



Diocese of Alexandria ~ Catholic Schools

Where faith and knowledge grow



DIOCESE OF ALEXANDRIA

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.

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Frameworks



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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 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.

Algebra II



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Overview

Standards for Mathematical Content	Unit Focus	Standards for Mathematical Practice for ALL Units
<p>Unit 1 Complex Solutions and Modeling with Rational Exponents</p> <ul style="list-style-type: none"> ○ N.CN.A.1 ○ N.CN.A.2 ○ N.CN.C.7 □ A.REI.B.4 ○ A.REI.C.7 ○ A.REI.C.6 ■ F.BF.A.2 □ F.LE.A.2 ○ F.LE.B.5 ■ A.SSE.B.4 ■ N.RN.A.1 ■ N.RN.A.2 ■ A.SSE.B.3 □ F.IF.C.8 □ F.LE.A.4 	<ul style="list-style-type: none"> • Perform arithmetic operations with complex numbers • Use complex numbers in polynomial identities and equations • Build a function that models a relationship between two quantities • Construct & compare linear, quadratic, & exponential models • Write expressions in equivalent forms to solve problems • Extend the properties of exponents to rational exponents • Analyze functions using different representations 	<ul style="list-style-type: none"> • MP.1 Make sense of problems and persevere in solving them. • MP.2 Reason abstractly and quantitatively. • MP.3 Construct viable arguments & critique the reasoning of others. • MP.4 Model with mathematics. • MP.5 Use appropriate tools strategically. • MP.6 Attend to precision. • MP.7 Look for and make use of structure. • MP.8 Look for and express regularity in repeated reasoning.
<p>Unit 1: <i>Suggested Open Educational Resources</i></p>		
<p>N.CN.A.1 Complex number patterns N.CN.A.2 Powers of a complex number N.CN.C.7, A.REI.B.4b Completing the square A.REI.C.7 Linear and Quadratic System A.REI.C.6 Pairs of Whole Numbers F.BF.A.2 Snake on a Plane F.LE.A.2 Rumors</p>	<p>F.LE.B.5, F.LE.A.2 Exponential Parameters A.SSE.B.4 Course of Antibiotics N.RN.A.1 Evaluating Exponential Expressions N.RN.A.2 Rational or Irrational? A.SSE.B.3c Forms of exponential expressions F.IF.C.8b Carbon 14 dating in practice I F.LE.A.4 Carbon 14 dating</p>	

Algebra II



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Overview

Standards for Mathematical Content	Unit Focus
<p>Unit 2 Polynomials and Analysis of Nonlinear Functions</p> <ul style="list-style-type: none">■ A.APR.B.2■ A.SSE.A.2■ A.APR.B.3□ F.IF.C.7○ A.APR.C.4□ A.APR.D.6■ A.REI.A.1■ A.REI.A.2□ A.CED.A.1■ F.IF.B.4■ F.IF.B.6○ G.GPE.A.2□ F.IF.C.7■ A.REI.D.1	<ul style="list-style-type: none">• Understand the relationship between zeros and factors of polynomials• Interpret the structure of expressions• Use polynomial identities to solve problems• Analyze functions using different representations• Rewrite rational expressions• Understand solving equations as a process of reasoning and explain the reasoning• Interpret functions in terms of the context• Translate between the geometric description and the equation for a conic section• Represent and solve equations and inequalities graphically

Unit 2: *Suggested Open Educational Resources*

- [A.APR.B.2 The Missing Coefficient](#)
- [A.SSE.A.2 A Cubic Identity](#)
- [A.APR.B.3 Graphing from Factors III](#)
- [F.IF.C.7c Graphs of Power Functions](#)
- [A.APR.C.4 Trina's Triangles](#)
- [A.APR.D.6 Combined Fuel Efficiency](#)
- [A.REI.A.1 Products and Reciprocals](#)
- [A.REI.A.2 Radical Equations](#)
- [A.REI.A.2, A.CED.A.1 An Extraneous Solution](#)
- [G.GPE.A.2 Defining Parabolas Geometrically](#)
- [F.IF.C.7e Logistic Growth Model](#)
- [A.REI.D.11 Ideal Gas Law](#)

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Standards for Mathematical Content	Unit Focus
<p>Unit 3 Periodic Models and the Unit Circle</p> <ul style="list-style-type: none">○ F.TF.A.1○ F.TF.A.2□ F.IF.C.7■ F.IF.B.4○ F.TF.B.5○ F.TF.C.8□ S.ID.B.6□ F.IF.C.9■ F.BF.A.1□ N.Q.A.2○ F.BF.B.3○ F.BF.B.4	<ul style="list-style-type: none">• Extend the domain of trigonometric functions using the unit circle• Analyze functions using different representations• Interpret functions that arise in applications in terms of the context• Model periodic phenomena with trigonometric functions• Prove and apply trigonometric identities• Summarize, represent, and interpret data on two categorical and quantitative variables• Build a function that models a relationship between two quantities• Build new functions from existing functions

Unit 3: *Suggested Open Educational Resources*

- [F.TF.A.1 Bicycle Wheel](#)
- [F.TF.A.2 What exactly is a radian?](#)
- [F.TF.A.2 Trigonometric functions for arbitrary angles \(radians\)](#)
- [F.TF.A.2 Trig Functions and the Unit Circle](#)
- [F.IF.B.4, F.IF.C.7e Model air plane acrobatics](#)
- [F.TF.B.5 As the Wheel Turns](#)
- [F.TF.C.8 Trigonometric Ratios and the Pythagorean Theorem](#)
- [F.IF.C.9 Throwing Baseballs](#)
- [F.BF.A.1b A Sum of Functions](#)
- [F.BF.B.3 Exploring Sinusoidal Functions](#)
- [F.BF.B.3 Transforming the graph of a function](#)
- [F.BF.B.4a Temperatures in degrees Fahrenheit and Celsius](#)

