Grade 10

Concepts and Procedures

Number and Quantity

RANGE PLD 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*) to 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 PLD 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 using common units and identify 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 multistep problem with scaffolding.	Level 3 students should be able to reason quantitatively to choose and interpret the units in a formula context using compound units or units that are not commonly used. They should be able to identify appropriate levels of measurement precision in a context and 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 a multistep problem with little to no scaffolding.	No Descriptor

Algebra

RANGE PLD 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 should also 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 PLD Target E: Write expressions in equivalent forms to solve problems.	Level 1 students should be able to choose or produce equivalent forms of linear expressions to reveal and explain properties of the quantity represented by an expression; 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, and 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 a quadratic function. They should be able to choose appropriate equivalent forms of expressions to reveal a property of interest when solving problems.
RANGE PLD Target F: Perform arithmetic operations on polynomials.	Level 1 students should be able to add, subtract, and multiply single-variable polynomials of degree 1.	Level 2 students should be able to add, subtract, and multiply single-variable polynomials of degree 2 or less.	Level 3 students should be able to add, subtract, and multiply multivariable polynomials of degree 2 or less.	Level 4 students should be able to add, subtract, and multiply multivariable polynomials of any degree.

RANGE PLD Target G: Create equations that describe numbers or relationships.	Level 1 students should be able to create and use linear equations and inequalities in one variable to solve a 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 real-world contexts. They should be able to rearrange linear formulas 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 and to solve problems. They should be able to rearrange formulas for a particular given quantity.	Level 4 students should be able to rearrange polynomial, exponential, or cubic multivariable formulas with one or more variables to highlight a quantity of interest and analyze in context to determine which quantity is of interest.
RANGE PLD 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 extraneous solutions may arise and why they arise when solving linear, quadratic, radical, and rational equations.
RANGE PLD Target I: Solve equations and inequalities in one variable.	Level 1 students should be able to solve linear equations and inequalities in one variable.	Level 2 students should be able to solve quadratic equations in one variable with integer roots.	Level 3 students should be able to solve quadratic equations in one variable with real roots.	Level 4 students should be able to recognize and solve quadratic equations in one variable with complex solutions.
RANGE PLD Target J: Represent and solve equations and inequalities graphically.	Level 1 students should be able to represent a linear equation on a coordinate plane.	Level 2 students should be able to represent linear inequalities with integer coefficients in one and two variables graphically on a coordinate plane. They should be able to graph and estimate the solution of systems of linear equations.	Level 3 students should be able to graph and estimate the solution of systems of linear inequalities and of systems of linear and/or quadratic equations. They should understand that the plotted region represents the solution set to a system of linear inequalities.	Level 4 students should be able to explain why the x-coordinates of the points where $f(x)$ and $g(x)$ intersect compose the solution to $f(x) = g(x)$.

Functions

RANGE PLD Target K: Understand the concept of a function and use function notation.	Level 1 students should be able to distinguish between functions and nonfunctions graphically.	Level 2 students should understand the concept of a function to distinguish a relation as a function or not a function. They should be able to identify domain and range of functions given a graph of a quadratic, linear, cubic, or absolute function.	Level 3 students should be able to find the input for an output when given in function notation. They should be able to use function notation to evaluate functions given in function notation for a particular input. They should understand that the graph of a function $f(x)$ is the graph of the equation $y = f(x)$.	Level 4 students should be able to identify the domain and range for any functions presented in any form (e.g., as a graph, a verbal description, or a sequence).
RANGE PLD 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 linear functions, they should be able to identify the appropriate graph.	Level 2 students should be able to interpret quadratic functions in two variables in context of the situation. Given the key features of quadratic functions, they should be able to identify the appropriate graph. They should be able to specify the average rate of change from an equation of a linear function and approximate it from a graph of a linear function.	Level 3 students should be able to interpret and relate key features to the graph. They should be able to specify the average rate of change of a function over 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 problems or contexts.
Target M	Level 1 students should be able to compare properties of two linear functions represented in different ways. They should be able to identify equivalent forms of linear functions.	Level 2 students should be able to graph quadratic functions by hand or using technology, compare properties of two quadratic or two other functions of the same type represented in different ways, and identify equivalent forms of quadratic functions.	Level 3 students should be able to graph functions of different types (limited to exponential, quadratic, and absolute value) by hand or using technology; analyze and compare properties of two different functions represented in different ways; and identify equivalent forms of functions. Students should be able to classify exponential functions as growth or decay.	Level 4 students should be able to graph a variety of functions, including square root, cube root, piecewise-defined, polynomial, logarithmic, and trigonometric, by hand and using technology. They should be able to analyze and explain relationships between various types of functions and the behaviors of the functions and determine which equivalent form reveals the properties of a function.

RANGE PLD Target N: Build a function that models a relationship between two quantities.	Level 1 students should be able to use an explicit or a recursive function from a context requiring up to two steps.	Level 2 students should be able to recognize the patterns involved in an explicit or a recursive function and identify the rule to continue the pattern.	Level 3 students should be able to write an explicit or a recursive function to describe or model relationships between two quantities and determine the steps for calculation from a context. Students should be able to translate between explicit and recursive forms of a function.	No Descriptor

Geometry

RANGE PLD 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 unfamiliar problems involving right triangles, finding the missing side or missing angle of a right triangle, with minimal scaffolding.	Level 4 students should be able to solve unfamiliar, complex, or multistep problems involving right triangles without scaffolding.
RANGE PLD 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 being 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 and revise proofs involving lines, angles, triangles, and parallelograms.
RANGE PLD Target R: Explain volume formulas and use them to solve problems.	Level 1 students should be able to calculate the area and circumference of circles and area and perimeter of polygons.	Level 2 students should be able to calculate the volume of cylinders, pyramids, cones, and spheres.	Level 3 students should be able to give an informal argument for the formulas for the circumference of circles and volume of cylinders, pyramids, and cones. Students should be able to calculate the volume or find unknown dimensions of cylinders, pyramids, cones, and spheres in real-world problems.	Level 4 students should be able to solve multistep mathematical and real-world problems involving composite figures composed of cylinders, pyramids, cones, and spheres.

Statistics and Probability

RANGE PLD 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, including in box plots, histograms, or dot plots.	Level 2 students should be able to describe two or more different data sets in terms of shape, center, and spread, represented by box plots, histograms, or dot plots. They should be able to identify the mean and the median and select the appropriate value for representing 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.