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New York State Regents Examination in Algebra I (Common Core)

Performance Level Descriptions

August 2014

Algebra I Performance Level Descriptions

Policy-Level Performance Level Definitions

For each subject area, there are students performing along a proficiency continuum with regard to the skills and knowledge necessary to meet the demands of Common Core Learning Standards for Mathematics. There are students who are exceed the expectations of the standards, students meet the expectations, students who partially meet the expectations, and students who do not demonstrate sufficient knowledge or skills required for any performance level. New York State assessments are designed to classify students into one of four proficiency categories; these proficiency categories are defined as:

NYS Level 5
Students performing at this level exceed Common Core expectations**.**

NYS Level 4
Students performing at this level meet Common Core expectations.

NYS Level 3
Students performing at this level partially meet Common Core expectations (required for current Regents Diploma purposes).

NYS Level 2 (Safety Net)
Students performing at this level partially meet Common Core expectations (required for Local Diploma purposes).

NYS Level 1
Students performing at this level do not demonstrate the knowledge and skills required for NYS Level 2.

Performance Level Descriptions

Performance Level Descriptions (PLDs) describe the range of knowledge and skills students should demonstrate at a given performance level.

How were the PLDs developed?

The New York State Education Department (NYSED) convened the state's English Language Arts (ELA) and Math Content Advisory Panels (CAPs) to develop the initial draft PLDs for Algebra I and English Language Arts. The CAPs are classroom teachers from elementary, middle and high school, school and district administrators, English Language Learner (ELL) and students with disabilities (SWD) specialists, and higher education faculty members from across the state.

The draft PLDs from the CAPs then went through additional rounds of review and edit from a number of NYS-certified educators, content specialists, and assessment experts under NYSED supervision. In developing PLDs, participants considered policy-level definitions of the performance levels (see above) and the expectations for each grade level in the Common Core Learning Standards.

How are the PLDs used in Assessment?

PLDs are essential in setting standards for the New York State Regents Examinations. Standard setting panelists use PLDs to determine the threshold expectations for students to demonstrate the knowledge and skills necessary to attain just barely a Level 2, Level 3, Level 4, or Level 5 on the assessment. These discussions then influence the panelists in establishing the cut scores on the assessment. PLDs are also used to inform item development, as each test needs questions that distinguish performance all along the continuum.

How can the PLDs be used in Instruction?

PLDs help communicate to students, families, educators and the public the specific knowledge and skills expected of students to demonstrate proficiency and can serve a number of purposes in classroom instruction. They are the foundation of rich discussion around what students need to do to perform at higher levels and to explain the progression of learning within a subject area. We encourage the use of the PLDs for a variety of purposes, such as differentiating instruction to maximize individual student outcomes, creating classroom assessments and rubrics to help in identifying target performance levels for individual or groups of students, and tracking student growth along the proficiency continuum as described by the PLDs. In order to facilitate the use of the PLDs in instruction, the skills differentiating performance levels have been identified using bold text.

Algebra I Performance Level Descriptions

Domain	NYS Level 5	NYS Level 4	NYS Level 3	NYS Level 2	NYS Level 1
The Real Number System (N-RN)	**Generalize** and explain when the sums and products are rational or irrational **using abstract representations.** Justify the conjecture using concrete examples.	Calculate sums and products of **two rational and/or irrational numbers.** **Explain when** sums and products are rational and irrational **using concrete examples.**	Calculate sums and products of **two rational or two irrational numbers.** **Determine whether** sums and products are rational or irrational.	**Distinguish between** rational and irrational numbers.	**Identify and order** rational numbers on a number line.
Quantities (N-Q)	Compare and interpret different representations of the accuracy of a quantity and justify choice of units and quantities. **Recognize and explain** how alteration of units would affect solutions.	**Choose and interpret units consistently.** **Choose and interpret the scale and the origin** in graphs and data displays. **Choose a** level of accuracy appropriate to context **and identify limitations on measurement** when reporting quantities. Select or define appropriate quantities for the purpose of modeling.	**Interpret** units selectively. Given a graph or data display, **interpret the scale and the origin.** **Choose a** level of accuracy appropriate to context when reporting quantities.	**Choose** units for the solutions of problems. Given a graph or data display, **identify the scale and the origin.** **Identify the indicated** level of accuracy and round to this indicated level of accuracy.	**Identify** units relevant to a context. Given a graph or data display, **identify the scale or the origin.**

