

Algebra 1 Course-Level Expanded Expectations

NUMBER AND QUANTITY: NQ

A1.NQ.A	Extend and use properties of rational exponents.	
A1.NQ.A.1	Explain how the meaning of rational exponents extends from the properties of integer exponents.	The expectation of the student is to explain how the meaning of rational exponents extends from the properties of integer exponents to rational exponents. (e.g., $(5^{\frac{1}{3}})^3 = 5$)
A1.NQ.A.2	Rewrite expressions involving radicals and rational exponents using the properties of exponents. Limit to rational exponents with a numerator of 1.	The expectation of the student is to rewrite expressions involving simple radicals and rational exponents using the properties of exponents. Limit to rational exponents with a numerator of 1. (e.g., $\sqrt[n]{x} = x^{\frac{1}{n}}$)
A1.NQ.B	Use units to solve problems.	
A1.NQ.B.3	<p>Use units of measure as a way to understand and solve problems involving quantities.</p> <ol style="list-style-type: none"> Identify, label and use appropriate units of measure within a problem. Convert units and rates. Use units within problems. Choose and interpret the scale and the origin in graphs and data displays. 	<p>The expectation of the student is to use units of measure as a way to understand and solve problems involving quantities such as rates, time, length, area and capacity.</p> <ol style="list-style-type: none"> Identify, label and use appropriate units of measure within a context. Convert units and rates within and between systems of measure. Use units within multi-step problems. (e.g., <i>An L-shaped concrete slab is composed of a rectangular piece 30 feet 6 inches by 20 feet 4 inches and a second piece 10 feet 8 inches by 8 feet 3 inches. If the slab is 4 inches thick, how many cubic yards (to the nearest greater $\frac{1}{4}$ cubic yard) need to be ordered?</i>) Choose and interpret the scale and the origin in graphs and data displays.
A1.NQ.B.4	Define and use appropriate quantities for representing a given context or problem.	The expectation of the student is to define and use appropriate quantities for representing a given context or problem.

A1.NQ.B.5	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.	The expectation of the student is to choose a level of accuracy appropriate to limitations on measurement when reporting quantities. <i>(e.g., Problems involving money are normally computed to the nearest cent. How precise can we measure with any given tool (ruler, calculator, scale, etc.?)</i>
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SEEING STRUCTURE IN EXPRESSIONS: SSE

A1.SSE.A Interpret and use structure.		
A1.SSE.A.1	Interpret the contextual meaning of individual terms or factors from a given problem that utilizes formulas or expressions.	The expectation of the student is to interpret the contextual meaning of individual terms or factors from a given situation that utilizes formulas or expressions. <i>(e.g., How does the height affect the volume of a cylinder versus the radius?)</i>
A1.SSE.A.2	Analyze the structure of polynomials to create equivalent expressions or equations.	The expectation of the student is to analyze the structure of polynomial expressions in order to rewrite the expressions in equivalent forms. <i>(e.g., Factor a quadratic expression)</i>
A1.SSE.A.3	<p>Choose and produce equivalent forms of a quadratic expression or equations to reveal and explain properties.</p> <ul style="list-style-type: none"> a) Find the zeros of a quadratic function by rewriting it in factored form. b) Find the maximum or minimum value of a quadratic function by completing the square. 	<p>The expectation of the student is to choose and produce equivalent forms of a quadratic expression to reveal and explain properties of the quantity represented by the expression.</p> <ul style="list-style-type: none"> a. Find the zeros of a quadratic function by rewriting it in factored form. b. Find the maximum or minimum value of a quadratic function by completing the square.

CREATING EQUATIONS: CED

A1.CED.A Create equations that describe linear, quadratic and exponential relationships.		
A1.CED.A.1	Create equations and inequalities in one variable and use them to model and/or solve problems.	The expectation of the student is to create equations and inequalities in one variable and use them to model and/or solve problems, including, linear, quadratic and exponential relationships.
A1.CED.A.2	Create and graph linear, quadratic and exponential equations in two variables.	The expectation of the student is to create linear and quadratic ($y = ax^2$, $y = ax^2 + b$) and exponential ($y = ab^x$) equations in two variables. Graph the equations on a Cartesian coordinate plane with labels and scales.

