MATHEMATICS GRADE 10

ALD	Standard	Novice	Partially Proficient	Proficient	Advanced
Policy		The Level 1 student is below proficient in applying mathematics knowledge/skills as specified in the standards. The student generally performs significantly below the standard for the grade-level/course, is likely able to partially access grade-level content, and engages with higher-order thinking skills with extensive support.	The Level 2 student is approaching proficient in applying mathematics knowledge/skills as specified in the standards. The student generally performs slightly below the standard for the grade level/course, is able to access grade-level content, and engages in higher-order thinking skills with some independence and support.	The Level 3 student is proficient in applying mathematics knowledge/skills as specified in the standards. The student generally performs at the standard for the grade level/course, is able to access grade-level content, and engages in higher-order thinking skills with some independence and minimal support.	The Level 4 student is highly proficient in applying mathematics knowledge/skills as specified in the standards. The student generally performs significantly above the standard for the grade level/course, is able to access above grade-level content, and engages in higher-order thinking skills independently.
The Real Number System					
		The Level 1 Student:	**The Level 2 Student:**	**The Level 3 Student:**	**The Level 4 Student:**
Range	N.RN.4	Simplifies single term radicals.	Performs basic operations on radicals with like radicands and simplifies the radicals.	Performs basic operations on radicals and simplifies radicals to write equivalent expressions.	Performs basic operations on radicals to include variables in the radicand, and simplifies radical expressions to write equivalent expressions.
Algebra					
		The Level 1 Student:	**The Level 2 Student:**	**The Level 3 Student:**	**The Level 4 Student:**
Range	A.SSE.3a	Identifies the zeroes of a quadratic function written in factored form.	Factors a quadratic expression with a leading coefficient of 1 to reveal the zeroes of the function it defines.	Factors a quadratic expression to reveal the zeroes of the function it defines.	Explains conditions for two, one, and no real roots.
Range	A.SSE.3b	Identifies the maximum or minimum of a function, using the graph.	Identifies the maximum or minimum of a function when given in vertex form.	Completes the square in a quadratic expression (where a=1 and b is even) to reveal the maximum or minimum value of the function it defines.	Completes the square in a quadratic expression (where b is not divisible by two).
Range	A.APR.1	Adds or subtracts polynomials.	Multiplies polynomials using the distributive property and then simplifies.	Understands closure of polynomials for addition, subtraction, and multiplication.	Adds, subtracts, and multiplies a quadratic expression in a problem-solving context.
Range	A.CED.1	Creates a linear equation or inequality or simple quadratic or exponential equation that models a given situation.	Creates a linear equation or inequality or simple quadratic or exponential equation that models a given situation and uses it to solve a problem.	Creates linear equations and inequalities and quadratic and exponential equations from contextual situations and uses these to solve problems.	Solves and interprets the solution to create linear, quadratic, and exponential equations and inequalities in context. Solves compound inequalities. Includes interval notation to represent inequalities.
Range	A.CED.2	Writes and graphs an equation to represent a linear relationship.	Graphs an equation to represent a quadratic or exponential relationship.	Writes and graphs equations with two variables or writes equations in more than two variables.	Interprets the relationship between the independent and dependent variables when graphing equations, in reference to context.

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ALD	Standard	Novice	Partially Proficient	Proficient	Advanced
Range	A.CED.3	Determines whether a point is a solution to a system of equations and/or inequalities given a graph or equations and/or inequalities.	Interprets solutions as viable or non-viable options in a modeling context where constraints are presented verbally.	Represents constraints by equations or inequalities, and by systems of equations and/or inequalities.	Defends and justifies solutions or non-solutions in a modeling context.
Range	A.CED.4	Rearranges a linear equation that contains only one variable.	Rearranges a linear equation that includes several steps with scaffolding.	Uses equation-solving techniques to rearrange linear formulas to highlight a specific quantity. Rearranges a simple quadratic equation (requiring one step).	Decides which variable to solve for or isolate, depending upon the given context or problem-solving situation.
Range	A.REI.1	Identifies an appropriate next step in the solving of a linear or quadratic equation.	Solves a linear or quadratic equation with multiple steps, without justifying the steps involved in solving.	Explains and justifies the steps in solving linear or quadratic equations by applying the properties of equality, inversion, and identity.	Explains and justifies the steps in solving linear or quadratic equations by applying and naming the properties of equality, inversion, and identity.