Algebra I Performance Level Descriptions

Domain	NYS Level 5	NYS Level 4	NYS Level 3	NYS Level 2	NYS Level 1
Seeing Structure in Expressions (A-SSE)	**Explain different interpretations** of expressions.	**Interpret parts of an expression** in terms of its context and rewrite it to reveal information about the context.	**Identify the relationship among** terms, variables, and factors; **describe and classify polynomials**; find appropriate equivalent representations.	**Identify** terms, variables, and factors of an expression. Identify linear or quadratic equivalent expressions.	**Provide evidence that two expressions are equivalent** by substituting numerical values for variables.
	Find the most appropriate form of a quadratic function to solve real-world or mathematical problems.	Identify algebraic factors of an expression and factor a quadratic expression with a leading integer coefficient greater than one to solve real-world or mathematical problems.	Distinguish between **linear, quadratic, and exponential** expressions.	Distinguish between **linear and quadratic** expressions.	
	Determine the maximum/minimum of a quadratic function **with a leading coefficient greater than one** by completing the square.	Determine the maximum or minimum of a quadratic function **with a leading coefficient of one** by completing the square.	**Factor a quadratic expression with a leading coefficient of one** to solve real-world or mathematical problems.	Factor an expression using the **greatest common factor**.	
			Given a quadratic expression, identify an equivalent expression in completed-square form.	Find the zeros of a factored quadratic function.	

Algebra I Performance Level Descriptions

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Arithmetic with Polynomials and Rational Expressions (A-APR)	**Explain and/or show generally** that polynomials are closed under addition, subtraction, and multiplication. **Determine and use the zeros of any polynomial function** to sketch its graph, generate graphs and expressions for multiple functions, given particular zeros, and explain the significance of the zeros.	Perform addition, subtraction, and multiplication with polynomials **and demonstrate that polynomials are closed under the three operations.** **Identify zeros of quadratic and cubic polynomials** and use the zeros to graph the function. **Explain the relationship** between a function and its zeros.	Perform **addition, subtraction, and multiplication on polynomials.** **Identify zeros of quadratic polynomials** and use the zeros to graph the function.	Perform **addition and subtraction** with linear expressions. Given a **linear polynomial**, construct a graph of the function and identify its zero.	Perform **addition** with linear expressions.
Creating Equations (A-CED)	Create equations and inequalities in one or two variables and use them to solve problems (i.e., linear, quadratic, or exponential equations). Explain how a created equation or inequality models a context.	**Create equations and inequalities in one or two variables** and use them to solve problems (i.e., linear, quadratic, or exponential equations with integer exponents).	**Create linear equations and linear inequalities in one variable** to solve problems.	**Create linear equations in one variable** and use them to solve problems.	Identify an unknown quantity from a context.

Domain	NYS Level 5	NYS Level 4	NYS Level 3	NYS Level 2	NYS Level 1
(A-CED continued)	Compare different models of the same context and describe limitations of models.	**Graph linear, quadratic, and exponential equations and linear inequalities in two variables.** Distinguish between a linear, quadratic, and exponential function, **given multiple representations**. Represent constraints (i.e., real world or mathematical) by equations or inequalities. Rearrange **complex** formulas to highlight a quantity of interest.	**Graph linear equations and inequalities in two variables** to solve problems. **Graph quadratic and exponential equations** on coordinate axes with labels and scales. Rearrange **simple** formulas to highlight a quantity of interest.	**Graph linear equations** on coordinate axes with labels and scales. Distinguish between a linear, quadratic, and exponential function **given the same representation** (i.e., algebraic, verbal, graph, table).	**Graph integer ordered pairs** from a given table of *x*- and *y*-values. Distinguish between a **linear and nonlinear function.**

