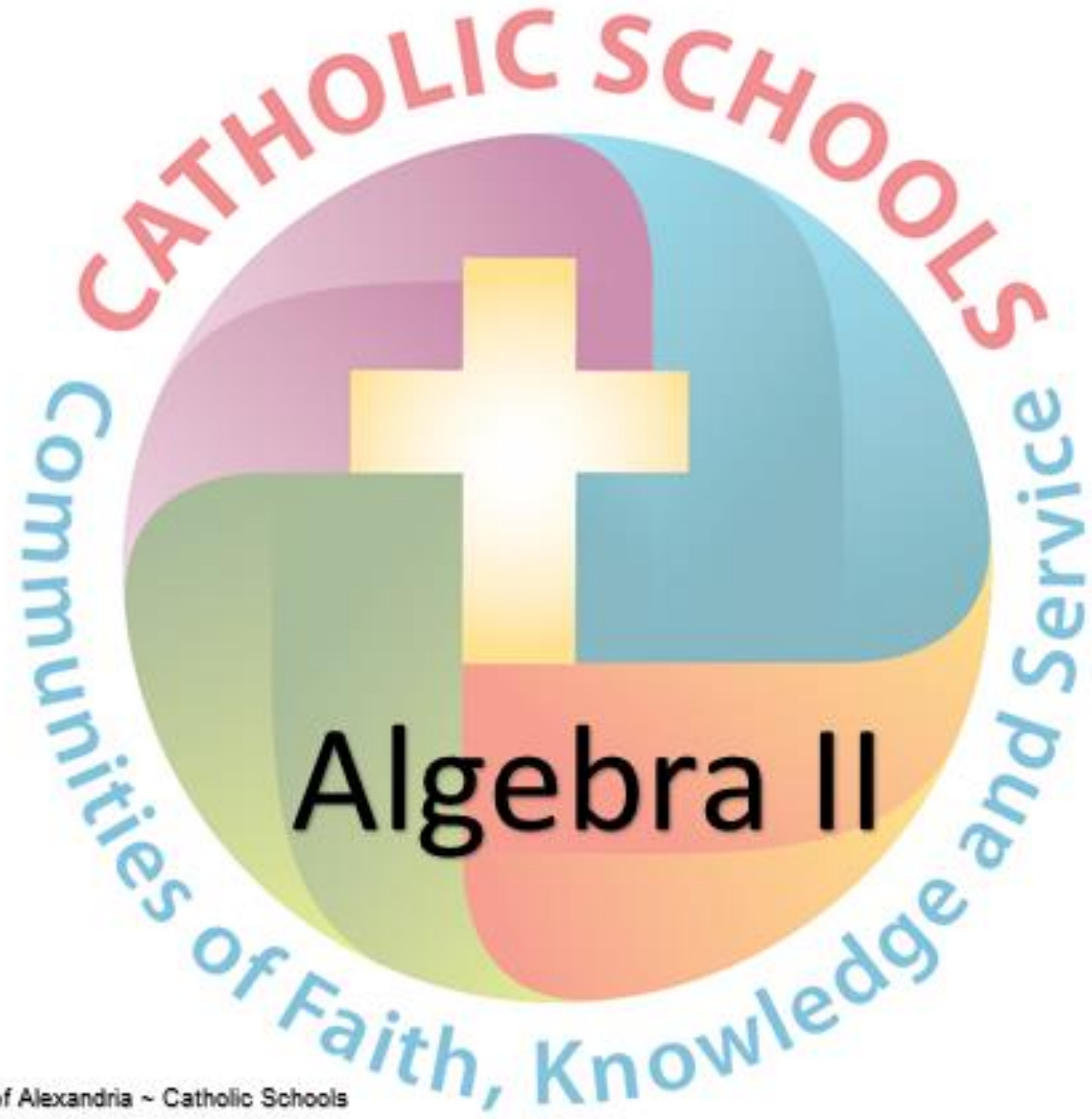

Diocese of Alexandria ~ Catholic Schools

Where faith and knowledge grow

As the Diocese of Alexandria seeks to provide a comprehensive learning environment, we are charged to "Teach More" by showing how all learning flows from and relates to our Creator. In this way, we will give our teaching a deeper meaning and purpose than simply the content itself. With this as our goal, the Catholic Schools Office has intertwined our selected curricular standards with the Catholic Standards developed by the Cardinal Newman Society. Through the merging of these two curricula, English Language Arts, Mathematics, Science, and Social Studies, teachers will be provided a roadmap to guide student's understanding and recognition of the relationship between learning and the connection to our God.

