Common Core Standards & CSD Curriculum Alignment

2014/2015 Curriculum Map – Algebra 2 – Middlestead and Evinger

Estimated Duration of Unit	Unit Title/Theme	Content Big Ideas/Goals	Instructional Activities Examples	CCSS Emphasis (Primary CCS in Bold)
45 days	**Unit 1: Polynomial, Rational, and Radical Relationships**	**Reason quantitatively and use units to solve problems.** **Perform arithmetic operations with complex numbers.** **Use complex numbers in polynomial identities and equations.** **Interpret the structure of expressions** **Understand the relationship between zeros and factors of polynomials** **Use polynomial identities to solve problems** **Solve equations and inequalities in one variable**	In this module, students draw on analogies between polynomial arithmetic and base-ten computation, focusing on properties of operations, particularly the distributive property. Students connect the structure inherent in multi-digit whole number multiplication with multiplication of polynomials, and similarly connect division of polynomials with long division of integers. Students identify zeros of polynomials, including complex zeros of quadratic polynomials. Through regularity in repeated reasoning, they make connections between zeros of polynomials and solutions of polynomial equations.	**N-Q.2**[38] Define appropriate quantities for the purpose of descriptive modeling. **N-CN.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.2** Use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers. **N-CN.7** Solve quadratic equations with real coefficients that have complex solutions. **A-SSE.2**[39] 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* $(x^2 - y^2)(x^2 + y^2)$. **A-APR.2**[40] 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 $p(x)$. **A-APR.3**[41] 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. **A-APR.4** Prove[42] polynomial identities and use them 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. **A-APR.6**[43] 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.

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2014/2015 Curriculum Map – Algebra 2 – Middlestead and Evinger

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45 days	**Unit 1: Polynomial, Rational, and Radical Relationships (cont.)**	**Rewrite rational expressions** **Understand solving equations as a process of reasoning and explain the reasoning** **Solve systems of equations** **Analyze functions using different representations** **Translate between the geometric description and the equation for a conic section**	Students analyze the key features of a graph or table of a polynomial function and relate those features back to the two quantities in the problem that the function is modeling. A theme of this module is that the arithmetic of rational expressions is governed by the same rules as the arithmetic of rational numbers.	**A-REI.1**[44] Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method. **A-REI.2** Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise. **A-REI.4**[45] Solve quadratic equations in one variable b. Solve quadratic equations by inspection (e.g., for $x^2 = 49$), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as $a \pm bi$ for real numbers a and b. **Solve systems of equations** **A-REI.6**[46] Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables. **A-REI.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 $x^2 + y^2 = 3$.* **F-IF-7** Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.★ c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior. **G-GPE.2** Derive the equation of a parabola given a focus and directrix.

Common Core Standards & CSD Curriculum Alignment

2014/2015 Curriculum Map – Algebra 2 – Middlestead and Evinger

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20 Days	**Unit 2: Trigonometric Functions**	**Extend the domain of trigonometric functions using the unit circle** **Model periodic phenomena with trigonometric functions** **Prove and apply trigonometric identities**	Building on their previous work with functions, and on their work with trigonometric ratios and circles in Geometry, students extend trigonometric functions to all (or most) real numbers. To reinforce their understanding of these functions, students begin building fluency with the values of sine, cosine, and tangent at π/6, π/4, π/3, π/2, etc. Students make sense of periodic phenomena as they model with trigonometric functions.	**F-TF.1** Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle. **F-TF.2**[47] 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. **F-TF.5**[48] Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.★ **F-TF.8** Prove the Pythagorean identity $\sin^2(\Theta) + \cos^2(\Theta) = 1$ and use it to find sin(Θ), cos(Θ), or tan(Θ) given sin(Θ), cos(Θ), or tan(Θ) and the quadrant of the angle.

