Grade 9

Concepts and Procedures

Number and Quantity

RANGE ALD Target A: Extend the properties of exponents to rational exponents and work with radicals and integer exponents.	Level 1 students should be able to identify that the square root of 2 is irrational, calculate or approximate to an appropriate degree of precision the square or cube of a rational number, solve quadratic and cubic monomial equations, and represent the solution as a square or cube root, respectively. They should be able to work with and perform operations with scientific notation and work with and apply the properties of integer exponents to produce or identify equivalent numerical expressions.	Level 2 students should be able to use scientific notation and choose units of appropriate size for realistic measurements.	Level 3 students should be able to rewrite expressions with rational exponents of the form (1/n) to radical form and vice versa.	Level 4 students should be able to look for and use structure to extend the properties of integer exponents to multiply and divide expressions with rational exponents that have common denominators.
RANGE ALD Target C: Reason quantitatively and use units to solve problems.	Level 1 students should be able to choose the units in a formula, correctly scale a graph with unit increments, and identify a quantity from a graph with a scale in unit increments of a specified measurement.	Level 2 students should be able to reason quantitatively to choose and interpret the units in a formula given in a familiar context, including making measurement conversions between simple units and identifying a quantity from a graph with the scale in increments of various sizes. They should be able to use units to guide the solution of a familiar multistep problem with scaffolding.	Level 3 students should be able to reason quantitatively to choose and interpret the units in a formula given in an unfamiliar context, including making measurement conversions between compound units, and to define appropriate quantities or measurements in familiar contexts with some scaffolding to construct a model. They should be able to identify appropriate levels of measurement precision in context and to choose and interpret the scale and origin of a graph or data display. They should be able to use units to guide the solution of an unfamiliar multistep problem without scaffolding.	Level 4 students should be able to define appropriate quantities or measurements in unfamiliar contexts with little to no scaffolding to construct a model.

Algebra

RANGE ALD Target D: Interpret the structure of expressions.	Level 1 students should be able to identify parts of an expression, such as terms, factors, coefficients, exponents, etc.	Level 2 students should be able to interpret parts of an expression, such as terms, factors, coefficients, exponents, etc.	Level 3 students should be able to recognize equivalent forms of linear expressions.	Level 4 students should be able to recognize equivalent forms of quadratic and exponential expressions.
RANGE ALD Target E: Write expressions in equivalent forms to solve problems.	Level 1 students should be able to write quadratic expressions with integer coefficients and a leading coefficient of 1 in an equivalent form by factoring. They should be able to use properties of exponents to expand a single variable (coefficient of 1) with a positive integer exponent into an equivalent form and vice versa, e.g., $x^3 = xxx$.	Level 2 Students should be able to factor with a leading coefficient of 1 and identify the zeros. They should be able to use properties of exponents to expand a repeated single variable (coefficient of 1) with a nonnegative integer exponent into an equivalent form and vice versa, e.g. $x^0x^2x^3 = xxxxx = x^{2+3}$.	Level 3 students should be able to write quadratic expressions with integer coefficients in an equivalent form by factoring and identify and use the zeros to solve or explain a familiar problem.	Level 4 students should be able to use properties of exponents to write equivalent forms of exponential functions with one or more variables and integer coefficients involving addition, subtraction, and multiplication, including distributing an exponent across terms within parentheses. They should be able to write quadratic expressions with integer coefficients in an equivalent form by completing the square.
RANGE ALD Target F: Perform arithmetic operations on polynomials.	Level 1 students should be able to add and subtract single-variable polynomials of degree 2 or less.	Level 2 students should be able to multiply single-variable polynomials of degree 2 or less.	Level 3 students should be able to add, subtract, and multiply multivariable polynomials made of monomials of degree 2 or less. They should understand that polynomials are closed under addition.	Level 4 students should be able to add, subtract, and multiply multivariable polynomials of any degree and understand that polynomials are closed under subtraction and multiplication.

RANGE ALD Target G: Analyze and solve linear equations and pairs of simultaneous linear equations. Create equations that describe numbers or relationships.	Level 1 students should be able to classify systems of linear equations as intersecting, collinear, or parallel; solve linear systems and estimate solutions; and show that a particular linear equation has one solution, no solution, or infinitely many solutions by successively transforming the given equation into simpler forms until an equivalent equation of the form $x = a$, $a = a$, or $a = b$ results (where a and b are different numbers). They should be able to solve and produce examples of linear equations in one variable, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.	Level 2 students should be able to analyze and solve problems leading to two linear equations in two variables in multiple representations.	Level 3 students should be able to create and use one-step linear equations in one variable to model a familiar situation and to solve a familiar problem. Students should be able to solve systems of linear equations exactly and approximately using a variety of approaches, (e.g., graphically, algebraically, and using analysis of tabular data).	Level 4 students should be able to create and use quadratic equations, linear equations, and linear inequalities in one and two variables to model a familiar situation and to solve a familiar problem. They should be able to graph linear or quadratic equations in two variables and rearrange a familiar formula or an unfamiliar linear formula in one or two variables for a given quantity.
RANGE ALD Target H: Understand solving multistep linear, simple radical, and simple rational equations as a process of reasoning and explain the reasoning.	Level 1 students should be able to understand and explain the steps for solving multistep linear equations in one variable as a process of reasoning.	Level 2 students should be able to solve binomial quadratic and cubic equations and represent the solution as a square or cube root, respectively.	Level 3 students should be able to generate algebraic equations involving integer exponents and radicals and justify the solution.	Level 4 students should be able to look for and make use of structure to solve simple radical equations and simple rational equations in one variable and understand the solution steps as a process of reasoning.
RANGE ALD Target I: Solve linear and quadratic equations in one variable and linear inequalities in one variable.	Level 1 students should be able to solve one-step linear equations, quadratic equations, and linear inequalities in one variable.	Level 2 students should be able to solve and produce examples of linear equations in one variable, including equations with one, infinite, or no solutions and equations that require expanding expressions using the distributive property and collecting like terms.	Level 3 students should be able to solve multistep inequalities in one variable and determine if a value is a solution. Students should be able to solve quadratic equations in one variable with integer solutions.	Level 4 students should be able to solve quadratic equations in one variable with real-number solutions.
RANGE ALD Target J: Represent and solve equations and inequalities graphically. Understand the	Level 1 students should be able to understand that slope is the rate of change in a proportional relationship and convert proportional	Level 2 students should be able to graph linear equations and linear inequalities on a coordinate plane with labels and scales and interpret	Level 3 students should be able to graphically represent on a coordinate plane linear, quadratic, and absolute value equations and	Level 4 students should be able to graph and estimate the solution of systems of equations and inequalities. They should be able to