Thomas E. Roque, Sr.
Superintendent of Catholic Schools

DIOCESE OF ALEXANDRIA

Through comprehensive review of curricula from high performing districts throughout the United States in combination with parochial schools and Newman Cardinal Standards, the Curriculum Team for the Diocese of Alexandria has generated curricula for English Language Arts, Mathematics, Science, and Social Studies. The development of this framework is designed to guide the instructional path of teachers as they focus on the formation of their students in the areas of faith, academic excellence, responsible citizenry, and effective communication and collaboration. This process is a continuous improvement process with no defined beginning or end.

Barbara Forest, M.A.
Courtney Gistorb, M.Ed.

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Tracy Bock, Ed.S.

Frameworks

THE DIOCESE of ALEXANDRIA

HOW TO USE

The frameworks are guides to instruction. The frameworks assist teachers in planning and pacing instruction. Specific dates or weeks that may be included in this document are for reference. Each school and teacher must consider the make-up of their students, focusing on the needs and strengths of each child when pacing and planning instruction.

The cycles for the year help pace instruction and ensure students have consistent coverage of the content. The duration (the suggested amount of time to spend on each cycle) does not accommodate for the scheduling of special events, inclement weather or school events. Teachers, with principal guidance, should adjust pacing as needed to accommodate for these events.

RESEARCH-BASED HIGH-YIELD PRACTICES FOR INSTRUCTION

These strategies have proven effective in affecting student learning and achievement gains. As you plan daily instruction, consider how and where to integrate these strategies into the instructional sequence. Effect size is in parentheses. Please refer to the works of John Hattie for a complete description of instructional effect size.

- Classroom Discussion/Discourse (.82)
- Teacher Clarity/making the learning visible with expectations for learning (.75)
- Reciprocal Teaching (.74)
- Feedback (.73)
- Metacognitive Strategies (.69)

Student focus Areas

Essential Questions
• *How does mathematics help us understand God's creation?* • *How does the use of math help us to understand the importance of clarity, reality and goodness?* • *How do we solve addition and subtraction sentences to solve real world problems with and without concrete objects?* • *What are the ethical, moral, and legal implications of Internet use?* • *How does the study of mathematics enable us to understand, communicate, and live Gospel values?*

Catholic School – Mathematic Standards (CS.GS)	
CS.M.712.GS.1	Demonstrate the mental habits of precise, determined, careful and accurate questioning, inquiry, and reasoning in pursuit of transcendent truths.
CS.M.712.GS.2	Develop lines of inquiry (as developmentally appropriate) to understand why things are true and why they are false.
CS.M.712.GS.3	Have faith in the glory and dignity of human reason as both a gift from God and a reflection of Him in whose image and likeness we are made.
CS.M.712.GS.4	Explain how mathematics in its reflection of the good, true, and beautiful reveals qualities of being and the presence of God.

NUMBER AND QUANTITY The Real Number System (DOA.A2:N-RN)		
STANDARDS		**ACT Reporting Category** ***ACT Knowledge and Skills***
Extend the properties of exponents to rational exponents		
DOA.A2: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. *For example, we define* $5^{1/3}$ *to be the cube root of 5 because we want* $(5^{1/3})3 = 5^{(1/3)3}$ *to hold, so* $(5^{1/3})^3$ *must equal 5.*	**Number & Quantity** **Justification and Explanation** **Modeling** Rational and Complex Numbers
DOA.A2:N-RN.A.2	Rewrite expressions involving radicals and rational exponents using the properties of exponents.	
NUMBER AND QUANTITY Quantities(DOA.A2:N-Q)		
Reason quantitatively and use units to solve problems		
DOA.A2:N-Q.A.2	Define appropriate quantities for the purpose of descriptive modeling.	**Number & Quantity** **Justification and Explanation** **Modeling** Rational and Complex Numbers
NUMBER AND QUANTITY The Complex Number System (DOA.A2:N-CN)		
Perform arithmetic operations with complex numbers		
DOA.A2:N-CN.A.1	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.	**Number & Quantity** **Justification and Explanation** **Modeling** Rational and Complex Numbers Vectors and Matrices
DOA.A.2:N-CN.A.2	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.	
Use complex numbers in polynomial identities and equations		
DOA.A.2:N-CN.C.7	Solve quadratic equations with real coefficients that have complex solutions.	**Number & Quantity** **Justification and Explanation** **Modeling** Rational and Complex Numbers Vectors and Matrices