Range	A.REI.3	Solves linear equations and inequalities in one variable.	Solves linear equations and inequalities in one variable, where that variable is included on both sides of the equal sign or inequality.	Solves linear equations and inequalities in one variable, including equations with coefficients represented by letters.	Solves linear equations and inequalities in one variable, including equations with coefficients represented by letters within a real-world context.
Range	A.REI.4a A.REI.4b	Solves quadratic equations by simple inspection.	Solves quadratic equations with integer solutions.	Solves quadratic equations by inspection (e.g., for x^2 = 49) -- taking square roots, completing the square, the quadratic formula, and factoring -- as appropriate to the initial form of the equation.	Determines the most efficient method for solving a quadratic equation and justifies the choice selected.
Range	A.REI.6	Solves a system of linear equations approximately when given a graph of the system.	Tests a solution to the system in both original equations, graphically and algebraically.	Solves a system of linear equations exactly and approximately.	Analyzes the system of equations and is able to solve exactly and approximately given a context or real-world situation. Solves a system of equations and manipulates one of the equations to provide additional information or an additional given solution.
Range	A.REI.10	Identifies solutions and non-solutions of linear equations in two variables.	Identifies solutions and non-solutions of equations in two variables.	Graphs points that satisfy an equation in two variables.	Describes viable solutions using the knowledge that continuous lines and curves contain an infinite number of solutions.
Range	A.REI.11	Finds the point(s) where two equations intersect given a graph.	Finds the solutions to the equation f(x)=g(x) given their equations, tables, or graphs.	Shows that the solution(s) to the equation f(x)=g(x) are the x-value(s) that result in the y-values of f(x) and g(x) being the same by using graphs, technology, tables, or successive approximations.	Explains the conditions of the functions that would produce no solutions, 1 solution, 2 solutions, or infinitely many solutions when f(x)=g(x).

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ALD	Standard	Novice	Partially Proficient	Proficient	Advanced
Range	A.REI.12	Identifies a solution region when the graph of a linear inequality is given.	Graphs the solutions to a linear inequality in two variables as a half-plane.	Graphs solutions of the system of inequalities and identifies the solution set as a region of the coordinate plane that satisfies both inequalities.	Writes or creates a system of linear inequalities given a context or graph and identifies the solution set as a region of the coordinate plane that satisfies all inequalities.
Functions					
		The Level 1 Student:	**The Level 2 Student:**	**The Level 3 Student:**	**The Level 4 Student:**
Range	F.IF.1	Identifies functions, including functions represented in equations, tables, graphs, or context.	Writes relations in function notation.	Demonstrates understanding that a function assigns to each element of the domain exactly one element of the range. Understands input and output values.	Applies and extends knowledge of domain and range to real-world situations and contexts.
Range	F.IF.2	Evaluates simple functions in their domains. Rewrites an equation in function notation when given in y = form.	Evaluates functions for inputs in their domain. Writes functions using function notation (without context).	Uses function notation and evaluates functions for inputs in their domain, and interprets statements that use function notation (including combinations and compositions) in terms of context.	Creates context from a given domain and range and uses function notation to write an equation to model the context.
Range	F.IF.3	Identifies the parts of a recursive function or sequence.	Generates a sequence given a recursive function.	Recognizes that sequences are functions. Recognizes that a sequence has a domain which is a subset of the integers. Defines and expresses a recursive sequence as a function.	Applies the ideas of sequences being functions to real-world contexts.
Range	F.IF.4	Identifies the key features of a linear or exponential graph.	Interprets the key features of a linear or exponential graph.	Identifies and interprets the key features of a graph when given a table of values for a linear or exponential function. Creates graphs showing key features, when given a verbal description of the relationship.	Creates graphs to model a situation.
Range	F.IF.5	Identifies domains of functions when given a graph.	Relates the domain of a function to its graph and graphs a function given a restricted domain.	Relates the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. Graphs a function given a restricted domain and identifies reasonability of a domain in a particular context.	Creates a function for a given context where the domain meets given parameters.
Range	F.IF.6	Determines the average rate of change of a linear or exponential function presented algebraically.	Determines the average rate of change of a linear or exponential function presented in a table.	Calculates and interprets the average rate of change of a linear or exponential function over a specified interval. Estimates the rate of change from a graph.	Compares rates of change between different types of functions.