A1.CED.A.3	Represent constraints by equations or inequalities and by systems of equations or inequalities, and interpret the data points as a solution or non-solution in a modeling context.	The expectation of the student is to represent constraints by equations or inequalities and by systems of equations or inequalities. Interpret data points as a solution or non-solution in a modeling context.
A1.CED.A.4	Solve literal equations and formulas for a specified variable that highlights a quantity of interest.	The expectation of the student is to solve literal equations and formulas for a specified variable that highlights a quantity of interest.

REASONING WITH EQUATIONS AND INEQUALITIES: REI

A1.REI.A	Understand solving equations as a process, and solve equations and inequalities in one variable.	
A1.REI.A.1	Explain how each step taken when solving an equation or inequality in one variable creates an equivalent equation or inequality that has the same solution(s) as the original.	The expectation of the student is to explain how each step taken when solving an equation or inequality in one variable creates a new equation or inequality that has the same solution as the original.
A1.REI.A.2	<p>Solve problems involving quadratic equations.</p> <ol style="list-style-type: none"> a) Use the method of completing the square to create an equivalent quadratic equation. b) Derive the quadratic formula. c) Analyze different methods of solving quadratic equations. 	<p>The expectation of the student is to solve problems involving quadratic equations in one variable.</p> <ol style="list-style-type: none"> a. Use the method of completing the square to transform a quadratic equation in x into an equation of the form $(x - p)^2 = q$ that has the same solution. b. Derive the quadratic formula from $ax^2 + bx + c = 0$, (a, b, c any real number) c. Solve quadratic equations by inspection, using the square root property, completing the square, using the quadratic formula and factoring as appropriate to the initial form of the equation. If a student encounter complex solutions, he or she should state “no real solution.” d. Analyze different methods of solving quadratic equations.
A1.REI.B	Solve systems of equations.	
A1.REI.B.3	Solve a system of linear equations algebraically and/or graphically.	The expectation of the student is to solve a system of linear equations algebraically and graphically.
A1.REI.B.4	Solve a system consisting of a linear equation and a quadratic equation algebraically and/or graphically.	The expectation of the student is to solve a system consisting of a linear equation and a quadratic function algebraically and graphically.

A1.REI.B.5	Justify that the technique of linear combination produces an equivalent system of equations.	The expectation of the student is to justify that given a system of two equations in two variables, the solution is not changed when one of the equations is replaced by a linear combination of itself.
A1.REI.C	Represent and solve linear and exponential equations and inequalities graphically.	
A1.REI.C.6	Explain that the graph of an equation in two variables is the set of all its solutions plotted in the Cartesian coordinate plane.	The expectation of the student is to explain that the graph of an equation in two variables is the set of all its solutions plotted in the Cartesian coordinate plane
A1.REI.C.7	Graph the solution to a linear inequality in two variables.	The expectation of the student is to graph the solution to a linear inequality in two variables.
A1.REI.C.8	Solve problems involving a system of linear inequalities.	The expectation of the student is to solve a system of linear inequalities by graphing, and when appropriate, interpreting the solutions in the context provided.

ARITHMETIC WITH POLYNOMIALS AND RATIONAL EXPRESSIONS: APR

A1.APR.A	Perform operations on polynomials.	
A1.APR.A.1	Add, subtract and multiply polynomials, and understand that polynomials follow the same general rules of arithmetic and are closed under these operations.	The expectation of the student is to add, subtract and multiply polynomials, and understand that polynomials follow the same general rules as arithmetic and are closed under these operations. (e.g., $(x^3+2x^2-x)-(3x^3+4x^2-x+2)$)
A1.APR.A.2	Divide polynomials by monomials.	The expectation of the student is to divide polynomials by monomials.