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Standards for Mathematical Content	Unit Focus
<p>Unit 4 Making Inference, Justifying Conclusion and Conditional Probability</p> <ul style="list-style-type: none"> <input type="radio"/> S.ID.A.4 <input type="checkbox"/> S.IC.A.1 <input type="checkbox"/> S.IC.A.2 <input type="checkbox"/> S.IC.B.3 <input type="checkbox"/> S.IC.B.4 <input type="checkbox"/> S.IC.B.5 <input type="checkbox"/> S.IC.B.6 <input type="radio"/> S.CP.A.1 <input type="radio"/> S.CP.A.2 <input type="radio"/> S.CP.A.3 <input type="radio"/> S.CP.A.4 <input type="radio"/> S.CP.A.5 <input type="radio"/> S.CP.B.6 <input type="radio"/> S.CP.B.7 	<ul style="list-style-type: none"> • Summarize, represent, and interpret data on a single count or measurement variable • Understand and evaluate random processes underlying statistical experiments • Make inferences and justify conclusions from sample surveys, experiments and observational studies • Understand the independence and conditional probability and use them to interpret data • Use the rules of probability to compute probabilities of compound events in a uniform probability model
<p>Unit 4: <i>Suggested Open Educational Resources</i></p>	
<p>S.ID.A.4 Do You Fit in This Car? S.IC.A.1 School Advisory Panel S.IC.A.2 Sarah, the chimpanzee S.IC.B.3 Strict Parents S.IC.B.4 Margin of Error for Estimating a Population Mean S.CP.A.1 Describing Events S.CP.A.2 Cards and Independence</p>	<p>S.CP.A.3 Lucky Envelopes S.CP.A.4 Two-Way Tables and Probability S.CP.A.5 Breakfast Before School S.CP.B.6 The Titanic 1 S.CP.B.7 The Addition Rule S.CP.B.7 Rain and Lightning</p>

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Unit 1 Algebra 2

1st 9 Weeks

Content Standards	Suggested Standards for Mathematical Practice	Critical Knowledge & Skills
<ul style="list-style-type: none"> ○ 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. ○ N.CN.A.2. Use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers 	<p>MP.6 Attend to precision. MP.7 Look for and make use of structure.</p>	<p>Concepts:</p> <ul style="list-style-type: none"> • Complex number i is defined such that $i^2 = -1$. • Every complex number has the form $a + bi$ with a and b real. <p>Students are able to:</p> <ul style="list-style-type: none"> • $i^2 = -1$ and the commutative, associative properties to add and subtract complex numbers are to be used. • determine that $i^2 = -1$ and the commutative, associative, and distributive properties to multiply complex numbers. <p>Learning Goal 1: Add, subtract, and multiply complex numbers using the commutative, associative and distributive properties.</p>
<ul style="list-style-type: none"> ○ N.CN.C.7. Solve quadratic equations with real coefficients that have complex solutions. ▣ A.REI.B.4. Solve quadratic equations in one variable. <ul style="list-style-type: none"> 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 	<p>MP.5 Use appropriate tools strategically. MP.7 Look for and make use of structure.</p>	<p>Concepts:</p> <ul style="list-style-type: none"> • As with real solutions, complex solutions to quadratic equations may be determined by taking square roots, factoring, and completing the square. <p>Students are able to:</p> <ul style="list-style-type: none"> • solve quadratic equations in one variable that have complex solutions by taking square roots. • solve a quadratic equations in one variable that have complex solutions by completing the square. • solve a quadratic equations in one variable that have complex solutions by factoring. • write complex solutions in $a \pm bi$ form.

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Content Standards	Suggested Standards for Mathematical Practice	Critical Knowledge & Skills
<p>equation. Recognize when the quadratic formula gives complex solutions and write them as $a \pm bi$ for real numbers a and b.</p>		<p>Learning Goal 2: Solve quadratic equations with real coefficients that have complex solutions by taking square roots, completing the square and factoring.</p>
<p>⦿ A.REI.C.7. Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. <i>For example, find the points of intersection between the line $y = -3x$ and the circle $x^2 + y^2 = 3$.</i></p>	<p>MP.1 Make sense of problems and persevere in solving them.</p>	<p>Concepts:</p> <ul style="list-style-type: none"> Solutions of linear systems contain different function types. <p>Students are able to:</p> <ul style="list-style-type: none"> solve a system containing one linear equation and one quadratic equation algebraically. graph a system containing one linear equation and one quadratic equation to determine a solution. <p>Learning Goal 3: Solve simple systems consisting of a linear and quadratic equation in two variables algebraically and graphically.</p>
<p>⦿ 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.</p>	<p>MP.1 Make sense of problems and persevere in solving them. MP.7 Look for and make use of structure.</p>	<p>Concepts:</p> <ul style="list-style-type: none"> Solving a system of linear equations containing n variables requires n equations. <p>Students are able to:</p> <ul style="list-style-type: none"> use the substitution method and/or elimination method to find the solution of a system containing three linear equations. <p>Learning Goal 4: Solve algebraically a system of three linear equations.</p>