connections between proportional relationships, linear equations, and their graphs.	relationships in multiple representations to linear equations in slope-intercept form while also understanding when and why the *y*-intercept is zero. Students should be able to interpret the rate of change and initial value of a linear function in terms of the situation it models and in terms of its graph or a table of values.	the solution to a contextual problem.	linear inequalities with rational coefficients in one and two variables and understand that the plotted line, curve, and/or shaded area represents the solution set to an equation and/or inequality.	determine and interpret a solution set of equations or inequalities in two variables beyond the displayed portion of a graph.

Functions

RANGE ALD Target K: Understand the concept of a function and use function notation.	Level 1 students should be able to classify functions as linear or nonlinear in different forms.	Level 2 students should be able to understand the concept of a function to distinguish whether a relation is a function. They should be able to define a function as a rule that assigns exactly one output to each input.	Level 3 students should be able to evaluate a function given in function notation for a particular input. They should be able to produce input and output pairs for a given function and identify whether an input-output pair satisfies a function.	Level 4 students should be able to identify the domain and range for any given function in the context of a situation and presented in any form, e.g., verbal description, sequence, or graph.
RANGE ALD Target M: Graph, compare, and analyze functions using different representations. Use functions to model relationships between quantities.	Level 1 students should be able to graph linear functions by hand or by using technology and identify qualitative features of the function in terms of the context.	Level 2 students should be able to graph and compare qualitative features of linear, quadratic, piecewise-defined, and exponential functions by hand or by using technology.	Level 3 students should be able to compare properties of two functions represented in different ways. They should be able to identify equivalent forms of a function represented in different ways.	Level 4 students should be able to identify parts of a graph that describe a particular qualitative description (e.g., increasing or decreasing) or sketch a graph based on a qualitative description.
RANGE ALD Target N: Build a function that models a relationship between two quantities.	Level 1 students should be able to identify an arithmetic or geometric sequence given a graph, a description of a relationship, or a minimum of two input-output pairs.	Level 2 students should be able to write explicit or recursive formulas for arithmetic and geometric sequences to describe or model a relationship between two quantities and determine the steps for calculation from a context.	Level 3 students should be able to rewrite the explicit form of arithmetic sequences as a linear function.	Level 4 students should be able to translate between the explicit and recursive forms of a function.

Geometry

RANGE ALD Target O: Define trigonometric ratios and solve problems involving right triangles.	Level 1 students should be able to identify trigonometric ratios and use the Pythagorean theorem to solve for the missing side in a right triangle in familiar, real-world or mathematical contexts with scaffolding.	Level 2 students should be able to define trigonometric ratios and know the relationship between the sine and cosine of complementary angles. They should be able to use the Pythagorean theorem in unfamiliar problems and trigonometric ratios in familiar problems to solve for the missing side in a right triangle with some scaffolding.	Level 3 students should be able to use the Pythagorean theorem, trigonometric ratios, and the sine and cosine of complementary angles to solve with minimal scaffolding unfamiliar problems involving right triangles or finding the missing side or missing angle of a right triangle.	Level 4 students should be able to solve without scaffolding unfamiliar, complex, or multistep problems involving right triangles.

Statistics and Probability

RANGE ALD Target P: Summarize, represent, and interpret data on a single count or measurement variable. Investigate patterns of association in bivariate data.	Level 1 students should be able to investigate scatter plots for patterns such as outliers and nonlinear association. They should be able to write equations for the trend line or line of best fit for a given scatter plot with a linear association. They should also be able to interpret and use relative frequencies from a two-way table to describe possible association between two variables.	Level 2 students should be able to use scatter plots, trend lines, and associations between variables in two-way frequency tables to make predictions in real-world situations.	Level 3 students should be able to describe a data set in terms of center and spread and represent data graphically.	Level 4 students should be able to describe and use appropriate statistics to interpret and explain differences in shape, center, and spread of two or more different data sets, including box plots, histograms, or dot plots, representing familiar contexts. They should be able to identify the mean and the median and select the appropriate one for representing the center of the data for data sets.