Domain	NYS Level 5	NYS Level 4	NYS Level 3	NYS Level 2	NYS Level 1
Reasoning with Equations and Inequalities (A-REI)	**Predict, without solving,** when a quadratic equation will have no real solutions and explain reasoning with algebraic or graphical evidence.	Solve quadratic equations in one variable **and recognize cases in which a quadratic equation has no real solutions.**	Solve quadratic equations in one variable **with real roots using an appropriate method.**	Verify that a number is a solution to a quadratic equation.	Select solution strategies.
	Solve linear equations and inequalities and construct a viable argument to justify the advantages of one particular method over another.	Solve linear equations and inequalities in one variable, **including equations with coefficients represented by letters.**	**Solve linear equations and inequalities** in one variable.	**Solve one- and two-step linear equations** in one variable.	**Verify a solution to one- and two-step linear equations** in one variable.
		Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.		Given a system of linear equations in two variables and the solution, **verify the solution algebraically.**	Identify the solution to a system of linear equations **from a graph.**

Domain	NYS Level 5	NYS Level 4	NYS Level 3	NYS Level 2	NYS Level 1
(A-REI continued)	Explain why the graph of an equation in two variables is the set of all its solutions. Represent coincidental linear equations as multiples of each other.	**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 $f(x) = g(x)$. (Functions are limited to **linear, polynomial, rational, or absolute value**.)	Given a system of linear equations **with integer coefficients in two variables**, solve the system exactly or approximately. Approximate the solution(s) to $f(x) = g(x)$, where $f(x)$ and $g(x)$ are **first- and second-degree polynomial functions.**	Approximate the solution(s) to $f(x) = g(x)$, where $f(x)$ and $g(x)$ are **linear functions.**	Given a graph of $y = g(x)$ and $y = f(x)$ (not limited to linear functions), **use integer-valued coordinates to name a point of intersection.**
	Explain why there are multiple solutions to a system of inequalities.	Graph the solutions to a linear inequality in two variables as a half-plane **and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.**	Graph the solutions to a linear inequality in two variables as a half-plane using a graphing calculator.	Given the graph of an inequality (or system of inequalities), **generate a point(s) in the solution set.**	Given the graph of an inequality (or system of inequalities), **identify whether a point is in the solution set.**
Interpreting Functions (F-IF)	**Identify the domain and range of a** function given its context.	**Describe a function** as a rule that assigns to each element of the domain a unique element of the range and use proper function notation.	Determine **from a table of inputs and outputs** whether a relation is a function.	Determine **from a graph** whether a relation is a function.	**Generate a graph of a linear function** given a table for the input and output.
			Evaluate linear, exponential, and quadratic functions.	**Use function notation** for inputs and outputs.	

Domain	NYS Level 5	NYS Level 4	NYS Level 3	NYS Level 2	NYS Level 1
(F-IF continued)		Evaluate functions. **Identify the domain and range from a graph** and **interpret statements that use function** notation in terms of a context.	Identify the domain from **a graph or table of values**. **Interpret statements that** use function notation.	**Identify the domain of a linear function** given a table of values.	
	Explain how and why explicit and recursive formulas define the same sequence and relate these representations to a context.	**Identify a recursively defined sequence as a function** and determine its n^{th} term.	**Identify an explicitly defined sequence** as a function and determine its n^{th} term.	**Identify and continue patterns** of arithmetic sequences.	