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Content Standards	Suggested Standards for Mathematical Practice	Critical Knowledge & Skills
<ul style="list-style-type: none">■ 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.■ 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).○ F.LE.B.5. Interpret the parameters in a linear or exponential function in terms of a context.	<p>MP.1 Make sense of problems and persevere in solving them.</p> <p>MP.2 Reason abstractly and quantitatively.</p> <p>MP.4 Model with mathematics</p> <p>MP.6 Attend to precision.</p> <p>MP.7 Look for and make use of structure.</p> <p>MP.8 Look for and express regularity in repeated reasoning.</p>	<p>Concepts:</p> <ul style="list-style-type: none">• Recursion <p>Students are able to:</p> <ul style="list-style-type: none">• distinguish between recursive and explicit formulas.• represent geometric and arithmetic sequences recursively.• represent geometric and arithmetic sequences with explicit formulas.• translate between recursive form and explicit form of geometric and arithmetic sequences.• recognize explicit formula for geometric sequences as exponential functions containing a domain in the integers only.• interpret the parameters of an exponential function representing a geometric sequence.• interpret the parameters of a linear function representing an arithmetic sequence. <p>Learning Goal 5: Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.</p>

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Content Standards	Suggested Standards for Mathematical Practice	Critical Knowledge & Skills
<p>■ A.SSE.B.4. Derive and/or explain the derivation of the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems. <i>For example, calculate mortgage payments.</i></p>	<p>MP.1 Make sense of problems and persevere in solving them. MP.7 Look for and make use of structure.</p>	<p>Concepts:</p> <ul style="list-style-type: none"> Series as a sum of a sequence <p>Students are able to:</p> <ul style="list-style-type: none"> derive or explain the derivation of the formula for the sum of a finite geometric series. use the formula for the sum of a finite geometric series to solve problems. <p>Learning Goal 6: Use the formula for the sum of a finite geometric series to solve problems [<i>for example, calculate mortgage payments</i>; derive the formula for the sum of a finite geometric series (when the common ratio is not 1)].</p>
<p>■ 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. <i>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.</i></p> <p>■ N.RN.A.2. Rewrite expressions involving radicals and rational exponents using the properties of exponents.</p>	<p>MP.7 Look for and make use of structure.</p>	<p>Concepts:</p> <ul style="list-style-type: none"> Properties of integer exponents extends to rational exponents (<i>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</i>) Radical notation is a representation of rational exponents. <p>Students are able to:</p> <ul style="list-style-type: none"> rewrite expressions containing rational exponents into radical form. rewrite expressions containing radical notation into exponential expressions containing rational exponents. <p>Learning Goal 7: Use properties of integer exponents to explain and convert between expressions involving radicals and rational exponents.</p>

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Content Standards	Suggested Standards for Mathematical Practice	Critical Knowledge & Skills
<p>■ 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 A.SSE.B.3c: Use the properties of exponents to transform expressions for exponential functions. <i>For example the expression 1.15^t can be rewritten as $(1.15^{1/12})^{12t}$ $\approx 1.012^{12t}$ to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.</i></p> <p>■ 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 F.IF.C.8b: Use the properties of exponents to interpret expressions for exponential functions. <i>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.</i></p>	<p>MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.4 Model with mathematics. MP.7 Look for and make use of structure.</p>	<p>Concepts:</p> <ul style="list-style-type: none"> • Alternate, equivalent forms of an exponential expression containing rational exponents may reveal specific attributes of the function that it defines. <p>Students are able to:</p> <ul style="list-style-type: none"> • use properties of exponent transform/rewrite an exponential expression for an exponential function. • explain the properties of the quantity or the function. <p>Learning Goal 8: Use the properties of exponents to transform expressions for exponential functions, explain properties of the quantity revealed in the transformed expression or different properties of the function.</p>

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Content Standards	Suggested Standards for Mathematical Practice	Critical Knowledge & Skills
<p>■ F.LE.A.4. Understand the inverse relationship between exponents and logarithms. 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.</p>	<p>MP.2 Reason abstractly and quantitatively. MP.4 Model with mathematics.</p>	<p>Concepts:</p> <ul style="list-style-type: none"> • Exponents and logarithms have an inverse relationship. • Solutions to an exponential equation in one variable can be written as a logarithm. <p>Students are able to:</p> <ul style="list-style-type: none"> • transform an exponential model represented by $ab^{ct} = d$ where a, c, and d are numbers and the base b is 2, 10, or e. • write the solution to $ab^{ct} = d$ as a logarithm. • use technology to evaluate logarithms having base 2, 10, or e. <p>Learning Goal 9: 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.</p>

District/School Formative Assessment Plan

Formative assessment informs instruction and is ongoing throughout a unit to determine how students are progressing against the standards.

District/School Summative Assessment Plan

Summative assessment is an opportunity for students to demonstrate mastery of the skills taught during a particular unit.

