Maryland
STATE DEPARTMENT OF EDUCATION

DRAFT Integrated Algebra 2 Standards

Maryland College and Career Ready Standards for Mathematics

Standards Crosswalk Document

Mathematics Branch

May 2025

Number and Operation Sense (NOS)

Previously Number and Quantity (N)

IA2.NOS.A EXTEND THE PROPERTIES OF EXPONENTS TO RATIONAL EXPONENTS.

PREVIOUSLY N.RN.A EXTEND THE PROPERTIES OF EXPONENTS TO RATIONAL EXPONENTS.

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IA2.NOS.A.1	Apply the properties of exponents to generate equivalent numerical expressions involving radicals and rational exponents.	**N.RN.A.2**	Rewrite expressions involving radicals and rational exponents using the properties of exponents.
[Not applicable]	Instructional; not assessed	**N.RN.A.1**	Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents.
[Not applicable]	Embedded in Modeling Evidence Statements	**N.Q.A.2**	Define appropriate quantities for the purpose of descriptive modeling.

IA2.NOS.B REASON ABOUT THE COMPLEX NUMBER SYSTEM.

PREVIOUSLY N.CN.A PERFORM ARITHMETIC OPERATIONS WITH COMPLEX NUMBERS; N.CN.B USE COMPLEX NUMBERS IN POLYNOMIAL IDENTITIES AND EQUATIONS.

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IA2.NOS.B.2	Use the knowledge that $i^2 = -1$ to write complex numbers in standard form, $a + bi$, and use them to represent solutions to quadratics that have no real solutions.	**N.CN.A.1** **N.CN.C.7**	Know there is a complex number i such that $i^2 = -1$, and every complex number has the form $a + bi$ with a and b real. Solve quadratic equations with real coefficients that have complex solutions.

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[Not applicable]	In Precalculus	**N.CN.A.2**	Use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.

Algebraic Thinking (AT)

Previously Algebra (A); Functions (F)

IA2.AT.A LOOK FOR AND MAKE USE OF STRUCTURE TO REWRITE EXPRESSIONS IN EQUIVALENT FORMS AND REASON ABOUT THEIR PROPERTIES.

PREVIOUSLY A.SSE.A INTERPRET THE STRUCTURE OF EXPRESSIONS; A.SSE.B WRITE EXPRESSIONS IN EQUIVALENT FOMS TO SOLVE PROBLEMS; A.APR.B UNDERSTAND THE RELATIONSHIP BETWEEN ZEROS AND FACTORS OF POLYNOMIALS; A.APR.C USE POLYNOMIAL IDENTITIES TO SOLVE PROBLEMS; A.APR.D REWRITE REATIONAL EXPRESSIONS.

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IA2.AT.A.1	Rewrite and interpret quadratic expressions to explain key properties of a relationship between two quantities. a. Factor quadratic expressions to reveal the zeros of the function, and explain their significance in the context. b. Complete the square to identify the maximum or minimum value of a relationship and interpret that value in context. c. Compare different forms of a quadratic expression (standard, factored, vertex) to determine which form is most useful for interpreting a given situation.	**A.SSE.A.1** **A.SSE.B.3** **F.IF.C.8**	Interpret expressions that represent a quantity in terms of its context. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. a. Factor a quadratic expression to reveal the zeros of the function it defines. b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines. c. ~~Use the properties of exponents to transform expressions for exponential functions.~~ Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and

