**Algebra II - PARCC Frameworks vs. Appendix A Comparison**

This document compares the standards listed as part of the scope of Algebra II (<http://parcconline.org/parcc-model-content-frameworks> ) in the PARCC Frameworks with

the Appendix A in the standards (<http://www.p12.nysed.gov/ciai/common_core_standards/> )

Please read the information below from the standards that explains the structure of the secondary math standards and the use of the plus and star symbols.

The underlined standards come from the PARCC notation and refer to standards assessed in more than one course. Please see the charts in the back of the PARCC frameworks that show the extent to which the standard is assessed each time it appears in a course.

**Mathematics Standards for High School**

The high school standards specify the mathematics that all students should study in order to be college and career ready. Additional mathematics that students should learn in order to take advanced courses such as calculus, advanced statistics, or discrete mathematics is indicated by (+), as in this example:

(+) Represent complex numbers on the complex plane in rectangular and polar form (including real and imaginary numbers).

All standards without a (+) symbol should be in the common mathematics curriculum for all college and career ready students. Standards with a (+) symbol may also appear in courses intended for all students.

The high school standards are listed in conceptual categories:

* Number and Quantity
* Algebra
* Functions
* Modeling
* Geometry
* Statistics and Probability

Conceptual categories portray a coherent view of high school mathematics; a student’s work with functions, for example, crosses a number of traditional course boundaries, potentially up through and including calculus.

Modeling (pg 61-62 of the standards) is best interpreted not as a collection of isolated topics but in relation to other standards. Making mathematical models is a Standard for Mathematical Practice, and specific modeling standards appear throughout the high school standards indicated by a star symbol(★ ). The star symbol sometimes appears on the heading for a group of standards; in that case, it should be understood to apply to all standards in that group.

|  |  |  |
| --- | --- | --- |
| In Both | In PARCC Only | In Appendix A Only |
|  | N-RN.1, 2  1. Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents. *For example, we define 51/3 to be the cube root of 5 because we want (51/3)3 = 5(1/3)3 to hold, so (51/3)3 must equal 5.*  2. Rewrite expressions involving radicals and rational exponents using the properties of exponents. |  |
|  | N-Q.2  2. Define appropriate quantities for the purpose of descriptive modeling. |  |
| N-CN1,2  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.  2. Use the relation *i*2 = –1 and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers. |  |  |
| N-CN.7  7. Solve quadratic equations with real coefficients that have complex solutions. |  |  |
|  |  | N-CN8,9  8. (+) Extend polynomial identities to the complex numbers. *For example, rewrite x2 + 4 as (x + 2i)(x – 2i).*  9. (+) Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials. |
|  |  | A-SSE.1A,B  1. Interpret expressions that represent a quantity in terms of its context.★   1. Interpret parts of an expression, such as terms, factors, and coefficients. 2. Interpret complicated expressions by viewing one or more of their parts as a single entity. *For example, interpret P(1+r)n as the product of P and a factor not depending on P.* |

|  |  |  |
| --- | --- | --- |
| In Both | In PARCC Only | In Appendix A Only |
| A-SSE.2  2. Use the structure of an expression to identify ways to rewrite it. *For example, see x4 – y4 as (x2)2 – (y2)2, thus recognizing it as a difference of squares that can be factored as (x2 – y2)(x2 + y2).* |  |  |
|  | A-SSE.3  3. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.★   1. Factor a quadratic expression to reveal the zeros of the function it defines. 2. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines. 3. Use the properties of exponents to transform expressions for exponential functions. *For example the expression 1.15t can be rewritten as (1.151/12)12t ≈ 1.01212t to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.* |  |
| A-SSE.4  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-APR.1  1. Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials. |
| A-APR.2  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*).  A-APR.3  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. |  |  |

|  |  |  |
| --- | --- | --- |
| In Both | In PARCC Only | In Appendix A Only |
| A-APR.4  4. Prove polynomial identities and use them to describe numerical relationships. *For example, the polynomial identity (x2 + y2)2 = (x2 – y2)2 + (2xy)2 can be used to generate Pythagorean triples* |  |  |
|  |  | A-APR.5  5. (+) Know and apply the Binomial Theorem for the expansion of (*x* + *y*)*n* in powers of *x* and *y* for a positive integer *n*, where *x* and *y* are any numbers, with coefficients determined for example by Pascal’s Triangle.1 |
| A-APR.6  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. |  |  |
|  |  | A-APR.7  7. (+) Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract, multiply, and divide rational expressions. |
| A-CED.1  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-CED.2  2. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.  A-CED.3  3. Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.* |