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Unit 2 Algebra 2

2nd 9 Weeks

Content Standards	Suggested Standards for Mathematical Practice	Critical Knowledge & Skills
<p>■ 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 $p(x)$.</p>	<p>MP.6 Attend to precision.</p>	<p>Concepts:</p> <ul style="list-style-type: none"> Polynomial division: For a polynomial $p(x)$ and a number a: <ul style="list-style-type: none"> $p(a) = 0$ if and only if $(x - a)$ is a factor of $p(x)$ $(x - a)$ is a factor of $p(x)$ if and only if $p(a) = 0$ <p>Students are able to:</p> <ul style="list-style-type: none"> use the Remainder Theorem to determine factors of a polynomial. <p>Learning Goal 1: Apply the Remainder Theorem in order to determine the factors of a polynomial.</p>
<p>■ A.SSE.A.2. Use the structure of an expression to identify ways to rewrite it. <i>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 $(x^2 - y^2)(x^2 + y^2)$.</i></p> <p>■ 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.</p>	<p>MP.7 Look for and make use of structure.</p>	<p>Concepts:</p> <ul style="list-style-type: none"> Factors of polynomials can be used to identify zeros to be used to develop a rough graph of the polynomial function. <p>Students are able to:</p> <ul style="list-style-type: none"> factor polynomials. analyze a table of values to determine where the polynomial is increasing and decreasing. use the zeros of the polynomial to create rough graph. <p>Learning Goal 2: Use an appropriate factoring technique to factor polynomials. Explain the relationship between zeros and factors of polynomials, and use the zeros to construct a rough graph of the function defined by the polynomial.</p>

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Content Standards	Suggested Standards for Mathematical Practice	Critical Knowledge & Skills
<p>▣ 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.</p> <p>F.IF.C.7c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.</p>	<p>MP.1 Make sense of problems and persevere in solving them.</p> <p>MP.5 Use appropriate tools strategically.</p> <p>MP.6 Attend to precision.</p>	<p>Concepts:</p> <ul style="list-style-type: none"> Factors of polynomials can be used to identify zeros to be used to develop a rough graph of the polynomial function. <p>Students are able to:</p> <ul style="list-style-type: none"> graph a polynomial function given its equation. identify zeros from the graph and using an appropriate factoring technique. show key features of the graph, including end behavior. use technology to graph and describe key features of the graph for complicated cases. <p>Learning Goal 3: Graph polynomial functions from equations; identify zeros when suitable factorizations are available; show key features and end behavior.</p>
<p>⦿ A.APR.C.4. Prove polynomial identities and use them to describe numerical relationships.</p> <p><i>For example, the difference of two squares; the sum and difference of two cubes; the polynomial identity $(x^2 + y^2)^2 = (x^2 - y^2)^2 + (2xy)^2$ can be used to generate Pythagorean triples.</i></p>	<p>MP.3 Construct viable arguments and critique the reasoning of others.</p> <p>MP.7 Look for and make use of structure.</p>	<p>Concepts:</p> <ul style="list-style-type: none"> Polynomial identities can be used to describe numerical relationships. <p>Students are able to:</p> <ul style="list-style-type: none"> show that the polynomial identity $(x^2 + y^2)^2 = (x^2 - y^2)^2 + (2xy)^2$ can be used to generate Pythagorean triples. prove polynomial identities. <p>Learning Goal 4: Use polynomial identities to describe numerical relationships and prove polynomial identities.</p>

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Content Standards	Suggested Standards for Mathematical Practice	Critical Knowledge & Skills
<p>□ A.APR.D.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.</p>	<p>MP.1 Make sense of problems and persevere in solving them.</p>	<p>Concepts:</p> <ul style="list-style-type: none"> Rational expressions can be written in different forms. <p>Students are able to:</p> <ul style="list-style-type: none"> 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 $b(x)$. use inspection, factoring and long division to rewrite rational expressions. use technology to rewrite rational expressions for more complicated cases. <p>Learning Goal 5: Rewrite simple rational expressions in different forms using inspection, long division, or, for the more complicated examples, a computer algebra system.</p>
<p>■ A.REI.A.2. Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.</p> <p>■ A.REI.A.1. 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</p>	<p>MP.2 Reason abstractly and quantitatively.</p> <p>MP.3 Construct viable arguments and critique the reasoning of others.</p> <p>MP.4 Model with mathematics.</p> <p>MP.6 Attend to precision.</p>	<p>Concepts:</p> <ul style="list-style-type: none"> Inverse relationships exist between roots and powers. Extraneous solutions do not result in true statements. <p>Students are able to:</p> <ul style="list-style-type: none"> use the inverse relationship between roots and powers when solving radical equations. identify any extraneous solutions. solve simple rational equations in one variable (degree of numerators and denominator is not greater than 2). write simple rational equations in one variable and use the rational equation to solve problems.

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Content Standards	Suggested Standards for Mathematical Practice	Critical Knowledge & Skills
<p>justify a solution method.</p> <p>■ A.CED.A.1 Create equations and inequalities in one variable and use them to solve problems. <i>Include equations arising from linear and quadratic functions, and simple rational and exponential functions.</i></p>		<p>Learning Goal 6: Solve simple rational and radical equations in one variable, use them to solve problems and show how extraneous solutions may arise. Create simple rational equations in one variable and use them to solve problems.</p>
<p>■ F.IF.B.4. 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. <i>Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and</i></p>	<p>MP.1 Make sense of problems and persevere in solving them. MP.4. Model with mathematics MP.5 Use appropriate tools strategically. MP.6 Attend to precision. MP.7 Look for and make use of structure.</p>	<p>Concepts:</p> <ul style="list-style-type: none"> • A radical function is any function that contains a variable inside a root. <p>Students are able to:</p> <ul style="list-style-type: none"> • interpret key features of radical functions from graphs and tables in the context of the problem. • sketch graphs of radical functions given a verbal description of the relationship between the quantities. • identify intercepts and intervals where function is increasing/decreasing. • determine the practical domain of a radical function. • determine key features including intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maxima and minima; symmetries; end behavior.