ALGEBRA Seeing Structure in Expressions (DOA.A2:A-SSE)

STANDARDS		ACT Reporting Category *ACT Knowledge and Skills*
Interpret the structure of expressions		
DOA.A2: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* $(x^2 - y^2)(x^2 + y^2)$.	**Algebra** **Justification and Explanation** **Modeling** Expressions Linear Equations
Write expressions in equivalent forms to solve problems		
DOA.A2:A-SSE.B.3	Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.	**Algebra** **Justification and Explanation** **Modeling** Expressions Linear Equations
DOA.A2:A-SSE.B.3b	Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.	
DOA.A2:A-SSE.B.3c	Use the properties of exponents to transform expressions for exponential functions. For example the expression 1.15t can be rewritten as (1.151/12) 12t ≈ 1.01212t to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.	
DOA.A2:A-SSE.B.4	Apply the formula for the sum of a finite geometric series (when the common ratio is not 1) to solve problems. *For example, calculate mortgage payments.*	

ALGEBRA Arithmetic with Polynomials and Rational Expressions (DOA.A2:A-APR)		
STANDARDS		**ACT Reporting Category** ***ACT Knowledge and Skills***
Understand the relationship between zeros and factors of polynomials		
DOA.A2: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 $p(x)$.	**Algebra** **Justification and Explanation** **Modeling** Expressions Linear Equations
DOA.A2:A-APR.B.3	Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.	
Use polynomial identities to solve problems		
DOA.A2:A-APR.B.4	Use polynomial identities to describe numerical relationships. *For example, the polynomial identity* $(x^2 + y^2)^2 = (x^2 - y^2)^2 + (2xy)^2$ *can be used to generate Pythagorean triples.*	**Algebra** **Justification and Explanation** **Modeling** Expressions Linear Equations
Rewrite rational expressions		
DOA.A2:A-APR.C.6	Rewrite simple rational expressions in different forms; write $a(x)/b(x)$ in the form $q(x) + r(x)/b(x)$, 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.	**Algebra** **Justification and Explanation** **Modeling** Expressions Linear Equations
ALGEBRA Creating Equations (DOA.A2:A-CED)		
Create equations that describe numbers or relationships		
DOA.A2:A-CED.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.*	**Algebra** **Justification and Explanation** **Modeling** Expressions Linear Equations

ALGEBRA Reasoning with Equations and Inequalities (DOA.A2:A-REI)

STANDARDS		ACT Reporting Category *ACT Knowledge and Skills*
Understand solving equations as a process of reasoning and explain the reasoning		
DOA.A2:A-REI.A.1	Explain each step in solving an 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.	**Algebra** **Justification and Explanation** **Modeling** Expressions Linear Equations
DOA.A2:A-REI.A.2	Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.	
Solve equations and inequalities in one variable		
DOA.A2:A-REI.B.4	Solve quadratic equations in one variable.	**Algebra** **Justification and Explanation** **Modeling** Expressions Linear Equations
DOA.A2:A-REI.B.4a	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.	
DOA.A2:A-REI.B.4b	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.	
Solve systems of equations		
DOA.A2:A-REI.C.6	Solve systems of linear equations exactly and approximately (e.g., with graphs), limited to systems of at most three equations and three variables. With graphic solutions, systems are limited to two variables.	**Algebra** **Justification and Explanation** **Modeling** Expressions Linear Equations
DOA.A2: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 $x^2 + y^2 = 3$.*	

ALGEBRA Reasoning with Equations and Inequalities (DOA.A2:A-REI)		
STANDARDS		**ACT Reporting Category** ***ACT Knowledge and Skills***
Represent and solve equations and inequalities graphically		
DOA.A2: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 $f(x)$ and/or $g(x)$ are linear, piecewise linear, polynomial, rational, absolute value, exponential, and logarithmic functions.	**Algebra** **Justification and Explanation** **Modeling** Expressions Linear Equations

