factor by grouping) (e.g., 4*x*3 – 36*x*2 + 3*x* – 27 = 4*x*2(*x* – 9) +3(*x* – 9) = (4*x*2 + 3)(*x* – 9)). |
| A.SSE.3 | Factors out the greatest common factor of an expression. | Rewrites exponential expressions with a sum in the exponent (e.g., rewrites 5(x+3) as 125(5x)). | Factors a quadratic and finds the zeros.  Determines the best form of a quadratic, either *y* = *ax*² + *bx* + *c* or *y* = *a*(*x*–*h*)² + *k*, and uses it to identify specific features, such as the vertex, line of symmetry, *x*-intercept, and y-intercept.  Rewrites an exponential expression, a = bx, to reveal the growth or decay rate (e.g., interest growth or decay, population growth or decay). | Rewrites a quadratic expression by completing the square to reveal specific features, such as the vertex, line of symmetry, x-intercept and *y*-intercept. |

## Algebra—Arithmetic with Polynomials and Rational Expressions

| Alaska Standard | **Needs Support**  **A student at this level:** | **Approaching Proficient**  **A student at this level:** | **Proficient**  **A student at this level:** | **Advanced**  **A student at this level:** |
| --- | --- | --- | --- | --- |
| A.APR.1 | Adds polynomials with one variable.  Multiplies a monomial by a polynomial. | Multiplies binomials of the form (x + a)(x + b), where a and b are integers.  Subtracts polynomials with one variable.  Adds polynomials with multiple variables. | Multiplies binomials of the form (ax + b)(cx + d), where a, b, c, and d are integers.  Subtracts polynomials with multiple variables. | Multiplies polynomials where at least one of the polynomials is a binomial and the other polynomial has more than 2 terms (e.g., (x³ + 2*x*²)(x⁵ – 7x³ + 5)).  Identifies addition, subtraction, multiplication, and division of polynomials as closed. |
| A.APR.3 | Identifies the zeros of a function given a graph. | Identifies the graph that represents a quadratic function given in factored form.  Creates a graph given the zeros. | Creates a rough graph using zeros of a quadratic function given in factored form.  Determines the zeros of a function and uses them to create a graph. | Interprets the relationships among factors, graphs, and zeros of the equation. |

## Algebra—Creating Equations and Inequalities

| Alaska Standard | **Needs Support**  **A student at this level:** | **Approaching Proficient**  **A student at this level:** | **Proficient**  **A student at this level:** | **Advanced**  **A student at this level:** |
| --- | --- | --- | --- | --- |
| A.CED.1 | Solves problems using linear equations. | Creates a linear equation or inequality in one variable that describes a real-world scenario. | Creates a simple exponential or quadratic equation or inequality in one variable that describes a real-world scenario. | Creates and solves linear, exponential, and quadratic equations and inequalities in one variable in the context of a multi-step modeling problem. |
| A.CED.2 | Identifies linear equations with two or more variables that describe a problem situation.  Identifies linear equations with two or more variables from a table of values. | Identifies an exponential equation that represents a given graph.   Identifies an exponential equation that represents a given table of values.   Writes a linear equation with two or more variables from a verbal description of the relationship.   Writes a linear equation from a table of values.  Graphs a linear function to represent a real-world scenario. | Writes an exponential equation that represents a real-world scenario (e.g., compound interest, population growth or decay).  Identifies a quadratic equation that represents a given graph of a parabola. | Creates a graph of linear, exponential, and quadratic equations to represent real-world scenarios, including appropriate labels on the axes and choosing an appropriate scale to represent the values from the context. |
| A.CED.3 | Identifies a system of linear equations that represents a simple scenario, such as the cost of two different types of items. | Creates a system of linear equations that represents a real-world scenario. | Identifies a system of linear inequalities that represents a real-world scenario, not including distinguishing between strict and not strict inequalities.   For a system of linear inequalities that represents a real-world scenario, maximizes or minimizes one variable given a specified value for the other.  Interprets solutions to systems of equations and/or inequalities as viable or nonviable in relation to the context. | Creates a system of linear inequalities that represents a real-world scenario, including distinguishing between strict and not strict inequalities. |
| A.CED.4 | Rearranges a formula that requires only one step to solve for the variable of interest (e.g., solves D = rt for t). | Rearranges a formula that requires more than one step to solve for the variable of interest (e.g., solves PV = nRT for T). | Rearranges a linear formula to solve for a variable of interest (e.g., solves 3x + 4y = 12 for *y*). | Rearranges a formula for a variable of interest that requires multiple steps in solving and could include square roots, grouping symbols, fractions, or exponents (e.g., given h = 3\*√(k/l) solve for *k*). |