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Content Standards	Suggested Standards for Mathematical Practice	Critical Knowledge & Skills
<p><i>periodicity.</i></p> <p>■ 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.</p>		<p>Learning Goal 7: For radical functions, 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.</p>
<p>○ G.GPE.A.2. Derive the equation of a parabola given a focus and directrix</p>	<p>MP.1 Make sense of problems and persevere in solving them. MP 4. Model with mathematics MP.5 Use appropriate tools strategically. MP.6 Attend to precision. MP.7 Look for and make use of structure.</p>	<p>Concepts:</p> <ul style="list-style-type: none"> Any point on a parabola is equidistant between the focus and the directrix. <p>Students are able to:</p> <ul style="list-style-type: none"> use the distance formula to write an equation of a parabola when the focus and directrix are given. <p>Learning Goal 8: Derive the equation of a parabola given a focus and directrix.</p>
<p>■ 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.</p> <p>■ F.IF.C.7e. Graph exponential and logarithmic functions, showing intercepts and</p>	<p>MP.1 Make sense of problems and persevere in solving them. MP 4. Model with mathematics MP.5 Use appropriate tools strategically. MP.6 Attend to precision. MP.7 Look for and make use of structure.</p>	<p>Concepts:</p> <ul style="list-style-type: none"> Logarithmic functions <p>Students are able to:</p> <ul style="list-style-type: none"> graph logarithmic functions having base 2, 10 or e, using technology for more complicated cases. show intercepts and end behavior of logarithmic functions. <p>Learning Goal 9: Graph logarithmic functions expressed symbolically and show key features of the graph (including intercepts and end behavior).</p>

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Content Standards	Suggested Standards for Mathematical Practice	Critical Knowledge & Skills
<p>end behavior, and trigonometric functions, showing period, midline, and amplitude.</p>		
<p>■ 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, polynomial, rational, absolute value, exponential, and logarithmic functions.*</p>	<p>MP.1 Make sense of problems and persevere in solving them. MP.5 Use appropriate tools strategically.</p>	<p>Concepts:</p> <ul style="list-style-type: none"> Solutions to complex systems of nonlinear functions can be approximated graphically <p>Students are able to:</p> <ul style="list-style-type: none"> find the solution to $f(x)=g(x)$ approximately, e.g., using technology to graph the functions; include cases where $f(x)$ and/or $g(x)$ are linear, polynomial, rational, absolute value, exponential, and logarithmic functions. find the solution to $f(x)=g(x)$ approximately, e.g., using technology to make tables of values, or find successive approximations; include cases where $f(x)$ and/or $g(x)$ are linear, polynomial, rational, absolute value, exponential, and logarithmic functions. <p>Learning Goal 10: Find approximate solutions for $f(x)=g(x)$, using technology to graph, make tables of values, or find successive approximations. Include cases where $f(x)$ and/or $g(x)$ are linear, polynomial, rational, absolute value, logarithmic and exponential functions.</p>

District/School Formative Assessment Plan

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District/School Summative Assessment Plan

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3rd 9 Weeks

Content Standards	Suggested Standards for Mathematical Practice	Critical Knowledge & Skills
<ul style="list-style-type: none"> ○ F.TF.A.1. Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle. ○ 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. 	<p>MP.3 Construct viable arguments and critique the reasoning of others. MP.6 Attend to precision.</p>	<p>Concepts:</p> <ul style="list-style-type: none"> • Radian measure of an angle as the length of the arc on the unit circle that is subtended by the angle • Relationship between degrees and radians <p>Students are able to:</p> <ul style="list-style-type: none"> • find the measure of the angle given the length of the arc. • find the length of an arc given the measure of the central angle. • convert between radians and degrees. • use the unit circle to evaluate sine, cosine and tangent of standard reference angles. <p>Learning Goal 1: Use the radian measure of an angle to find the length of the arc in the unit circle subtended by the angle and find the measure of the angle given the length of the arc.</p> <p>Learning Goal 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.</p>
<ul style="list-style-type: none"> □ 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. F.IF.C.7e. Graph 	<p>MP.1 Make sense of problems and persevere in solving them. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. MP.7 Look for and make</p>	<p>Concepts:</p> <ul style="list-style-type: none"> • Relationship between the unit circle in the coordinate plane and graph of trigonometric functions. <p>Students are able to:</p> <ul style="list-style-type: none"> • graph trigonometric functions, showing period, midline, and amplitude.

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Content Standards	Suggested Standards for Mathematical Practice	Critical Knowledge & Skills
<p>exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.</p> <p>■ F.IF.B.4. 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. <i>Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.</i></p>	<p>use of structure.</p>	<p>Learning Goal 3: Graph trigonometric functions expressed symbolically, showing key features of the graph, by hand in simple cases and using technology for more complicated cases.</p>