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			symmetry of the graph, and interpret these in terms of a context.
IA2.AT.A.2	Given a polynomial of degree 3 or higher in factored form, use the Zero Product Property to identify its zeros and sketch a graph of the function.	**A.APR.B.3**	Identify zeros of polynomials when suitable factorizations are available; use the zeros to construct a rough graph of the function defined by the polynomial.
IA2.AT.A.3	Add, subtract, and multiply polynomials to rewrite expressions in equivalent forms for clarity, efficiency, or problem-solving applications. Use these operations to represent and analyze polynomial relationships in context. Multiplication of polynomials includes multiplying a binomial and a trinomial.	**A.APR.A.1**	Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials
[Not applicable]	Factoring special binomials is in Precalculus	**A.SSE.A.2**	Use the structure of an expression to identify ways to rewrite it. For example, see $x^4 - y^4$ as $(x^2)^2 - (y^2)^2$, thus recognizing it as a difference of squares that can be factored as $(x^2 - y^2)(x^2 + y^2)$.
[Not applicable]	In Precalculus	**A.APR.B.2**	Know and apply the Remainder Theorem: For a polynomial $p(x)$ and a number a, the remainder on division by $x - a$ is $p(a)$ so $p(a) = 0$ if and only if $x - a$ is a factor of $p(x)$.
[Not applicable]	In Precalculus	**A.APR.C.4**	Prove polynomial identities and use them to describe numerical relationships.
[Not applicable]	In Precalculus	**A.APR.D.6**	Rewrite simple rational expressions in different forms; write $\frac{a(x)}{b(x)}$ in the form $q(x) + \frac{r(x)}{b(x)}$, where $a(x)$, $b(x)$, $q(x)$, and $r(x)$ are polynomials with the degree of $r(x)$ less than the degree of $b(x)$, using inspection, long division, or, for the more complicated examples, a computer algebra system.

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[Not applicable]	Not included as a standard	**A.SSE.B.4**	Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems. For example, calculate mortgage payments.

IA2.AT.B MAKE SENSE OF AND SOLVE EQUATIONS AND SYSTEMS OF EQUATIONS.

PREVIOUSLY A.CED.A CREATE EQUATIONS THAT DESCRIBE NUMBERS OR RELATIONSHIPS; A.REI.A UNDERSTAND SOLVING EQUATIONS AS A PROCESS OF REASONING AND EXPLAIN THE REASONING; A.REI.B SOLVE EQUATIONS AND INEQUALITIES IN ONE VARIABLE; A.REI.C SOLVE SYSTEMS OF EQUATIONS; A.REI.D REPRESENT AND SOLVE EQUATIONS AND INEQUALITIES GRAPHICALLY.

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IA2.AT.B.4	Create and solve quadratic equations in one variable. a. Write quadratic equations in one variable to model a real-world situation. b. Flexibly choose and apply methods to solve quadratic equations based on their initial form (i.e., solve equations by recognizing perfect squares (e.g., $x^2=49$), taking square roots, factoring when possible, completing the square, or applying the quadratic formula when necessary). Justify the selected method by reasoning about the structure of the equation. c. Represent complex solutions as $a \pm bi$ for real numbers a and b.	**A.CED.A.1** **A.REI.B.4** **A.REI.A.1**	Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions. Solve quadratic equations in one variable. a. Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x-p)^2=q$ that has the same solutions. Derive the quadratic formula from this form. b. Solve quadratic equations by inspection (e.g., for $x^2=49$), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as $a \pm bi$ for real numbers a and b.

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			Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method
IA2.AT.B.5	Solve radical equations in one variable that contain a single radical term. Explain why some solutions may be extraneous and justify whether a given solution is valid based on a given context.	**A.REI.A.2**	Solve simple ~~rational~~ and radical equations in one variable, and give examples showing how extraneous solutions may arise.
IA2.AT.B.6	Create, solve, and analyze systems consisting of a linear and a quadratic equation in two variables. a. Create systems consisting of a linear and a quadratic equation to represent mathematical or real-world contexts. b. Solve these systems exactly and approximately using algebraic methods (i.e., substitution), graphical methods, or tables. c. Interpret the meaning of the solution(s) in context.	**A.REI.C.7**	Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. For example, find the points of intersection between the line $y = -3x$ and the circle $x^2 + y^2 = 3$.
IA2.AT.B.7	Use technology to solve systems of equations that include a combination of linear, exponential, quadratic, and/or radical equations. Interpret the solution(s) within a given context.	**A.REI.D.11**	Explain why the x-coordinates of the points where the graphs of the equations $y = f(x)$ and $y = g(x)$ intersect are the solutions of the equation $f(x) = g(x)$; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where f and/or g are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.
[Not applicable]	In Integrated Algebra 1	**A.REI.C.6**	Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.

IA2.AT.C REASON ABOUT FUNCTIONS.