INTERPRETING FUNCTIONS: IF

A1.IF.A	Understand the concept of a function and use function notation.	
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A1.IF.A.1	<p>Understand that a function from one set (domain) to another set (range) assigns to each element of the domain exactly one element of the range.</p> <ul style="list-style-type: none"> a) Represent a function using function notation. b) Understand that the graph of a function labeled f is the set of all ordered pairs (x, y) that satisfy the equation $y=f(x)$. 	<p>The expectation of the student is to extend previous knowledge of a function to apply to general behavior and features of a function. Understand that a function from one set (domain) to another set (range) assigns to each element of the domain exactly one element of the range.</p> <ul style="list-style-type: none"> a. Represent a function using function notation and explain that $f(x)$ denotes the elements of the range of a function f that correspond to the elements of the domain. b. Understand that the graph of a function labeled f is the set of all ordered pairs (x, y) that satisfy the equation $y = f(x)$.
A1.IF.A.2	Use function notation to evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.	The expectation of the student is to use function notation to evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.
A1.IF.B	Interpret linear, quadratic and exponential functions in terms of the context.	
A1.IF.B.3	Using tables, graphs and verbal descriptions, interpret key characteristics of a function that models the relationship between two quantities.	The expectation of the student is to, using tables, graphs and verbal descriptions, interpret the key characteristics of a function that models the relationship between two quantities. Sketch a graph showing key features including: intercepts; intervals where the function is increasing, decreasing, positive or negative; relative maximum or minimum; symmetries; and end behavior.
A1.IF.B.4	Relate the domain and range of a function to its graph and, where applicable, to the quantitative relationship it describes.	The expectation of the student is to relate the domain and range of a function to its graph and, where applicable, to the quantitative relationship it describes.
A1.IF.B.5	Determine the average rate of change of a function over a specified interval and interpret the meaning.	The expectation of the student is given a function in graphical, symbolic or tabular form, determine the average rate of change of the function over a specified interval. Interpret the meaning of the average rate of change in a given context.
A1.IF.B.6	Interpret the parameters of a linear or exponential function in terms of the context.	The expectation of the student is to interpret the parameters of a linear or exponential function in terms of the context. (e.g., <i>Explain what happen as the values of t increase $A=300(.96)^t$.</i>)
A1.IF.C	Analyze linear, quadratic and exponential functions using different representations.	

A1.IF.C.7	Graph functions expressed symbolically and identify and interpret key features of the graph.	The expectation of the student is to graph functions, including piecewise-defined functions (linear, quadratic and exponential), from their symbolic representation and show key features of the graph both by hand and by using technology.
A1.IF.C.8	Translate between different but equivalent forms of a function to reveal and explain properties of the function and interpret these in terms of a context.	The expectation of the student is to translate between different but equivalent forms of a function to reveal and explain different properties of the function and interpret these in terms of a context, (<i>e.g., slope, intercepts and extreme values</i>).
A1.IF.C.9	Compare the properties of two functions given different representations.	The expectation of the student is to compare the properties of two functions given different representations. (<i>e.g., tables, graphs, equations or verbal descriptions</i>)

BUILDING FUNCTIONS: BF

A1.BF.A	Build new functions from existing functions (linear, quadratic and exponential).	
A1.BF.A.1	Analyze the effect of translations and scale changes on functions.	The expectation of the student is to analyze the effect of translations and scale changes on functions. Describe the effect of the transformations on the graph of $f(x)$ by $kf(x)$, $f(x) + k$, $f(x + k)$ for specific values of k (any real number). Find the specific value of k given the graphs of $f(x)$ and the graph after a transformation has been performed.