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Content Standards	Suggested Standards for Mathematical Practice	Critical Knowledge & Skills
<ul style="list-style-type: none"> ○ F.TF.B.5 Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline. 	MP.4 Model with mathematics.	Concepts: <ul style="list-style-type: none"> • Periodic functions may model real-world scenarios. Students are able to: <ul style="list-style-type: none"> • use characteristics of real world phenomena to select a trigonometric model. • identify amplitude, frequency and midline appropriate for the model. Learning Goal 4: Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.
<ul style="list-style-type: none"> ○ F.TF.C.8. Prove the Pythagorean identity $\sin^2(\theta) + \cos^2(\theta) = 1$ and use it to find $\sin(\theta)$, $\cos(\theta)$, or $\tan(\theta)$ given $\sin(\theta)$, $\cos(\theta)$, or $\tan(\theta)$ and the quadrant of the angle. 	MP.3 Construct viable arguments and critique the reasoning of others. MP.5 Use appropriate tools strategically. MP.7 Look for and make use of structure.	Concepts: No new concept(s) introduced Students are able to: <ul style="list-style-type: none"> • prove the Pythagorean identity: $\sin^2(\theta) + \cos^2(\theta) = 1$. • use the Pythagorean identity to find $\sin(\theta)$, $\cos(\theta)$, or $\tan(\theta)$ when given $\sin(\theta)$, $\cos(\theta)$, or $\tan(\theta)$ and the quadrant of the angle. Learning Goal 5: Use the Pythagorean identity $(\sin \theta)^2 + (\cos \theta)^2 = 1$ to find $\sin \theta$, $\cos \theta$, or $\tan \theta$, given $\sin \theta$, $\cos \theta$, or $\tan \theta$, and the quadrant of the angle.
<ul style="list-style-type: none"> □ S.ID.B.6. Represent data on two quantitative variables on a scatter plot, and describe how the variables are related 6a. Fit a function to the data (including with the use of technology); use 	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically.	Concepts: No new concept(s) introduced Students are able to: <ul style="list-style-type: none"> • fit exponential and trigonometric functions to data using technology. • solve problems using functions fitted to data (prediction equations). • interpret the intercepts of models in context. • Plot residuals of non-linear functions.

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Content Standards	Suggested Standards for Mathematical Practice	Critical Knowledge & Skills
<p>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.</p>	<p>MP.6 Attend to precision.</p>	<ul style="list-style-type: none"> Analyze residuals in order to informally evaluate the fit of exponential and trigonometric functions. <p>Learning Goal 6: Represent nonlinear (exponential and trigonometric) data for two variables on a scatter plot, fit a function to the data, analyze residuals (in order to informally assess fit), and use the function to solve problems. Use given functions or choose a function suggested by the context; emphasize exponential and trigonometric models.</p>
<p>▣ F.IF.C.9. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). <i>For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.</i></p>	<p>MP.1 Make sense of problems and persevere in solving them. MP.3 Construct viable arguments and critique the reasoning of others. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. MP.8 Look for and express regularity in repeated reasoning.</p>	<p>Concepts: No new concept(s) introduced Students are able to:</p> <ul style="list-style-type: none"> compare key attributes of functions each represented in a different way (i.e. zeros, end behavior, periodicity, asymptotes). <p>Learning Goal 7: Analyze and compare properties of two functions when each is represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).</p>

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Content Standards	Suggested Standards for Mathematical Practice	Critical Knowledge & Skills
<p>■ F.BF.A.1. Write a function that describes a relationship between two quantities.</p> <p>F.BF.A.1b. Combine standard function types using arithmetic operations. <i>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.</i></p> <p>■ N.Q.A.2. Define appropriate quantities for the purpose of descriptive modeling.</p>	<p>MP.4 Model with mathematics.</p> <p>MP.7 Look for and make use of structure.</p>	<p>Concepts:</p> <ul style="list-style-type: none">• Functions of various types can be combined to model real world situations. <p>Students are able to:</p> <ul style="list-style-type: none">• use arithmetic operations to combine functions of varying types in order to model relationships between quantities. <p>Learning Goal 8: Construct a function that combines, using arithmetic operations, standard function types to model a relationship between two quantities.</p>

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3rd 9 Weeks

Content Standards	Suggested Standards for Mathematical Practice	Critical Knowledge & Skills
<p>○ 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. <i>Include recognizing even and odd functions from their graphs and algebraic expressions for them.</i></p>	<p>MP.3 Construct viable arguments and critique the reasoning of others. MP.5 Use appropriate tools strategically. MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.</p>	<p>Concepts:</p> <ul style="list-style-type: none">• Function notation representation of transformations <p>Students are able to:</p> <ul style="list-style-type: none">• perform transformations on graphs of polynomial, exponential, logarithmic, or trigonometric functions.• identify the effect on the graph of replacing $f(x)$ by<ul style="list-style-type: none">– $f(x) + k$;– $k f(x)$;– $f(kx)$;– $f(x + k)$ for specific values of k (both positive and negative).• identify the effect on the graph of combinations of transformations.• given the graph, find the value of k.• illustrate an explanation of the effects on polynomial, exponential, logarithmic, or trigonometric graphs using technology. <p>Learning Goal 9: Identify the effect on the graph of a polynomial, exponential, logarithmic, or trigonometric function 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 and identify even and odd functions from graphs and equations.</p>

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Content Standards	Suggested Standards for Mathematical Practice	Critical Knowledge & Skills
<p>○ F.BF.B.4. Find inverse functions. 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. <i>For example, $f(x) = 2x^3$ or $f(x) = (x+1)/(x-1)$ for $x \neq 1$.</i> [*note: composition of functions is not introduced here]</p>	<p>MP.1 Make sense of problems and persevere in solving them. MP.6 Attend to precision. MP.8 Look for and express regularity in repeated reasoning.</p>	<p>Concepts:</p> <ul style="list-style-type: none"> For a function $f(x)$ that has an inverse, the domain/input for $f(x)$ is the inverse function's range/output and that the range/output for $f(x)$ is the inverse function's domain/input. <p>Students are able to:</p> <ul style="list-style-type: none"> use function notation to represent the inverse of a function - $f^{-1}(x)$. transform an equation in order to isolate the independent variable, recognizing that the domain/input for $f(x)$ is the inverse function's range/output and that the range/output for $f(x)$ is the inverse function's domain/input. <p>Learning Goal 10: Determine the inverse function for a simple function.</p>
<p>District/School Formative Assessment Plan</p>		<p>District/School Summative Assessment Plan</p>
<p><i>Formative assessment informs instruction and is ongoing throughout a unit to determine how students are progressing against the standards.</i></p>		<p><i>Summative assessment is an opportunity for students to demonstrate mastery of the skills taught during a particular unit.</i></p>