Domain	NYS Level 5	NYS Level 4	NYS Level 3	NYS Level 2	NYS Level 1
(F-IF continued)	Accurately sketch graphs, showing key features, given a verbal description of the relationship, **including piece-wise defined and step functions.**	**Accurately sketch and create graphs using technology and interpret** key features of graphs and tables given a verbal description of the relationship, **including square root and cube root functions with domains in real numbers.**	**Accurately sketch and create graphs using technology and identify** key features of graphs, given a verbal description of the relationship**, including linear, quadratic, and exponential functions with domains in the integers.**	**Graph linear and quadratic functions** and identify key features visible within the "standard zoom" (-10 to 10 calculator window) by hand or technology.	**Identify the properties of linear functions** represented algebraically, graphically, or numerically in tables.
	Estimate, calculate, and interpret the average rate of change **in terms of a context** over a specified interval, including linear, quadratic, square root, cube root, piece-wise defined, and exponential functions with domains in the real numbers.	Estimate, calculate, and interpret the average rate of change over a specified interval, **including linear, quadratic, square root, cube root, piece-wise defined and exponential functions with domains in the integers.**	Calculate the average rate of change over a specified interval from a graph, **including linear, quadratic, and exponential functions with domains in the integers.**	Calculate the rate of change **of a linear function from a graph or table.**	**Identify the rate of change** given the symbolic representation of a linear function. Distinguish between graphs of **increasing and decreasing** linear functions.
		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.**	Use the process of factoring **to show zeros and symmetry of a graph.**	Graph quadratic functions using **technology and identify their roots.**	Identify *x*-intercepts of a quadratic function, **given its graph.**

Domain	NYS Level 5	NYS Level 4	NYS Level 3	NYS Level 2	NYS Level 1
(F-IF continued)	Compare properties of two functions with each represented in a different way (i.e., algebraically, graphically, numerically in tables, or by verbal descriptions), including linear, quadratic, square root, cube root, piecewise-quadratic, and exponential functions **with domains in the real numbers.**	Compare properties of two functions with each represented in a different way (i.e., algebraically, graphically, numerically in tables, or by verbal descriptions), **including linear, quadratic, square root, cube root, piecewise-quadratic, and exponential functions with domains in the integers.**	Compare **properties** of two functions with each **represented in a different way** (i.e., algebraically, graphically, or numerically in tables), **including linear, quadratic, and exponential functions with domains in the integers.**	Compare **qualitative descriptions** of two **linear functions represented in the same way** (i.e., algebraically, graphically, or numerically in tables).	
Building Functions (F-BF)	**Determine a recursive representation** for a linear, quadratic, or exponential function.	**Determine and write the appropriate linear, quadratic, or exponential function** that describes a relationship between two quantities.	**Write a linear or quadratic function** that describes a relationship between two quantities.	**Write a qualitative or narrative description of a linear function** that describes the behavior and/or relationship between two quantities. Determine a representation, intermediate steps, or calculations for a linear function.	Identify the descriptive characteristics of inputs and outputs of a linear function.

Domain	NYS Level 5	NYS Level 4	NYS Level 3	NYS Level 2	NYS Level 1
(F-BF continued)	Given the equation of a transformed linear or quadratic function, **create an appropriate graph and interpret the transformations.**	Identify the effect on a graph of **replacing *f*(*x*) with *f*(*x*) + *k*, *k f*(*x*), *f*(*kx*), and *f*(*x* + *k*). Find the value of k given the graphs.**	Identify the effect on a graph of **replacing *f*(*x*) with *k f*(*x*), *f*(*kx*), and *f*(*x* + *k*) for specific values of *k* (both positive and negative integers).**	Identify the effect on a graph of **replacing *f*(*x*) with *f*(*x*) + *k* where *k* is a positive or negative integer and replacing *f*(*x*) with *kf*(*x*) where *k* is a positive integer.**	Identify the effect on a graph of **replacing *f*(*x*) with *f*(*x*) + *k* where *k* is a positive integer.**
Linear, Quadratic, and Exponential Models (F-LE)	Explain, using graphs and tables, that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.	**Demonstrate that** a given linear function grows by equal differences over equal intervals and an exponential function grows by equal factors over equal intervals (where differences and factors are integers). 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).	Show, **using graphs and tables,** that a quantity increasing exponentially eventually exceeds a quantity increasing linearly or quadratically. Construct **linear and exponential functions** given a graph or two input-output pairs with or without a graphing calculator (including reading these from a table).	Identify **a situation that can be modeled** with a linear function. Construct **linear functions** given a graph or two input-output pairs (including reading these from a table).	Identify **the graph of a** linear function. Distinguish between **graphs of different linear functions.**

