Grade 10

Concepts and Procedures

Number and Quantity

RANGE ALD Target A: Extend the properties of exponents to rational exponents.	Level 1 students should be able to rewrite expressions with rational exponents of the form (1/*n*) in radical form and vice versa.	Level 2 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.	Level 3 students should be able to rewrite expressions with rational exponents of the form (*m*/*n*) to radical form, and vice versa, and look for and use structure to extend the properties of integer exponents to all laws of exponents on radical expressions and expressions with rational exponents.	Level 4 students should be able to identify and distinguish between exponent properties used when rewriting expressions and justify when laws of exponents cannot be used to rewrite an expression.
RANGE ALD Target B: Use properties of rational and irrational numbers.	Level 1 students should be able to identify the difference between a rational and an irrational number.	Level 2 students should be able to perform operations on rational and irrational numbers and look for and use repeated reasoning to understand that rational numbers are closed under addition and multiplication.	Level 3 students should be able to provide specific examples given generalization statements, such as providing examples that justify that the sum of a rational number and an irrational number is irrational.	Level 4 students should be able to look for and use repeated reasoning to understand and explain when the sums and products of rational and irrational numbers are irrational.
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 graphs 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 a scale in increments of various sizes. They should be able to use units to guide the solution of familiar multistep problems 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 unfamiliar multistep problems 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., and interpret simple compound expressions by viewing one or more of their parts as a single entity. They also should be able to recognize equivalent forms of linear expressions.	Level 3 students should be able to recognize equivalent forms of expressions and use the structure of an expression to identify ways to rewrite it. They should be able to interpret complicated expressions by viewing one or more of their parts as a single entity.	Level 4 students should be able to look for and use structure and repeated reasoning to make generalizations about the possible equivalent forms expressions can have, e.g., a quadratic expression can always be represented as the product of two factors containing its roots.
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 write quadratic expressions with integer coefficients in an equivalent form by factoring or by completing the square. 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 rational coefficients in an equivalent form by factoring and by completing the square. They should be able to identify and use the zeros to solve or explain familiar problems. They should be able to use properties of exponents to write equivalent forms of exponential functions with one or more variables, integer coefficients, and nonnegative rational exponents involving operations of addition, subtraction, and multiplication, including distributing an exponent across terms within parentheses.	Level 4 students should be able to find the maximum or minimum values of quadratic functions. They should be able to choose an appropriate equivalent form of an expression in order to reveal a property of interest when solving problems.
RANGE ALD Target F: Perform arithmetic operations on polynomials.	Level 1 students should be able to add, subtract, and multiply single-variable polynomials of degree 2 or less.	Level 2 students should be able to add, subtract, and multiply multivariable polynomials made up of monomials of degree 2 or less. They should understand that polynomials are closed under addition.	Level 3 students should be able to add, subtract, and multiply multivariable polynomials of degree 2 or less and understand that polynomials are closed under subtraction and multiplication.	Level 4 students should be able to add, subtract, and multiply multivariable polynomials of any degree and understand and explain that polynomials of any degree form a system analogous to the integers.

RANGE ALD Target G: Create equations that describe numbers or relationships.	Level 1 students should be able to create and use one-step linear equations and inequalities in one variable to model a familiar situation and to solve a familiar problem.	Level 2 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 particular given quantity.	Level 3 students should be able to create and use linear, quadratic, and simple rational equations and inequalities and exponential equations to model unfamiliar situations and to solve unfamiliar problems. They should be able to graph equations in two variables. They should be able to rearrange linear, quadratic, absolute, or rational formulas for a particular given quantity.	Level 4 students should be able to rearrange polynomial, logarithmic, exponential, cubic multivariable formula, or trigonometric formulas with one or more variables to highlight a quantity of interest and analyze in context to determine which quantity is of interest.
RANGE ALD Target H: Understand solving equations as a process of reasoning and explain the reasoning.	Level 1 students should be able to explain solution steps for solving linear equations in one variable.	Level 2 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. They should be able to understand and explain solution steps for solving linear equations in one variable as a process of reasoning.	Level 3 students should be able to look for and make use of structure to solve simple radical and rational equations in one variable presented in various forms. They should be able to identify extraneous solutions. They should be able to understand and explain solution steps for solving quadratic, radical, and rational equations in one variable as a process of reasoning.	Level 4 students should be able to give examples showing how and why extraneous solutions may arise when solving linear, quadratic, radical, and rational equations.
RANGE ALD Target I: Solve equations and inequalities in one variable.	Level 1 students should be able to solve one-step linear equations in one variable.	Level 2 students should be able to solve one-step linear inequalities and quadratic equations in one variable with integer roots.	Level 3 students should be able to solve quadratic equations, multistep linear equations, and inequalities and in one variable with real roots.	Level 4 students should be able to solve quadratic equations in one variable with complex roots.