## Algebra—Reasoning with Equations and Inequalities

| Alaska Standard | **Needs Support**  **A student at this level:** | **Approaching Proficient**  **A student at this level:** | **Proficient**  **A student at this level:** | **Advanced**  **A student at this level:** |
| --- | --- | --- | --- | --- |
| A.REI.1 | Identifies a justification for each step in solving a two-step equation of the form ax + b = c. | Identifies a justification for each step in solving an equation of the form a(bx + c) = d or ax + b = cx + d, where a, b, c, and d are integers. | Explains and justifies each step in solving an equation of the form a(bx + c) = d or ax + b = cx + d, where a, b, c, and d are integers. | Explains and justifies each step in solving an equation of the form a(bx + c) = d(ex + f), where a, b, c, d, e, and f are rational numbers. |
| A.REI.3 | Solves linear equation of the form A*x* + B = C, where A, B, and C are integers.  Solves linear equation of the form *A*(*x* + *B*) = *C*, where *A*, *B*, and *C* are integers. | Solves linear equations and inequalities with integer numbered coefficients. | Solves linear equations and inequalities with real numbered coefficients. | Solve and represent solution sets of compound inequalities. |
| A.REI.4 | Identifies the solutions to a quadratic equation of the form x² = a perfect square (e.g., x² = 49). | Identifies the solutions to a quadratic equations in factored form with an integer solution that is presented as a trinomial with coefficient of 1 that is set equal to zero (e.g., (x + 1)(x – 5) = 0).  Identifies the solutions to a quadratic equation of the form ax2 = C (e.g., 3x² = 75). | Identifies the solutions to a quadratic equation with fractional solutions that is presented as the product of two binomials set equal to zero, where at least one of the binomials has a leading coefficient that is not 1 (e.g., (3x + 1)(2*x* – 7) = 0).  Solves quadratic equations using the quadratic formula with rational solutions. | Solves quadratic equations by factoring a trinomial with leading coefficient that may or may not be 1 (e.g., 3x² + 5x – 2 = 0).  Solves quadratic equations using the quadratic formula with irrational solutions. |
| A.REI.5 | Identifies an equivalent system of two equations in two variables that has a multiple of one of the equations of the original system (e.g., shows that the system *x* + y = 3 and x – y = 7 has the same solution as x + y = 3 and 2x – 2y = 14). | Identifies an equivalent system that has a sum of the original as one of the equations and a multiple of the other (e.g., adding a linear multiple of one equation to another to get one of the variables to eliminate). | Identifies systems that have the same solutions. | Justifies why multiple equivalent systems would have the same solution. |
| A.REI.6 | Identifies the approximated solution of the system of equations graphed. | Identifies the point of intersection of two linear equations graphed in the *xy*-plane as the solution. | Solves a system of two linear equations when both equations are presented in slope-intercept form and have integer coefficients (e.g., y = 2x + 1 and y = 3x + 5).  Solves a system of two linear equations when both equations are presented in standard form and one of the variables has opposite coefficients in the two equations (e.g., x + y = 10, x – y = 14). | Solves a system of two linear equations that can be in any form, using substitution method or linear multiples, and the coefficients are not restricted to integers (i.e., elimination method). |
| A.REI.7 | Identifies the system of equations graphed as being a linear equation and a quadratic equation graphed in the xy-plane. | Identifies the point, or points, of intersection of a linear equation and a quadratic equation graphed in the xy-plane as the solution(s) or the approximated solution(s) of the system of equations graphed. | Solves a system of a linear and a quadratic equation where the linear equation is already solved for one of the variables, and the coefficients in each equation are integers (e.g., y = 2x – 5, y = x² + 6x – 2). | Solves a system of equations consisting of a linear and a quadratic equation, where the linear equation can be in any form, and the coefficients are not restricted to integers (e.g., 3x – 4y = -32, y = 3x² + 7x – 15). |
| A.REI.10 | Given a linear equation and the graph of the linear equation, verifies that a point that lies on the line on the graph is a solution to the equation. | Given a non-linear equation and the graph of the equation, verifies that a point that lies on the graph is a solution to the equation. | Interprets the solutions represented by the graph of an equation in two variables in terms of the context. | Explains why the graph of an equation in two variables is the set of all solutions to the equation. |
| A.REI.11 | Identifies the points of intersection between two graphs as solution(s) to a system. | Given an equation, identify the graph of the system of equations that could represent the given equation, and identify solutions to the original equation (e.g., given the equation x² – 1 = x + 5 and graphs of the system y = x² – 1, y = x + 5 , then the x-values of the points of intersection are the solutions). | Using technology and a given equation, creates a system of linear equations, graphs the system, and solves the system (e.g., finds the solution to 3x = x + 2 by analyzing the graph of y = 3x and y = x + 2). | Creates and solves a system of equations when at least one of the equations is nonlinear (e.g., creates and solves the system y = x² – 1, y = x + 5). |
| A.REI.12 | Determines if a point in the *xy*-plane is a solution to a given inequality. | Identifies the linear inequality that is represented by a given graph.  Determines if a point in the *xy*-plane is a solution to a given system of inequalities. | Identifies the region(s) of a graph that represents the solution to a system of linear inequalities given a graph of the boundaries of the inequalities. | Graphs and solves a system of linear inequalities from a given situation. |