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ALD	Standard	Novice	Partially Proficient	Proficient	Advanced
Range	F.IF.7a	Identifies the graph of linear and quadratic functions given their equations.	Constructs the graphs of linear and quadratic functions given their equations.	Constructs the graph of linear and quadratic functions given their equations, and identifies the intercepts, maxima, and minima, where appropriate.	Graphs and compares linear and quadratic functions expressed in various forms.
Range	F.IF.7e	Identifies the graph of an exponential function given its equation.	Constructs the graph of an exponential function given its equation.	Constructs the graph of an exponential function given its equation and identifies the intercepts and end behavior.	Graphs exponential equations generated from real-life contexts.
Range	F.IF.9	Compares the properties of two functions of the same representation (e.g., a table to a table, or an equation to an equation).	Compares the properties of two functions of the same type with different representations (such as a linear to linear, but using a table and equation).	Compares properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, compares a linear equation to an exponential graph.	Constructs a linear or exponential function that has a characteristic (i.e., slope, x- or y-intercept, maximum) that is greater than or lesser than a given function.
Range	F.BF.1a	Recognizes a relationship between explicit or recursive functions.	Describes an explicit or recursive expression for a linear function.	Describes steps to model a given linear or exponential context with mathematical representations.	Writes an explicit or recursive expression for a linear or exponential function or recursive process for a given context.
Range	F.BF.1b	Combines linear or exponential functions using addition or subtraction.	Combines linear or exponential functions using multiplication or division.	Combines linear and exponential functions, using arithmetic operations.	Builds a function that models a given situation by using an additional function that alters the situation, and relates these individual and combined functions to the model.
Range	F.BF.3	Performs vertical translations on linear and exponential graphs. Describes what will happen to a function when f(x) is replaced by f(x) + k (for different values of k).	Performs translations on linear and exponential graphs. Identifies the value of k, given f(x) replaced by f(x) + k (on a graph).	Identifies the effect on the graph of replacing f(x) with f(x) + k, kf(x), f(kx), and f(x + k), for specific values of k (both positive and negative); finds the value of k, given the graphs.	Recognizes which transformations take away the even nature of a quadratic or absolute value function.
Range	F.LE.1	Recognizes situations in which one quantity changes at a constant rate per unit interval relative to another.	Recognizes relationships in tables and graphs that can be modeled with linear functions (constant rate of change) and with exponential functions (multiplicative rate of change).	Justifies that linear functions grow by equal differences over equal intervals and exponential functions grow by equal factors over equal intervals (e.g., percent change).	Describes the rate of change per unit as constant or the growth factor as a constant percentage. Proves that linear functions grow by equal differences over equal intervals; exponential functions grow by equal factors over equal intervals.
Range	F.LE.2	Constructs linear functions representing arithmetic sequences when given a graph.	Constructs linear and exponential functions, including arithmetic and geometric sequences, given a graph.	Constructs linear functions and exponential functions, including arithmetic sequences and geometric sequences, given input-output pairs, including those in a table.	Constructs linear and exponential functions, including arithmetic and geometric sequences, in a real-life context.

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ALD	Standard	Novice	Partially Proficient	Proficient	Advanced
Range	F.LE.3	Compares the values of functions at specific points.	Compares the values of functions over various intervals.	Discerns, using graphs and tables, that a quantity increasing exponentially eventually exceeds a quantity that is increasing linearly or quadratically.	Observes, explores, predicts, models, and evaluates different situations that compare linear, quadratic, and exponential functions.
Range	F.LE.5	Identifies which values are constant in a linear function from a given context.	Interprets the slope and x- and y-intercepts in a linear function in terms of a context.	Interprets the base value and initial value in an exponential function of the form f(x) = ab^x, where b is an integer, and a can be any positive integer including one in terms of context.	Interprets the base value, initial value, and vertical shift in an exponential function of the form f(x) =ab^x + k , where b is an integer and k can equal zero in terms of context.
Geometry					
		The Level 1 Student:	**The Level 2 Student:**	**The Level 3 Student:**	**The Level 4 Student:**
Range	G.CO.1	Identifies an angle, circle, perpendicular line, parallel line, and line segment using proper notation.	Informally defines an angle, circle, perpendicular line, parallel line, and line segment using examples and non-examples.	Can explain definitions of an angle, circle, perpendicular line, parallel line, and line segment based on the notions of point, line, plane distance along a line, and distance around a circular arc.	Identifies real-life examples of an angle, circle, perpendicular line, parallel line, and line segment using precise definitions.