Domain	NYS Level 5	NYS Level 4	NYS Level 3	NYS Level 2	NYS Level 1
(F-LE continued)	Interpret **changes in parameters** based on the comparison of two functions in terms of a real-world context.	Identify situations in which a quantity grows or decays at **a constant percent rate per unit interval relative to another.** **Interpret the parameters** (i.e., slope or growth factor) in a linear, quadratic, or exponential function in terms of a real-world context.	Identify situations in which one quantity changes at **a constant rate per unit interval relative to another.** Identify and **distinguish between situations that can be modeled with linear functions and exponential functions.** **Identify the slope and *y*-intercept in a linear function** in terms of a real-world context.	**Using a graph**, show that a quantity increasing exponentially grows faster than a quantity increasing linearly.	
Summarize, Represent, and Interpret Data (S-ID)	Choose and justify the most appropriate plot on a number line. **Choose and justify the most appropriate measures** of center and spread of the data distribution in two or more data sets.	**Interpret data** with plots on a number line. **Choose and interpret the most appropriate measures** of center and spread of the data distribution **in two or more data sets.**	Represent data with plots on a number line **(i.e., dot plots, histogram, and box plots).** **Choose the most appropriate measure** of center of data sets, considering the shape and spread of the data.	Represent data with plots on a number line with a **dot plot or histogram.** **Calculate a given** measure of center.	Represent data with a **dot plot.**

Domain	NYS Level 5	NYS Level 4	NYS Level 3	NYS Level 2	NYS Level 1
(S-ID continued)	**Identify and explain** errors in inferences made based on assumptions about the data.	Interpret the differences in shape, center, **and** spread in the context of the data, including the effects of outliers.	Interpret the differences in shape, center, **or** spread in the context of the data, including the effects of outliers.	**Identify** outliers.	
	Provide evidence to show possible associations and trends in the data.	**List and interpret possible associations** and trends in the data in a two-way frequency table.	**Summarize categorical data** for two categories in two-way frequency tables.	Given two-way table, **identify quantitative differences** of categorical data.	From a two-way table, **state** relative frequencies.
	Summarize, represent, and interpret data on two categorical and quantitative variables.	Interpret marginal, joint, and conditional relative frequencies in the context of the data.	Interpret marginal relative frequencies in the context of the data.		
	Fit a linear, quadratic, or exponential function to real-world data and use residuals to assess the fit.	**Use residuals to assess the fit of a linear, quadratic, or exponential function.**	**Fit a linear function** to real world data.		

Domain	NYS Level 5	NYS Level 4	NYS Level 3	NYS Level 2	NYS Level 1
(S-ID continued)	Compare and contrast the strength of the fit for a **variety of functions.**	Use the graphing calculator to determine the correlation coefficient of **a linear model and assess the strength and direction of the fit.**	Use the graphing calculator to **determine the correlation coefficient** and **direction of a linear model.**	Identify a strong or weak correlation **given a correlation coefficient**.	**Distinguish between** scatterplots that show a negative correlation and scatterplots that show a positive correlation.
			Interpret the meaning of slope **and** the *y*-intercept of a linear model in real-world context.	**Interpret the meaning of the *y*-intercept or slope** of a linear model in real-world context.	**Identify the slope or *y*-intercept** given a linear model.
	Generate and explain examples of relationships that are correlated and causal or correlated but not causal.	**Distinguish between** correlation and causation.			