## Functions – Interpreting Functions

| Alaska Standard | **Needs Support**  **A student at this level:** | **Approaching Proficient**  **A student at this level:** | **Proficient**  **A student at this level:** | **Advanced**  **A student at this level:** |
| --- | --- | --- | --- | --- |
| F.IF.1 | Identifies *x* as the input of a function and y as the output of a function, given a graph. | Identifies the equation of a function that has a graph that contains a given set of points.  Determines whether a relation is a function from a given graph of the relation. | Identifies domain and range of a function given in a graph, table, map, or list. | Identifies domain and range of a function given as an equation.  Evaluates a function for a given output (e.g., finds x when 3 = f(x) given f(x) = 2x + 4). |
| F.IF.2 | Identifies correct use of function notation (e.g., if f(x) = 3x + 2, then f(5) = 3(5) + 2). | Evaluates a function for a given input. (e.g., finds f(3) when f(x) = 2x + 4). | Interpret statements that use function notation in terms of a context. (If d(t) means distance after t minutes, then d(4) means distance after 4 minutes.) | Given f(x) and g(x), evaluate f(g(x)). |
| F.IF.3 | Identifies a function as being recursive or explicit. | Determines the next or later value given an explicit formula. | Determines the next or later value given a recursive formula. | Recognizes that *an* is equivalent to *f*(*n*) and has the domain of a subset of the integers. |
| F.IF.4 | Identifies graphs as being increasing, decreasing, positive, negative, or having symmetry. | Matches a graph or a table to a given real-world context. | Interprets the maximum/minimum, *y*-intercept, *x*-intercept(s) in terms of a given context. | Interprets the periodicity of a graph given the context.  Understands the difference between relative and absolute minimums/maximums. |
| F.IF.5 | Identifies values that are not appropriate inputs for a function that represents a real-world relationship (e.g., identifies that 1.2 is not an appropriate input for a function in which the input is the number of people enrolled in a class). | Identifies an appropriate context given the domain of a function. | Describes the domain of a function that represents a real-world relationship (e.g., for a function in which the input is the number of gallons of water used by a family in a month, the domain can be described as all nonnegative real numbers). | Identifies the domain of a function that represents a real-world relationship based on the output values (e.g., for a quadratic function the represents projectile motion, the domain is all values that result in nonnegative heights). |
| F.IF.6 | Calculates the rate for a linear function presented as a table. | Estimates the average rate of change between two specified input values for a nonlinear function presented as a graph. | Calculates the average rate of change between two specified input values for a nonlinear function presented as a table. | Calculates the average rate of change for a nonlinear function between two specified input values when the function is presented as an equation.  Calculates the average rate of change for a nonlinear function between two specified input values when the function is presented as a graph. |
| F.IF.7 | Identifies an equation as being a linear, simple quadratic, or simple exponential function. | Identifies the graph of a linear, simple quadratic, or simple exponential function given its equation. | Constructs the graph of a linear, quadratic, or exponential function given its equation.  Constructs a linear function using x- and y-intercepts. | Constructs the graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions. |
| F.IF.8 | Identifies exponential functions as representing exponential growth or decay. | Factors a quadratic trinomial with leading coefficient of 1 to show the zeros of the function it describes. | Factors a quadratic trinomial with leading coefficient that is not 1 to show the zeros of the function it describes.  Identifies the growth or decay rate for exponential functions of the form y=a(b)t, where *a* and *b* are positive real numbers. | Rewrites a quadratic trinomial with leading coefficient that is not 1 by completing the square to show extreme values or axis of symmetry of the function it describes.  Rewrites a quadratic trinomial with leading coefficient of 1 by completing the square to show extreme values or axis of symmetry of the function it describes.  Identifies the growth or decay rate for exponential functions of the form y = a(b)ct, where a, b, and c are positive real numbers. |
| F.IF.9 | Compares the y-intercepts of two linear functions for one function given as an equation and the other function given a graph or table with the y-intercept shown. | Compares the slopes of two linear functions for one function given as an equation, and the other function given a graph or table. | Identifies intervals of the input for which one function is greater than, less than, or equal to another function when the two functions are presented in different ways. | Compares properties of two quadratic functions presented in different ways. |