PREVIOUSLY F.IF.A UNDERSTAND THE CONCEPT OF A FUNCTION AND USE FUNCTION NOTATION; F.IF.B INTERPRET FUNCTIONS THAT ARISE IN APPLICATIONS IN TERMS OF THE CONTEXT; F.IF.C ANALYZE FUNCTIONS USING DIFFERENT REPRESENTATIONS.

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IA2.AT.C.8	Calculate or estimate and interpret the average rate of change over a specified interval for exponential, quadratic, and radical functions presented graphically, symbolically or as a table within a given context.	**F.IF.B.6**	Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.
IA2.AT.C.9	Compare properties of two quadratic functions each represented in a different way (algebraically, graphically, numerically in tables, or by narrative descriptions), to analyze differences and similarities between the relationships the functions model.	**F.IF.C.9**	Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.
IA2.AT.C.10	Analyze and compare the behavior of functions across different families a. Compare linear, quadratic, exponential, polynomial (degree of 3 or higher), and radical functions by analyzing differences in their patterns of change and explain how these differences affect the modeling of real-world situations. b. Describe and compare key characteristics of functions (including symmetry and end behavior) using graphs, equations, or narrative descriptions. c. Analyze how the number and type of solutions to equations vary across function	**[New standard]**	New standard

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	families and explain how those solutions are represented and interpreted in graphs and equations.		
[Not applicable]	In Integrated Algebra 1	**F.IF.A.3**	Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers.

IA2.AT.D MODEL WITH FUNCTIONS.

PREVIOUSLY F.IF.B INTERPRET FUNCTIONS THAT ARISE IN APPLICATIONS IN TERMS OF THE CONTEXT; F.IF.C ANALYZE FUNCTIONS USING DIFFERENT REPRESENTATIONS; F.BF.A BUILD A FUNCTION THAT MODELS A RELATIONSHIP BETWEEN TWO QUANTITIES; F.BF.B BUILD A NEW FUNCTION FROM EXISTING FUNCTIONS; F.LE.A CONSTRUCT AND COMPARE LINEAR, QUADRATIC, AND EXPONENTIAL MODELS AND SOLVE POBLEMS; F.LE.B INTERPRET EXPRESSIONS FOR FUNCTIONS IN TERMS OF THE SITUATION THEY MODEL.

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IA2.AT.D.11	Write a quadratic function to model relationships between quantities given a narrative description, table of values, or graph.	**A.CED.A.2** **F.BF.A.1**	Create equations in two or more variables to represent relationships between quantities; ~~graph equations on coordinate axes with labels and scales.~~ Write a function that describes a relationship between two quantities.
IA2.AT.D.12	Represent and interpret quadratic functions using tables and graphs and apply them in context. a. Create tables and graphs to represent quadratic relationships and identify key features. Key features include: intercepts/zeros, symmetry, intervals of increase and decrease, relative extrema, end behavior, domain (if restricted in context), and range.	**F.IF.B.4**	~~Create equations in two or more variables to represent relationships between quantities~~; graph equations on coordinate axes with labels and scales. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is

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	b. Relate key features in the table and graph to characteristics of a real-world context. c. Justify the appropriateness of a quadratic model by analyzing trends in the table or graph and explaining how the model's features support predictions or contextual interpretations.		increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and ~~periodicity~~.
IA2.AT.D.13	Represent and interpret higher degree polynomial (degree 3 or higher), and radical functions in context using tables and graphs. a. Create tables and graphs to represent higher degree polynomial functions and identify key features. Key features include: intercepts/zeros, symmetry, intervals of increase and decrease, relative extrema, and end behavior. b. Create tables and graphs to represent radical functions and identify key features. Key features include: domain restrictions, intercepts, intervals of increase and decrease, and end behavior. c. Relate key features of higher-degree polynomial and radical functions to real-world contexts.	**F.IF.C.7**	Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. a. Graph linear and quadratic functions and show intercepts, maxima, and minima. b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions. c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior. d. Graph exponential and ~~logarithmic functions~~, showing intercepts and end behavior, and ~~trigonometric functions, showing period, midline, and amplitude.~~
IA2.AT.D.14	Analyze how transformations affect the graph of a polynomial function given in vertex form and interpret their meaning in context. a. Identify how the graph of a quadratic function changes when $f(x)$ is replaced by $f(x+k)$, $f(x)+k$, and $kf(x)$ and determine the value of k from the graph. Describe the type of transformation.	**F.BF.B.3**	Identify the effect on the graph of replacing $f(x)$ by $f(x)+k$, $kf(x)$, $f(kx)$, and $f(x+k)$ for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them.