FUNCTIONS Interpreting Functions (DOA.A2:F-IF)

STANDARDS		ACT Reporting Category *ACT Knowledge and Skills*
Understand the concept of a function and use function notation		
DOA.A2:F-IF.A.3	Recognize that sequences are functions whose domain is a subset of the integers. Relate arithmetic sequences to linear functions and geometric sequences to exponential functions.	**Functions** **Justification and Explanation** **Modeling** Linear Functions Function Behavior Exponential & Logarithmic Functions
Interpret functions that arise in applications in terms of the context		
DOA.A2:F-IF.B.4	For a function (include quadratic, exponential, and piecewise linear to include absolute value) 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 increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.*	**Functions** **Justification and Explanation** **Modeling** Linear Functions Function Behavior Quadratic & Polynomial Functions Advanced Functions Exponential & Logarithmic Functions
DOA.A2: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.	
Analyze functions using different representations		
DOA.A2: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.	**Functions** **Justification and Explanation** **Modeling** Linear Functions Function Behavior Quadratic & Polynomial Functions Advanced Functions Exponential & Logarithmic Functions
DOA.A2:F-IF.C.7b	Graph square root, cube root, exponential, and piecewise-defined functions, including step functions and absolute value functions.	
DOA.A2:F-IF.C.7c	Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.	
DOA.A2:F-IF.C.7e	Graph exponential and logarithmic functions showing intercepts and end behavior and trigonometric functions, showing period, midline, and amplitude.	
DOA.A2:F-IF.C.8	Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.	

FUNCTIONS Interpreting Functions (DOA.A2:F-IF) continued…		
STANDARDS		**ACT Reporting Category** ***ACT Knowledge and Skills***
Analyze functions using different representations		
DOA.A2:F-IF.C.8a	Use the process of completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.	**Functions** **Justification and Explanation** **Modeling** Linear Functions Function Behavior Quadratic & Polynomial Functions Advanced Functions Exponential & Logarithmic Functions
DOA.A2:F-IF.C.8b	Use the properties of exponents to interpret expressions for exponential functions. *For example, identify percent rate of change in functions such as* $y = (1.02)^t$, $y = (0.97)^t$, $y = (1.01)^{12t}$, $y = (1.2)^{t/10}$, *and classify them as representing exponential growth or decay.*	
DOA.A2: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, determine which has the larger maximum.*	
FUNCTIONS Building Functions (DOA.A2:F-BF)		
Build a function that models a relationship between two quantities		
DOA.A2:F-BF.A.1	Write a function that describes a relationship between two quantities.	**Functions** **Justification and Explanation** **Modeling** Linear Functions Function Behavior Quadratic & Polynomial Functions Advanced Functions Exponential & Logarithmic Functions
DOA.A2:F-BF.A.1a	Determine an explicit expression, a recursive process, or steps for calculation from a context.	
DOA.A2:F-BF.A.1b	Combine standard function types using arithmetic operations. *For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.*	
DOA.A2: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.	

FUNCTIONS Interpreting Functions (DOA.A2:F-IF) continued…		
STANDARDS		**ACT Reporting Category** ***ACT Knowledge and Skills***
Build new functions from existing functions		
DOA.A2:F-BF.B.3	Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $k\ f(x)$, $f(kx)$, 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.*	**Functions** **Justification and Explanation** **Modeling** Linear Functions Function Behavior Quadratic & Polynomial Functions Advanced Functions Exponential & Logarithmic Functions
DOA.A2:F-BF.B.4	Find inverse functions.	
DOA.A2:F-BF.B.4a	Solve an equation of the form $f(x) = c$ for a simple function f that has an inverse and write an expression for the inverse. *For example, $f(x) = 2x^3$ or $f(x) = (x+1)/(x-1)$ for $x \neq 1$.*	
FUNCTIONS Linear, Quadratic and Exponential Models (DOA.A2:F-LE)		
Construct and compare linear, quadratic, and exponential models and solve problems		
DOA.A2:F-LE.A.1	Distinguish between situations that can be modeled with linear functions and with exponential functions.	**Functions** **Justification and Explanation** **Modeling** Linear Functions Function Behavior Quadratic & Polynomial Functions Advanced Functions Exponential & Logarithmic Functions
DOA.A2:F-LE.A.1a	Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals.	
DOA.A2:F-LE.A.1b	Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.	
DOA.A2:F-LE.A.1c	Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.	
DOA.A2:F-LE.A.2	Given a graph, a description of a relationship, or two input-output pairs (include reading these from a table), constructs linear and exponential functions, including arithmetic and geometric sequences, to solve multi-step problems.	
DOA.A2:F-LE.A.4	For exponential models, express as a logarithm the solution to $a\ b^{ct} = d$ where a, c, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology.	
Interpret expressions for functions in terms of the situation they model		
DOA.A2:F-LE.B.5	Interpret the parameters in a linear, quadratic, or exponential function in terms of a context.	**Same as above***