Common Core Standards & CSD Curriculum Alignment

2014/2015 Curriculum Map – Algebra 2 – Middlestead and Evinger

Estimated Duration of Unit	Unit Title/Theme	Content Big Ideas/Goals	Instructional Activities Examples	CCSS Emphasis (Primary CCS in Bold)
45 Days	Unit 3: Functions	**Extend the properties of exponents to rational exponents.** **Reason quantitatively and use units to solve problems.** **Write expressions in equivalent forms to solve problems** **Create equations that describe numbers or relationships** **Represent and solve equations and inequalities graphically** **Understand the concept of a function and use function notation** **Interpret functions that arise in applications in terms of the context**	In this Unit, students synthesize and generalize what they have learned about a variety of function families. They extend their work with exponential functions to include solving exponential equations with logarithms. They explore (with appropriate tools) the effects of transformations on graphs of diverse functions, including functions arising in an application. They notice, by looking for general methods in repeated calculations, that the transformations on a graph always have the same effect regardless of the type of the underlying function. These observations lead to students to conjecture and construct general principles about how the graph of a function changes after applying a function transformation to that function	**N-RN.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 **N-RN.2** Rewrite expressions involving radicals and rational exponents using the properties of exponents. **N-Q.2** Define appropriate quantities for the purpose of descriptive modeling. **A-SSE.3** Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. c. Use the properties of exponents to transform expressions for exponential functions. **A-SSE.4** Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems. *For example, calculate mortgage payments*. **A-CED.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*. **A-REI.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. **F-IF.3** Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers.

Common Core Standards & CSD Curriculum Alignment

2014/2015 Curriculum Map – Algebra 2 – Middlestead and Evinger

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45 Days	**Unit 3: Functions**	**Analyze functions using different representations** **Build a function that models a relationship between two quantities** **Build new functions from existing functions** **Construct and compare linear, quadratic, and exponential models and solve problems** **Interpret expressions for functions in terms of the situation they model**	Students identify appropriate types of functions to model a situation, they adjust parameters to improve the model, and they compare models by analyzing appropriateness of fit and making judgments about the domain over which a model is a good fit. The description of modeling as, "*the process of choosing and using mathematics and statistics to analyze empirical situations, to understand them better, and to make decisions,*" is at the heart of this module. In particular, through repeated opportunities in working through the modeling cycle (see page 61 of the CCLS), students acquire the insight that the same mathematical or statistical structure can sometimes model seemingly different situations.	**F-IF.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. **F-IF.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. **F-IF.7** Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.★ e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude. **F-IF.8** Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. **F-BF.4** Find inverse functions. a. 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. **F-LE.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.4** For exponential models, express as a logarithm the solution to $ab^{ct} = d$ where a, c, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology. **F-LE.5** Interpret the parameters in a linear or exponential function in terms of a context.

Common Core Standards & CSD Curriculum Alignment

2014/2015 Curriculum Map – Algebra 2 – Middlestead and Evinger

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40 Days	Unit 4: Inferences and Conclusions from Data	**Reason quantitatively and use units to solve problems.** **Summarize, represent, and interpret data on a single count or measurement variable** **Summarize, represent, and interpret data on two categorical and quantitative variables** **Understand and evaluate random processes underlying statistical experiments**	In this unit, students see how the visual displays and summary statistics they learned in earlier grades relate to different types of data and to probability distributions. They identify different ways of collecting data—including sample surveys, experiments, and simulations—and the role that randomness and careful design play in the conclusions that can be drawn. Students create theoretical and experimental probability models following the modeling cycle (see page 61 of CCLS). They compute and interpret probabilities from those models for compound events, attending to mutually exclusive events, independent events, and conditional probability.	**N-Q.2** Define appropriate quantities for the purpose of descriptive modeling. **S-ID.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. **S-ID.6**66 Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. **S-IC.1** Understand statistics as a process for making inferences about population parameters based on a random sample from that population. **S-IC.2** Decide if a specified model is consistent with results from a given date-generating process, e.g., using simulation. **S-IC.3** Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each. **S-IC.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. **S-IC.5** Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant. **S-IC.6** Evaluate reports based on data. **S-CP.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”). **S-CP.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.

Common Core Standards & CSD Curriculum Alignment

2014/2015 Curriculum Map – Algebra 2 – Middlestead and Evinger

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45 Days	**Unit 4: Inferences and Conclusions from Data**	Make inferences and justify conclusions from sample surveys, experiments, and observational studies Make inferences and justify conclusions from sample surveys, experiments, and observational studies Make inferences and justify conclusions from sample surveys, experiments, and observational studies Understand 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	In this unit, students see how the visual displays and summary statistics they learned in earlier grades relate to different types of data and to probability distributions. They identify different ways of collecting data— including sample surveys, experiments, and simulations—and the role that randomness and careful design play in the conclusions that can be drawn. Students create theoretical and experimental probability models following the modeling cycle (see page 61 of CCLS). They compute and interpret probabilities from those models for compound events, attending to mutually exclusive events, independent events, and conditional probability.	**S-CP.3** Understand the conditional probability of *A* given *B* as *P*(*A* 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.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 decide if events are independent and to approximate conditional probabilities. **S-CP.5** Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. **S-CP.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.7** Apply the Addition Rule, P(*A* or *B*) = P(*A*) + P(*B*) – P(*A* and *B*), and interpret the answer in terms of the model.

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