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	b. Explain the meaning of each transformation by connecting the structure of the transformed function to the quantities it represents (e.g., how changes affect the vertex, direction of opening, and rate of change).		
[Not applicable]	In Integrated Algebra 1	**F.BF.A.2**	Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.
[Not applicable]	In Integrated Algebra 1	**F.LE.A.2**	Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).
[Not applicable]	In Precalculus	**F.LE.A.4**	For exponential models, express as a logarithm the solution to $ab^{ct}=d$ where a, c, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology.
[Not applicable]	In Integrated Algebra 1	**F.LE.B.5**	Interpret the parameters in a linear or exponential function in terms of a context.

THIS IS NO LONGER A CLUSTER

PREVIOUSLY F.TF.A EXTEND THE DOMAIN OF TRIGONOMETRIC FUNCTIONS USING THE UNIT CIRCLE; F.TF.B MODEL PERIODIC PHENOMENA WITH TRIGONOMETRIC FUNCTIONS; F.TF.C PROVE AND APPLY TRIGONOMETRIC IDENTITIES.

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[Not applicable]	In Precalculus	**F.TF.A.1**	Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.

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[Not applicable]	In Precalculus	**F.TF.A.2**	Explain how the unit circle in the coordinate plane enables the extension of trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle.
[Not applicable]	In Precalculus	**F.TF.B.5**	Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.
[Not applicable]	In Precalculus	**F.TF.C.8**	Prove the Pythagorean identity $\sin^2(\theta) + \cos^2(\theta) = 1$ and use it to find sine, cosine, or tangent of theta given sine, cosine, or tangent of theta and the quadrant of the angle.

Geometric Reasoning (GR)

Previously Geometry (G)

IA2.GR.A REASON ABOUT TRANSFORMATIONS AND SIMILARITY

PREVIOUSLY (FROM GEOMETRY) G.SRT.A UNDERSTAND SIMILARITY IN TERMS OF SIMILARITY TRANSFORMATIONS; G.SRT.B PROVE THEOREMS INVOLVING SIMILARITY.

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IA2.GR.A.1	Describe the effect of dilations on two-dimensional figures using coordinates, including how scale factor and center of dilation impact side lengths and angle measures.	**8.G.A.3**	Describe the effect of dilations, translations, rotations, and reflections on two dimensional figures using coordinates.
IA2.GR.A.2	Use similarity transformations to determine and justify triangle similarity. a. Determine whether two triangles are similar by identifying a sequence of similarity transformations (rotations, reflections, translations, and dilations) that relates one triangle onto another and aligns corresponding parts. b. Justify triangle similarity by explaining how similarity transformations establish that corresponding angles are congruent and corresponding sides are proportional.	**8.G.A.4** **G.SRT.A.2**	Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them. Given two figures, use the definition of similarity in terms of similarity transformations to decide if they are similar; explain using similarity transformations the meaning of similarity for triangles as the equality of all corresponding pairs of angles and the proportionality of all corresponding pairs of sides.
IA2.GR.A.3	Apply properties of similar triangles to solve geometric problems in context.	**G.SRT.B.5**	Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures
IA2.GR.A.4	Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.	**G.SRT.A.3**	Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.

IA2.GR.B REASON ABOUT RIGHT TRIANGLE RELATIONSHIPS.

PREVIOUSLY (FROM GEOMETRY) G.SRT.C DEFINE TRIGONOMETRIC RATIOS AND SOLVE PROBLEMS INVOLVING RIGHT TRIANGLES.

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IA2.GR.B.5	Use similarity of right triangles to explain and define trigonometric ratios (sine, cosine, and tangent) for acute angles as properties of the angles, based on side ratios.	**G.SRT.C.6**	Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles.
IA2.GR.B.6	Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied contexts.	**G.SRT.C.8**	Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.