## Functions—Building Functions

| Alaska Standard | **Needs Support**  **A student at this level:** | **Approaching Proficient**  **A student at this level:** | **Proficient**  **A student at this level:** | **Advanced**  **A student at this level:** |
| --- | --- | --- | --- | --- |
| F.BF.1 | Identifies a real-world context that matches the equation of a linear function.  Identifies an equation that matches a simple verbal description of a linear function in a mathematical context. | Identifies an equation that matches a simple verbal description of a linear function in a real-world context. | Identifies an equation that matches a verbal description of a real-world exponential function.  Writes an equation that represents a linear function that is presented as a table.  Writes an equation that represents a description of a linear function in a mathematical context. | Writes an equation that represents a real-world context of an exponential function. |
| F.BF.2 | Identifies an explicit linear formula for an arithmetic sequence that represents a real-world scenario. | Writes an explicit linear formula for an arithmetic sequence that represents a real-world scenario. | Identifies an explicit formula in a real-world scenario for an arithmetic sequence given the recursive formula.  Writes an explicit formula for a geometric sequence in a real-world scenario with an initial value of 1 when given the first few terms of the sequence.   Identifies subsequent terms in a given recursive sequence in a real-world scenario. | Writes an explicit formula for a geometric sequence in a real-world scenario when given the first few terms of the sequence.  Writes an explicit formula for a geometric sequence in a real-world scenario when given the recursive formula. |
| F.BF.3 | Identifies the type of transformation of a function given the graph before and after. | Describes the vertical transformation that will map one graph onto another for two functions. | Describes the horizontal transformation that will map one graph onto another for two functions.  Identifies the value of k given a graph of *f*(*x*) and either *f*(*x*) + *k* or *kf*(*x*). | Identifies the value of k given a graph of f(x) and either f(x + k) or f(kx). |
| F.BF.4 | Given a graph of a function, identifies the graph of the inverse. | Determines an equation for the inverse of a linear function with integer coefficients that is given in slope-intercept form. | Determines an equation for the inverse of a linear function with a fractional slope that is given in slope-intercept form (e.g., y = (2/3)x – 10). | Given a graph of a function with an inverse that is not a function, explain why the inverse is not a function. |