FUNCTIONS Trigonometric Functions (DOA.A2:F-TF)		
STANDARDS		**ACT Reporting Category** ***ACT Knowledge and Skills***
Extend the domain of trigonometric functions using the unit circle		
DOA.A2:F-TF.A.1	Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.	**Geometry** **Justification and Explanation** **Modeling** **Trigonometry**
DOA.A2: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.	
Model periodic phenomena with trigonometric functions		
DOA.A2:F-TF.B.5	Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.	**Geometry** **Justification and Explanation** **Modeling** **Trigonometry**
Prove and apply trigonometric identities		
DOA.A2:F-TF.C.8	Prove the Pythagorean identity $\sin^2(\theta) + \cos^2(\theta) = 1$ and use it find $\sin(\theta)$, $\cos(\theta)$, or $\tan(\theta)$ given $\sin(\theta)$, $\cos(\theta)$, or $\tan(\theta)$ and the quadrant.	**Geometry** **Justification and Explanation** **Modeling** **Trigonometry**

STATISTICS and PROBABILITY
Interpreting Categorical and Quantitative Data (DOA.A2:S-ID)

STANDARDS		ACT Reporting Category *ACT Knowledge and Skills*
Summarize, represent, and interpret data on a single count or measurement variable		
DOA.A2:S-ID.A.2	Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.	**Statistics and Probability** **Justification and Explanation** **Modeling** Descriptive Statistics Inferential Statistics Probability
DOA.A2:S-ID.A.3	Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).	
DOA.A2:S-ID.A.4	Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve.	
Summarize, represent, and interpret data on two categorical and quantitative variables		
DOA.A2:S-ID.B.6	Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.	**Statistics and Probability** **Justification and Explanation** **Modeling** Descriptive Statistics Inferential Statistics Probability
DOA.A2:S-ID.B.6a	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 quadratic and exponential models.*	
DOA.A2:S-ID.B.6b	Informally assess the fit of a function by plotting and analyzing residuals.	
Interpret linear models		
DOA.A2:S-ID.C.8	Compute (using technology) and interpret the correlation coefficient of a linear fit.	**Statistics and Probability** **Justification and Explanation** **Modeling** Descriptive Statistics Inferential Statistics Probability

STATISTICS and PROBABILITY
Making Inferences and Justifying Conclusions (DOA.A2:S-IC)

STANDARDS		ACT Reporting Category *ACT Knowledge and Skills*
Understand and evaluate random processes underlying statistic experiments		
DOA.A2:S-IC.A.1	Understand statistics as a process for making inferences to be made about population parameters based on a random sample from that population.	**Statistics and Probability** **Justification and Explanation** **Modeling** Descriptive Statistics Inferential Statistics Probability
DOA.A2:SIC.A.2	Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation. *For example, a model says a spinning coin falls heads up with probability 0.5. Would a result of 5 tails in a row cause you to question the model?*	
Make inferences and justify conclusions from sample surveys, experiments, and observation studies		
DOA.A2:S-IC.B.3	Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.	**Statistics and Probability** **Justification and Explanation** **Modeling** Descriptive Statistics Inferential Statistics Probability
DOA.A2:S-IC.B.4	Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling.	
DOA.A2:S-IC.B.5	Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.	
DOA.A2:S-IC.B.6	Evaluate reports based on data.	