Functions

RANGE ALD Target K: Understand the concept of a function and use function notations.	Level 1 students should be able to distinguish graphically between functions and non-functions.	Level 2 students should be able to understand the concept of a function in order to distinguish a relation as a function or not a function. They should be able to identify domain and range of a function given a graph of a quadratic, linear, cubic, or absolute function and understand that the graph of a function $f(x)$ is the graph of the equation $y = f(x)$.	Level 3 students should be able to use function notation to evaluate a function given in function notation for a particular input. They should be able to identify the domain and range for any given function presented in any form, e.g., as a graph, a verbal description, or a sequence.	Level 4 students should be able to find the input for a given output when given in function notation.
RANGE ALD Target L: Interpret functions that arise in applications in terms of a context.	Level 1 students should be able to interpret linear functions in context and, given the key features of a linear graph, identify the appropriate graph.	Level 2 students should be able to interpret quadratic in two variables in context of the situation and, given the key features of a linear functions, identify the appropriate graph. They should be able to specify the average rate of change from equations of a linear function and approximate it from a graph of a linear function.	Level 3 students should be able to graph linear, quadratic, absolute value, and exponential functions and interpret and relate key features, including range and domain, in familiar or scaffolded contexts. They should be able to specify the average rate of change of a function on a given domain from its equation or approximate the average rate of change of a function from its graph.	Level 4 students should be able to interpret complex key features such as holes, symmetries, and end behavior of graphs and functions in unfamiliar problems or contexts.
RANGE ALD Target N: Build a functions model a relationship between two quantities.	Level 1 students should be able to identify functions as explicit or recursive and determine the steps for calculation from a context requiring up to two steps. They should be able to add and subtract two linear functions.	Level 2 students should be able to build an explicit or a recursive function to describe or model a relationship between two quantities and determine the steps for calculation from a context. They should be able to add, subtract, and multiply linear and quadratic functions.	Level 3 students should be able to translate between explicit and recursive forms of a function. They should be able to add, subtract, and multiply functions.	Level 4 students should be able to determine when it is appropriate to combine functions using arithmetic operations in context.

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 right triangles 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 right triangles 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 unfamiliar problems with minimal scaffolding involving right triangles, finding the missing side or missing angle of right triangles.	Level 4 students should be able to solve unfamiliar, complex, or multistep problems without scaffolding involving right triangles.
RANGE ALD Target Q: Prove geometric theorems.	Level 1 students should be able to identify lines, angles, and/or necessary components of triangles and parallelograms to prove theorems.	Level 2 students should be able to identify the property used to prove theorems involving lines, angles, triangles, and parallelograms.	Level 3 students should be able to identify the error in proofs involving lines, angles, triangles, and parallelograms.	Level 4 students should be able to complete proofs involving lines, angles, triangles, and parallelograms.
RANGE ALD Target R: Explain volume formulas and use them to solve problems.	Level 1 students should be able to calculate the volume of cylinders, pyramids, cones, and spheres in direct and familiar mathematical and real-world problems	Level 2 students should be able to solve unfamiliar or multistep problems involving the volume of cylinders, pyramids, cones, and spheres.	Level 3 students should be able to use volume formulas for cylinders, pyramids, cones, and spheres in real-world problems to find an unknown dimension.	Level 4 Students should be able to give an informal argument for the volume formulas of cylinders, pyramids, and cones. They should be able to solve multistep mathematical and real-world problems involving figures composed of cylinders, pyramids, cones, and spheres.

Statistics and Probability

RANGE ALD Target P: Summarize, represent, and interpret data on a single count or measurement variable.	Level 1 students should be able to describe a data set in terms of center and spread and represent data graphically.	Level 2 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, and dot plots, representing familiar contexts. They should be able to identify the mean and the median and select the appropriate value to represent the center of the data for data sets.	Level 3 students should be able to use appropriate statistics to interpret, explain, and summarize differences in shape, center, and spread of two or more different data sets of varying complexity and levels of familiarity, including the effect of outliers.	Level 4 students should be able to interpret data to explain why a data value is an outlier and interpret and explain differences in the approximate areas under the normal curve of two or more data sets. They should be able to select the appropriate choice of spread as interquartile range or standard deviation based on the selection of center and use the standard deviation of a data set to fit to a normal distribution.