IA2.GR.C MAKE SENSE OF CIRCLES AND THEIR PROPERTIES.

PREVIOUSLY (FROM GEOMETRY) G.C.B FIND ARC LENGTHS AND AREAS OF SECTORS OF CIRCLES; G.GPE.A TRANSLATE BETWEEN THE GEOMETRIC DESCRIPTION AND THE EQUATION FOR A CONIC SECTION.

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IA2.GR.C.7	Apply similarity to develop and use formulas involving arc length, radian measure, and sector area. a. Explain and demonstrate, using similarity, that arc length is proportional to the radius of a circle. b. Calculate the radian measure of a central angle as the ratio of arc length to radius. c. Apply the formula for the area of a sector using radian measure.	**G.C.B.5**	Derive using similarity the fact that the length of the arc intercepted by an angle is proportional to the radius, and define the radian measure of the angle as the constant of proportionality; derive the formula for the area of a sector.
IA2.GR.C.8	Create the equation of a circle given the center and radius; identify the center and radius of a circle given the equation.	**G.GPE.A.1**	Derive the equation of a circle of given center and radius using the Pythagorean Theorem; complete the square to find the center and radius of a circle given by an equation.

IA2.GR.D MODEL WITH GEOMETRY.

PREVIOUSLY (FROM GEOMETRY) G.MD.A EXPLAIN VOLUME FORMULAS AND USE THEM TO SOLVE PROBLEMS.

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IA2.GR.D.9	Use geometric shapes, their measures, and their properties to represent real world objects, and solve related authentic modeling and design problems.	**G.MD.A.1**	Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).

Reasoning with Data, Statistics, and Probability (DS)

Previously Statistics (S)

IA2.DS.A MAKE SENSE OF STATISTICAL INQUIRY

PREVIOUSLY (FROM STATISTICS) S.ID.C INTERPRET LINEAR MODELS; S.IC.A UNDERSTAND AND EVALUATE RANDOM PROCESSES UNDERLYING STATISTICAL EXPERIMENTS; S.IC.B MAKE INFERENCES AND JUSTIFY CONCLUSION FROM SAMPLE SURVEYS, EXPERIMENTS AND OBSERVATIONAL STUDIES.

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IA2.DS.A.1	Evaluate and refine statistical study designs and critically analyze data-based claims to improve the quality and validity of inferences. a. Assess the limitations of a sample or study design in terms of bias, randomness, and representativeness. b. Propose modifications to sampling methods or data collection strategies to enhance the validity and generalizability of conclusions. c. Identify potential sources of bias or misuse in data collection, representation, or modeling. d. Recognize when correlation is misused to imply causation.	**S.ID.C.9** **S.IC.A.1** **S.IC.B.6**	Distinguish between correlation and causation. Understand statistics as a process for making inferences about population parameters based on a random sample from that population. S.IC.B.6 Evaluate reports based on data.

IA1.DS.B DESCRIBE, ANALYZE, AND COMPARE DATA USING VISUAL AND NUMERICAL REPRESENTATIONS TO MODEL SITUATIONS AND DRAW INFERENCES.

PREVIOUSLY S.ID.B SUMMARIZE, REPRESENT, AND INTERPRET DATA ON TWO CATEGORICAL AND QUANTITATIVE VARIABLES.

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IA1.DS.B.2	Represent data on two quantitative variables with a scatter plot, and describe how the variables are related. a. Fit a quadratic, higher degree polynomial, or radical function to data. Use functions fitted to data to solve problems in the real-world context of the data. b. Informally assess the fit of a quadratic, higher degree polynomial, or radical function visually by analyzing the graph and analytically by evaluating the appropriateness of the chosen model in representing the data and context.	**S.ID.B.6**	Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear, quadratic, and exponential models. b. Informally assess the fit of a function by plotting and analyzing residuals. c. Fit a linear function for a scatter plot that suggests a linear association.
IA1.DS.B.3	Construct and interpret two-way frequency tables to analyze associations between two categorical variables. a. Use the tables to decide if events are independent b. Approximate conditional probabilities and explain their meaning in real-world contexts, including the relationship between conditional probability and independence.	**S.ID.B.5**	Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data.]