Integrated Pathway Year 1 Integrated Math I Test Specifications
DCAS Aligned to Common Core State Standards

The following document shows the alignment of the Delaware Comprehensive Assessment System (DCAS) to the Delaware Common Core State Standards (CCSS), as reflected on the computer-adaptive test for Integrated Math I. To respect the intent of the CCSS, all standards are represented in either the traditional or integrated pathway documents. Therefore, all standards should be taught in grades 9 through 11 to ensure continuity of learning.

The standards that are identified in the Integrated Math I document are specific to this course. Where there are gaps in numbering of the standards, please refer to the Overview of the Pathway document to see the vertical alignment within that CCSS domain.

Number and Quantity
9-12.N.RN – The Real Number System Domain
• **Extend the properties of exponents to rational exponents.**
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. *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.*
N.RN.2 Rewrite expressions involving radicals and rational exponents using the properties of exponents.
9-12.N.Q – Quantities Domain
• **Reason quantitatively and use units to solve problems.** ▪ *Standard Clarification: Foundation for work with expressions, equations, and functions.*
N.Q.1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.
N.Q.2 Define appropriate quantities for the purpose of descriptive modeling.
N.Q.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

Algebra
9-12.A.SSE – Seeing Structure in Expressions Domain
• **Interpret the structure of expressions.** ▪ *Standard Clarification: Linear expressions and exponential expressions with integer exponents*
A.SSE.1 Interpret expressions that represent a quantity in terms of its context.*
A.SSE.1.a Interpret parts of an expression, such as terms, factors, and coefficients.
A.SSE.1.b 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.*
9-12.A.APR – Arithmetic with Polynomials and Rational Expressions Domain
• **Perform arithmetic operations on polynomials.**
A.APR.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.
9.12.A.CED – Creating Equations* Domain
• **Create equations that describe numbers or relationships.** ▪ *Linear and exponential (integer inputs only); for A.CED.3, linear only*
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.CED.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 Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.*
A.CED.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.*

9-12.A.REI – Reasoning with Equations and Inequalities Domain
• **Understand solving equations as a process of reasoning and explain the reasoning.** ▪ *Standard Clarification: Master linear, learn as general principle*
A.REI.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.
• **Solve equations and inequalities in one variable** ▪ *Integrated Math I Clarification: Linear inequalities; literal that are linear in the variables being solved for; exponential of a form, such as $2^x = 1/16$*
A.REI.3 Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.
A.REI.4 Solve quadratic equations in one variable.
A.REI.4.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.** ▪ *Standard Clarification: Linear systems*
A.REI.5 Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions.
A.REI.6 Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.
• **Represent and solve equations and inequalities graphically.** ▪ *Standard Clarification: Linear and exponential; learn as general principle*
A.REI.10 Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).
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.*
A.REI.12 Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.

Functions
9-12.F.IF – Interpreting Functions Domain
• **Understand the concept of a function and use function notation.** ▪ *Standard Clarification: Learn as general principle; focus on linear and on arithmetic and geometric sequences*
F.IF.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.*
• **Interpret functions that arise in applications in terms of the context.** ▪ *Standard Clarification: Linear and exponential (linear domain)*
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.*
• **Analyze functions using different representations** ▪ *Standard Clarification: Linear and exponential*
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.*
F.IF.7a Graph linear and quadratic functions and show intercepts, maxima, and minima.
F.IF.8b Use the properties of exponents to interpret expressions for exponential functions. *For example, identify percent rate of change in functions such as* $y = (1.02)^t$, $y = (0.97)^t$, $y = (1.01)^{12t}$, $y = (1.2)^{t/10}$, *and classify them as representing exponential growth or decay.*
F.IF.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.*
9-12.F.BF – Building Functions Domain
• **Build a function that models a relationship between two quantities.** ▪ *Standard Clarification: Linear and exponential (integer inputs)*
F.BF.1 Write a function that describes a relationship between two quantities.*
F.BF.1a Determine an explicit expression, a recursive process, or steps for calculation from a context.
F.BF.1b Combine standard function types using arithmetic operations. *For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.*
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 functions** ▪ *Standard Clarification: Linear and exponential; focus on vertical translations for exponential*
F.BF.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.*

9-12.F.LE – Linear, Quadratic, and Exponential Models Domain
• **Construct and compare linear, quadratic, and exponential models and solve problems.** ▪ *Standard Clarification: Linear and exponential*
F.LE.1 Distinguish between situations that can be modeled with linear functions and with exponential functions.
F.LE.1a Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals.
F.LE.1b Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.
F.LE.1c Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.
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.3 Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.
• **Interpret expressions for functions in terms of the situation they model.** ▪ *Standard Clarification: Linear and exponential of form* $f(x) = b^x + k$
F.LE.5 Interpret the parameters in a linear or exponential function in terms of a context.

Geometry
9-12.G.GPE – Expressing Geometric Properties with Equations Domain
• **Use coordinates to prove simple geometric theorems algebraically.** ▪ *Integrated Math I Clarification: Include distance formula; relate to Pythagorean theorem*
G.GPE.4 Use coordinates to prove simple geometric theorems algebraically. *For example, prove or disprove that a figure defined by four given points in the coordinate plane is a rectangle; prove or disprove that the point (1, √3) lies on the circle centered at the origin and containing the point (0, 2).*
G.GPE.5 Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems (e.g., find the equation of a line parallel or perpendicular to a given line that passes through a given point).
G.GPE.7 Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula.*
9-12.G.GMD – Geometric Measurement and Dimension Domain
G.GMD.1 Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone. *Use dissection arguments, Cavalieri's principle, and informal limit arguments.*
G.GMD.3 Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.*
9-12.G.MG – Modeling with Geometry Domain
• **Apply geometric concepts in modeling situations.**
G.MG.1 Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).*

Statistics and Probability
9-12.S.ID – Interpreting Categorical and Quantitative Data Domain
• **Summarize, represent, and interpret data on a single count or measurement variable**
S.ID.1 Represent data with plots on the real number line (dot plots, histograms, and box plots).
S.ID.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.
S.ID.3 Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).
• **Summarize, represent, and interpret data on two categorical and quantitative variables.** ▪ *Standard Clarification: Linear focus; discuss general principle*
S.ID.5 Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data.
S.ID.6 Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.
S.ID.6a Fit a function to the data; use functions fitted to data to solve problems in the context of the data. *Use given functions or choose a function suggested by the context. Emphasize linear and exponential models.*
S.ID.6b Informally assess the fit of a function by plotting and analyzing residuals.
S.ID.6c Fit a linear function for a scatter plot that suggests a linear association.
• **Interpret linear models.**
S.ID.7 Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.
S.ID.8 Compute (using technology) and interpret the correlation coefficient of a linear fit.
S.ID.9 Distinguish between correlation and causation.
9-12.S.CP – Conditional Probability and the Rules of Probability Domain
• **Understand independence and conditional probability and use them to interpret data**
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.

* Modeling 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 (*).