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4th 9 Weeks

Content Standards	Suggested Standards for Mathematical Practice	Critical Knowledge & Skills
<p>○ 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.</p>	<p>MP.2 Reason abstractly and quantitatively. MP.4 Model with mathematics.</p>	<p>Concepts:</p> <ul style="list-style-type: none">• Mean and standard deviation are used to fit in a normal distribution• Population percentages may be estimated when the data are approximately normally distributed. <p>Students are able to:</p> <ul style="list-style-type: none">• identify data sets as approximately normally distributed or not.• explain the 68-95-99.7 rule for normal distributions (approximately 68% of the area under a normal distribution curve is within one standard deviation, approximately 95% of the area under a normal distribution curve is within two standard deviations, etc).• use the mean and standard deviation of a normal distribution to estimate population percentages.• use calculators, spreadsheets, and tables to estimate areas under the normal curve and interpret in context. <p>Learning Goal 1: Use the mean and standard deviation of a data set to fit it to a normal distribution, estimate population percentages, and 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).</p>

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Unit 4 Algebra 2

4th 9 Weeks

Content Standards	Suggested Standards for Mathematical Practice	Critical Knowledge & Skills
<p>□ S.IC.A.1. Understand statistics as a process for making inferences about population parameters based on a random sample from that population.</p>	<p>MP.2 Reason abstractly and quantitatively. MP.4 Model with mathematics.</p>	<p>Concepts:</p> <ul style="list-style-type: none">• Statistics is a process for making inferences about a population based on analysis of a random sample from the population. <p>Students are able to:</p> <ul style="list-style-type: none">• identify and evaluate random sampling methods.• explain the importance of randomness to sampling and inference making.• explain the difference between values that describe a population and a sample, in context. <p>Learning Goal 2: Identify and evaluate random sampling methods.</p>
<p>□ S.IC.A.2. Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation. <i>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?</i></p>	<p>MP.2 Reason abstractly and quantitatively. MP.4 Model with mathematics.</p>	<p>Concepts:</p> <ul style="list-style-type: none">• Random processes can be described mathematically by using a model: a list or description of possible outcomes. <p>Students are able to:</p> <ul style="list-style-type: none">• determine whether a given model is consistent with results from an experiment.• know the difference between experimental and theoretical modeling.• know how far predictions can be projected based on sample size.• design simulations of random sampling. <p>Learning Goal 3: Determine if the outcomes and properties of a specified model are consistent with results from a given data-generating process (e.g. using simulation).</p>

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4th 9 Weeks

Content Standards	Suggested Standards for Mathematical Practice	Critical Knowledge & Skills
<p>■ S.IC.B.3. Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.</p>	<p>MP.4 Model with mathematics.</p>	<p>Concepts:</p> <ul style="list-style-type: none">• Collecting data from a random sample of a population makes it possible to draw conclusions about the whole population.• Randomly assigning individuals to different treatments allows a fair comparison of the effectiveness of those treatments.• Sample surveys, experiments, and observational studies serve different statistical purposes allowing for different statistical analyses. <p>Students are able to:</p> <ul style="list-style-type: none">• distinguish between sample surveys, experiments, and observational studies.• explain the importance of randomization in each of these processes.• identify voluntary response samples and convenience samples.• describe simple random samples, stratified random samples, and cluster samples.• explain how under coverage, nonresponse, and question wording can lead to bias in a sample survey. <p>Learning Goal 4: Identify the differences among and purposes of sample surveys, experiments, and observational studies, explaining how randomization relates to each.</p>

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Content Standards	Suggested Standards for Mathematical Practice	Critical Knowledge & Skills
<p>■ 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</p>	<p>MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision.</p>	<p>Concepts:</p> <ul style="list-style-type: none"> • Appropriately drawn samples of a population may be used to estimate a population mean or population proportion. • Relationship between margin of error, variation with a data set, and variability in the population <p>Students are able to:</p> <ul style="list-style-type: none"> • conduct simulations of random sampling to gather samples. • estimate population means with sample means. • estimate population proportions with sample proportions. • calculate margins of error for the estimates. • explain how the results relate to variability in the population. <p>Learning Goal 5: 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.</p>
<p>■ S.IC.B.5. Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant</p> <p>■ S.IC.B.6. Evaluate reports based on data.</p>	<p>MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision.</p>	<p>Concepts:</p> <ul style="list-style-type: none"> • A statistically significant outcome is one that is unlikely to be due to chance alone. <p>Students are able to:</p> <ul style="list-style-type: none"> • conduct a t-test to evaluate the effectiveness and differences in two treatments. • use simulations to generate data simulating applying two treatments. • use the results of simulations to determine if the differences are significant. • read and explain, in the context of the situation, data from outside reports - discussing experimental study design,

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Content Standards	Suggested Standards for Mathematical Practice	Critical Knowledge & Skills
		<p>drawing conclusions from graphical and numerical summaries, and identifying characteristics of the experimental design.</p> <p>Learning Goal 6: Use data from a randomized experiment to compare two treatments and use simulations to decide if differences between parameters are significant; evaluate reports based on data.</p>
<p>● S.CP.A.1. Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events (“or,” “and,” “not”).</p>	<p>MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision.</p>	<p>Concepts:</p> <ul style="list-style-type: none">• Events are described as subsets of a sample space. <p>Students are able to:</p> <ul style="list-style-type: none">• identify a sample space, recognizing it as the set of all possible outcomes.• identify and describe subsets of a sample space as events.• describe unions, intersections and complements of events.• visualize unions, intersections and complements of events with Venn diagrams. <p>Learning Goal 7: Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events (“or,” “and,” “not”).</p>