|  |  |  |
| --- | --- | --- |
| In Both | In PARCC Only | In Appendix A Only |
|  |  | A-CED.4  4. Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. *For example, rearrange Ohm’s law V = IR to highlight resistance R.* |
|  | A-REI.1  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 justify a solution method. |  |
| A-REI.2  2. Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise. |  |  |
|  | A-REI.4  4. Solve quadratic equations in one variable.   1. 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.   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* ± *bi* for real numbers *a* and *b*.  A-REI.6  6. Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.  A-REI.7  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* = –3*x* and the circle *x*2 + *y*2 = 3. |  |

|  |  |  |
| --- | --- | --- |
| In Both | In PARCC Only | In Appendix A Only |
| A-REI.11  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  3. Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. *For example, the Fibonacci sequence is defined recursively by f(0) = f(1) = 1, f(n+1) = f(n) + f(n-1) for n ≥ 1.* |  |
| F-IF.4  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. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity*.★  F-IF.6  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.5  5. Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.*★ |

|  |  |  |
| --- | --- | --- |
| In Both | In PARCC Only | In Appendix A Only |
| F-IF.7b,c,e  b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.  c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.  e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude | F-IF.7a, d  7. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.★  a. Graph linear and quadratic functions and show intercepts, maxima, and minima.  d. (+) Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior (as a plus standard-this may not be assessed even though F.IF.7 was listed on the framework). |  |
| F-IF. 8  8. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.   1. Use the process of factoring and 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. 2. Use the properties of exponents to interpret expressions for exponential functions. For example, identify percent rate of change in functions such as y = (1.02)t, y = (0.97)t, y = (1.01)12t, y = (1.2)t/10, and classify them as representing exponential growth or decay.   F.IF. 9  9. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.* |  |  |

|  |  |  |
| --- | --- | --- |
| In Both | In PARCC Only | In Appendix A Only |
|  | F.BF.1  1. Write a function that describes a relationship between two quantities.★  a. Determine an explicit expression, a recursive process, or steps for calculation from a context.  c. (+) Compose functions. *For example, if T(y) is the temperature in the atmosphere as a function of height, and h(t) is the height of a weather balloon as a function of time, then T(h(t)) is the temperature at the location of the weather balloon as a function of time.* |  |
| F.BF.1B  b. Combine standard function types using arithmetic operations. *For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.* |  |  |
|  | F.BF.2  Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.★ |  |
| Build new functions from existing ones (include simple, radical, rational, and exponential functions)  F.BF.3  3. Identify the effect on the graph of replacing *f*(*x*) by *f*(*x*) + *k*, *k* *f*(*x*), *f*(*kx*), and *f*(*x* + *k*) for specific values of *k* (both positive and negative); find the value of *k* given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them.  F.BF.4A  4. Find inverse functions.  Solve an equation of the form f(x) = c for a simple function f that has an inverse and write an expression for the inverse. *For example, f(x) =2 x3 or f(x) = (x+1)/(x–1) for x ≠ 1.* |  |  |

|  |  |  |
| --- | --- | --- |
| In Both | In PARCC Only | In Appendix A Only |
|  | F.LE.2  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  4. For exponential models, express as a logarithm the solution to *abct* = *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  5. Interpret the parameters in a linear or exponential function in terms of a context |  |
| F.TF.1  1. Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.  F.TF.2  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. |  |  |
| F.TF.5  5. Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.★ |  |  |
| F.TF.8  8. Prove the Pythagorean identity sin2(θ) + cos2(θ) = 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. |  |  |
|  | G.GPE.2  2. Derive the equation of a parabola given a focus and directrix. |  |
| S.ID.4  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 |  |  |

|  |  |  |
| --- | --- | --- |
| In Both | In PARCC Only | In Appendix A Only |
|  | S.ID.6  6. Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.   1. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear, quadratic, and exponential models. 2. Informally assess the fit of a function by plotting and analyzing residuals. 3. Fit a linear function for a scatter plot that suggests a linear association. |  |
| S.IC.1  1. Understand statistics as a process for making inferences about population parameters based on a random sample from that population.  S.IC.2  2. Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation. *For example, a model says a spinning coin falls heads up with probability 0.5. Would a result of 5 tails in a row cause you to question the model?* |  |  |
| S.IC.3  3. Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.  S.IC.4  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  5. Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.  S.IC.6  6. Evaluate reports based on data. |  |  |

|  |  |  |
| --- | --- | --- |
| In Both | In PARCC Only | In Appendix A Only |
|  | S.CP.1  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  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.3  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  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. *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.*  S.CP.5  5. Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. *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.* |  |

|  |  |  |
| --- | --- | --- |
| In Both | In PARCC Only | In Appendix A Only |
|  | S.CP.6  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  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. |  |
|  |  | S.MD.6,7  6. (+) Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator).  7. (+) Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game). |