## Functions—Linear, Quadratic, and Exponential Models

| Alaska Standard | **Needs Support**  **A student at this level:** | **Approaching Proficient**  **A student at this level:** | **Proficient**  **A student at this level:** | **Advanced**  **A student at this level:** |
| --- | --- | --- | --- | --- |
| F.LE.1 | Determines whether graphs are linear, quadratic, or exponential. | Determines if a verbal description of a context is describing a linear, exponential, or neither type of scenario. | Explains the difference between linear and exponential functions in the context of modeling (e.g., linear function increases by equal differences over equal intervals and exponential function increases by equal factors over equal intervals). | None at this level. |
| F.LE.2 | Identifies linear functions, including arithmetic sequences, given a graph or input-output table. | Identifies a linear function, including arithmetic sequences, given a verbal description of a relationship.  Identifies an exponential function, including geometric sequences, given a graph, verbal description, or input-output table of values. | Creates a linear function given a graph, verbal description, or input-output table of values.  Creates an exponential function, including geometric sequences, given a table, graph, or verbal description of a relationship. | Justifies how a function represents the context given a table, graph, or verbal description. |
| F.LE.3 | Compares quantities increasing exponentially to quantities increasing linearly using graphs or tables. | Compares quantities increasing exponentially to quantities increasing quadratically using graphs or tables. | Determines when an exponential function will exceed a linear or quadratic function using graphs or tables. | Explains that a quantity increasing exponentially will eventually exceed one increasing linearly or quadratically. |
| F.LE.5 | Identifies the value of a real-world parameter given a real-world scenario and a linear function that represents it (i.e., Given the context and equation y = 4x + 5.99, find that the price of soap is 4 dollars). | Interprets the meaning of the constant term in a linear function that represents a real-world scenario.  Interprets the meaning of the slope in a linear function that represents a real-world scenario. | Identifies the percentage increase or decrease from an exponential function that represents a real-world scenario.  Interprets the meaning of the initial value in an exponential function that represents a real-world scenario. | Calculates the x-intercept of a linear function that represents a real-world scenario, and interprets the meaning in terms of the context.  Explains why an exponential function may not have an x-intercept in a real-world scenario. |

## Statistics and Probability—Interpreting Categorical and Quantitative Data

| Alaska Standard | **Needs Support**  **A student at this level:** | **Approaching Proficient**  **A student at this level:** | **Proficient**  **A student at this level:** | **Advanced**  **A student at this level:** |
| --- | --- | --- | --- | --- |
| S.ID.1 | Identifies a data display that represents given data. | Identifies and completes the most appropriate data display for representing given data. | Creates a dot plot, histogram, or box plot that represents a given set of data (includes answering questions about the process of creating the data displays). | Explains which data display is best for examining a particular measure of central tendency or spread. |
| S.ID.2 | Calculates the mean, median, or range of a data set given in a list or table. | Calculates the interquartile range.   Compares the measures of center of two different data sets. | Compares the center and spread of two different data sets using median and interquartile range. | Compares the center and spread of two different data sets using mean and standard deviation. |
| S.ID.3 | Identifies outliers within the context of the data set. | Compares distributions of data based on shape, center, or spread based on given graphs of distributions which include outliers. | Identifies the difference that removing an outlier has on the mean, median, or range of a data set. | Explains why, in some cases, the median is a better measure of central tendency than the mean. |
| S.ID.5 | Identifies relevant data in two-way tables. | Completes missing values in a fully determinable two-way frequency table.  Calculates relative frequency from a two-way frequency table. | Interprets data represented in a two-way frequency table by explaining the meaning of a row or column total (marginal), a row or column percentage (conditional) or a “total” percentage (joint). | Recognizes possible associations and trends in the data. |
| S.ID.6 | Identifies relevant data in scatter plots. | Identifies a line of best fit for a scatter plot without finding the equation of the line. | Identifies or creates an equation for the line of best fit for a given scatter plot.  Uses a line of best fit for a model to interpolate or extrapolate data. | Describes the fit of a linear model, such as describing for what values the model tends to overestimate or underestimate the actual values. |
| S.ID.7 | Identifies a scatter plot that represents a given description of a relationship: positive/negative, strong/weak, linear/nonlinear. | Interprets the intercept of a linear model in terms of the context given the equation of the model. | Interprets the intercept and slope of a linear model in terms of the context given the graph of the line. | Analyzes the intercept and slope of a linear model in terms of the context given the graph of the line. |
| S.ID.8 | Given a correlation coefficient, identifies whether the correlation is weak or strong. | Uses technology to compute the correlation coefficient of data with a linear fit. | Interprets the correlation coefficient of a model in terms of the context. | Compares models of data sets based on their correlation coefficients. |
| S.ID.9 |  | Identifies the definition of causation and/or correlation. | Distinguishes between correlation and causation. | Analyzes statements of causation within the context of a problem and the data. |