LINEAR, QUADRATIC AND EXPONENTIAL MODELS: LQE

A1.LQE.A	Construct and compare linear, quadratic and exponential models and solve problems.	
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A1.LQE.A.1	<p>Distinguish between situations that can be modeled with linear or exponential functions.</p> <ol style="list-style-type: none"> Determine that linear functions change by equal differences over equal intervals. Recognize exponential situations in which a quantity grows or decays by a constant percent rate per unit interval. 	<p>The expectation of the student is to distinguish between situations that can be modeled with linear or with exponential functions.</p> <ol style="list-style-type: none"> Show that linear functions change by equal differences over equal intervals. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another. Show that exponential functions change by equal factors over equal intervals. (<i>e.g., by algebraic proof, with a table showing differences or by calculating average rates of change over equal intervals</i>) Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.
A1.LQE.A.2	Describe, using graphs and tables, that a quantity increasing exponentially eventually exceeds a quantity increasing linearly or quadratically.	The expectation of the student is to describe, using graphs and tables, a quantity increasing exponentially eventually exceeds a quantity increasing linearly or quadratically.
A1.LQE.A.3	Construct linear, quadratic and exponential equations given graphs, verbal descriptions or tables.	The expectation of the student is to construct linear, quadratic and exponential equations given graphs, verbal descriptions or tables.
A1.LQE.B	Use arithmetic and geometric sequences.	
A1.LQE.B.4	Write arithmetic and geometric sequences in recursive and explicit forms, and use them to model situations and translate between the two forms.	<p>The expectation of the student is to write arithmetic and geometric sequences in recursive and explicit forms, use them to model situations and translate between the two forms. Connect arithmetic sequences to linear functions and geometric sequences to exponential functions. (<i>e.g., Explicit form: $f(n)=3n+2$; Recursive Form: $f(n+1)= f(n) + 1$</i>)</p> <p>Construct arithmetic and geometric sequences, given graphs, verbal descriptions or tables.</p>
A1.LQE.B.5	Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the set of integers.	The expectation of the student is to recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the set of integers.
A1.LQE.B.6	Find the terms of sequences given an explicit or recursive formula.	The expectation of the student is to find the terms of general sequences given an explicit or recursive formula.

DATA AND STATISTICAL ANALYSIS: DS

A1.DS.A	Summarize, represent and interpret data.	
A1.DS.A.1	Analyze and interpret graphical displays of data.	The expectation of the student is to analyze and interpret data plots on the real number line (dot plots, histograms and box plots).
A1.DS.A.2	Use statistics appropriate to the shape of the data distribution to compare center and spread of two or more different data sets.	<p>The expectation of the student is to use statistics appropriate to the shape of the data distribution to compare center (median, mean, mode) and spread (interquartile range, standard deviation*) of two or more different data sets.</p> <p>*The standard deviation should be limited to a small data set with an integral mean. (e.g., Calculate the standard deviation of a sample of 10 quiz scores with a mean of 23.)</p>
A1.DS.A.3	Interpret differences in shape, center and spreads in the context of the data sets, accounting for possible effects of outliers.	The expectation of the student is to interpret differences in shape, center and spreads in the context of the data sets, accounting for possible effects of extreme data points (outliers).
A1.DS.A.4	Summarize data in two-way frequency tables. Interpret relative frequencies in the context of the data, and recognize possible associations and trends in the data.	The expectation of the student is to 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.
A1.DS.A.5	<p>Construct a scatter plot of bivariate quantitative data describing how the variables are related; determine and use a function that models the relationship.</p> <p>a) Construct a linear function to model bivariate data represented on a scatter plot that minimizes residuals.</p> <p>b) Construct an exponential function to model bivariate data represented on a scatter plot that minimizes residuals.</p>	<p>The expectation of the student is to construct a scatter plot of bivariate quantitative data describing how the variables are related; determine and use a function that models the relationship. Given a table of data (or data in context) for two quantitative variables, represent the relationship on a scatter plot and describe how the variables are related. Identify a function that best describes the relationship and use this function to solve problems.</p> <p>a. Using estimation and calculation, and/or technology, to fit a linear function to bivariate data represented on a scatter plot that minimizes residuals (distances from the mean).</p> <p>b. Using technology, fit an exponential or quadratic function to bivariate data represented on a scatter plot that minimizes residuals.</p>

A1.DS.A.6	Interpret the slope (rate of change) and the y-intercept (constant term) of a linear model in the context of the data.	The expectation of the student is to interpret the slope (rate of change) and the y-intercept (constant term) of a linear model in the context of the data.
A1.DS.A.7	Determine and interpret the correlation coefficient for a linear association.	The expectation of the student is, using available technology, to determine the correlation between two numerical unknowns, interpret the correlation and describe the strengths and weaknesses of the correlation coefficient as a measure of linear association.
A1.DS.A.8	Distinguish between correlation and causation.	The expectation of the student is to distinguish between correlation and causation.