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Content Standards	Suggested Standards for Mathematical Practice	Critical Knowledge & Skills
<ul style="list-style-type: none">○ S.CP.A.2. Understand that two events A and B are independent if the probability of A and B occurring together is the product of their probabilities, and use this characterization to determine if they are independent.○ S.CP.A.3. Understand the conditional probability of A given B as $P(A \text{ and } B)/P(B)$, and interpret independence of A and B as saying that the conditional probability of A given B is the same as the probability of A, and the conditional probability of B given A is the same as the probability of B.○ S.CP.A.4. Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to	<p>MP.1 Make sense of problems and persevere in solving them.</p> <p>MP.2 Reason abstractly and quantitatively.</p> <p>MP.4 Model with mathematics.</p> <p>MP.5 Use appropriate tools strategically.</p> <p>MP.6 Attend to precision.</p>	<p>Concepts:</p> <ul style="list-style-type: none">• Two events A and B are independent if the probability of A and B occurring together is the product of their probabilities.• Independence of event A and event B means that the conditional probability of A given B is the same as the probability of, and the conditional probability of B given A is the same as the probability of B. <p>Students are able to:</p> <ul style="list-style-type: none">• identify events as independent or dependent.• interpret the conditional probability of A given B as answering the question 'now that B has occurred, what is the probability that event A will occur?'• determine the conditional probability of A given B using $P(A \text{ and } B)/P(B)$.• represent conditional probability of A given B as $P(A B)$.• calculate conditional probabilities.• construct two-way frequency tables for two categorical variables.• calculate probabilities from the two-way frequency table.• use the probabilities to assess independence of two variables. <p>Learning Goal 8: Use two-way frequency tables to determine if events are independent and to calculate conditional probability. Use everyday language to explain independence and conditional probability in real-world situations.</p>

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Content Standards	Suggested Standards for Mathematical Practice	Critical Knowledge & Skills
<p>decide if events are independent and to approximate conditional probabilities. <i>For example, collect data from a random sample of students in your school on their favorite subject among math, science, and English. Estimate the probability that a randomly selected student from your school will favor science given that the student is in tenth grade. Do the same for other subjects and compare the results.</i></p> <p>● S.CP.A.5. Recognize and explain the NEW Concepts of conditional probability and independence in everyday language and everyday situations. <i>For example, compare the chance of having lung cancer if you are a smoker with the chance of being a smoker if you have lung cancer.</i></p>		

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Content Standards	Suggested Standards for Mathematical Practice	Critical Knowledge & Skills
<ul style="list-style-type: none"> ○ S.CP.B.6. Find the conditional probability of A given B as the fraction of B's outcomes that also belong to A, and interpret the answer in terms of the model. ○ S.CP.B.7. Apply the Addition Rule, $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$, and interpret the answer in terms of the model. 	<p>MP.1 Make sense of problems and persevere in solving them.</p> <p>MP.2 Reason abstractly and quantitatively.</p> <p>MP.4 Model with mathematics.</p> <p>MP.5 Use appropriate tools strategically.</p> <p>MP.6 Attend to precision.</p>	<p>Concepts:</p> <ul style="list-style-type: none"> • Mutually exclusive events exist. <p>Students are able to:</p> <ul style="list-style-type: none"> • analyze event B's outcomes to determine the proportion of B's outcomes that also belong to event A. • interpret this proportion as conditional probability of A given B. • identify two events as mutually exclusive (disjoint). • calculate probabilities using the Addition rule $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$. <p>Learning Goal 9: Find the conditional probability of A given B as the fraction of B's outcomes that also belong to A and apply the Addition Rule [$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$].</p>

District/School Formative Assessment Plan

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District/School Summative Assessment Plan

Summative assessment is an opportunity for students to demonstrate mastery of the skills taught during a particular unit.

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. <i>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.</i>	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. <i>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 $(x^2 - y^2)(x^2 + y^2)$.</i>	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 $(1.151/12) 12t \approx 1.01212t$ 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. <i>For example, calculate mortgage payments.</i>	

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. <i>For example, the polynomial identity $(x^2 + y^2)^2 = (x^2 - y^2)^2 + (2xy)^2$ can be used to generate Pythagorean triples.</i>	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. <i>Include equations arising from linear and quadratic functions, and simple rational and exponential functions.</i>	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. <i>For example, find the points of intersection between the line $y = -3x$ and the circle $x^2 + y^2 = 3$.</i>	

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

STANDARDS		ACT Reporting Category <i>ACT Knowledge and Skills</i>
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. <i>Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.</i>	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 <i>ACT Knowledge and Skills</i>
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. <i>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.</i>	
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). <i>For example, given a graph of one quadratic function and an algebraic expression for another, determine which has the larger maximum.</i>	

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. <i>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.</i>	
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 <i>ACT Knowledge and Skills</i>
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. <i>Include recognizing even and odd functions from their graphs and algebraic expressions for them.</i>	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. <i>For example, $f(x) = 2x^3$ or $f(x) = (x+1)/(x-1)$ for $x \neq 1$.</i>	

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 <i>ACT Knowledge and Skills</i>
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. <i>Use given functions or choose a function suggested by the context. Emphasize quadratic and exponential models.</i>	
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. <i>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?</i>	
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.	