Range	G.CO.2	Describes reflections, rotations, and translations.	Describes dilations.	Compares transformations in the plane and understands them as functions that take points in the plane as inputs and give other points as outputs.	Represents transformations as functions. Uses a variety of methods to describe transformations.
Range	G.CO.3	Distinguishes between rotations and reflections given a rectangle, parallelogram, trapezoid, or regular polygon and its transformation.	Identifies lines and points of symmetry given a rectangle, parallelogram, trapezoid, or regular polygon.	Describes the rotations and reflections that a given rectangle, parallelogram, trapezoid, or regular polygon may use to carry it onto itself.	Identifies a rectangle, parallelogram, trapezoid, or regular polygon that satisfies a description of rotational symmetry or lines of symmetry.
Range	G.CO.4	Identifies rotations, reflections, and translations given an image and its transformation.	Informally describes rotations, reflections, and translations using examples and non-examples.	Develops definitions of rotations, reflections, and translations using the terms angles, circles, perpendicular lines, parallel lines, and line segments.	Justifies statements about rotations, reflections, and translations on the coordinate plane.
Range	G.CO.5	Performs rotations, reflections, and translations on a given figure.	Identifies a sequence of transformations that will carry a given figure onto another.	Performs rotations, reflections, and translations using a variety of methods and specifies the sequence of transformations that will carry a given figure onto another.	Explains how the order of a sequence of transformations is performed may result in different outcomes.
Range	G.CO.6	Identifies transformations of a given figure based on descriptions of rigid motion.	Predicts the effect of a transformation of a given figure based on descriptions of rigid motion.	Establishes whether two figures are congruent using rigid motion transformations.	Justifies the congruence of two complex figures using properties of rigid motion.

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ALD	Standard	Novice	Partially Proficient	Proficient	Advanced
Range	G.CO.7	Identifies corresponding pairs of angles or corresponding pairs of sides of two triangles that are congruent.	Identifies corresponding pairs of angles and corresponding pairs of sides of two triangles that are congruent.	Shows that two triangles are congruent if and only if corresponding pairs of sides and corresponding pairs of angles are congruent (CPCTC) using the definition of congruence in terms of rigid motions.	Justifies that two triangles are congruent if and only if corresponding pairs of sides and corresponding pairs of angles are congruent in a context.
Range	G.CO.8	Identifies corresponding parts of two congruent triangles.	Identifies the minimum conditions necessary for triangle congruence (ASA, SAS, SSS).	Proves two triangles are congruent using triangle congruence.	Understands and explains why SSA and AAA do not provide enough evidence for triangle congruence.
Range	G.CO.9	Describes examples of theorems about lines and angles.	Determines the validity of statements within a given proof of a theorem about lines and angles.	Applies theorems about lines and angles.	Proves theorems about lines and angles.
Range	G.CO.10	Describes examples of theorems about triangles.	Determines the validity of statements within a given proof of a theorem about triangles.	Applies theorems about triangles.	Proves theorems about triangles. (Theorems include: measures of interior angles of a triangle sum to 180°; base angles of isosceles triangles are congruent; the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; the medians of a triangle meet at a point.)
Range	G.CO.11	Describes examples of theorems about parallelograms.	Determines the validity of statements within a given proof of a theorem about parallelograms.	Applies theorems about parallelograms.	Proves theorems about parallelograms.
Range	G.SRT.5	Finds measures of sides and angles of congruent and similar triangles.	Solves problems involving triangles, using congruence and similarity criteria.	Solves problems and justifies relationships in geometric figures by using congruence and similarity criteria for triangles. Includes problems from context.	Proves conjectures about congruence or similarity in geometric figures, using congruence and similarity criteria for triangles. Includes problems from context.
Range	G.GPE.4	Solves problems algebraically, using geometric theorems. Locates segments on a coordinate plane that are parallel or perpendicular by calculating slopes.	Verifies simple geometric theorems using coordinates, when given a visual representation on the coordinate plane, including calculating lengths of segments.	Justifies simple geometric theorems algebraically using coordinates, such as proving that a triangle is a special triangle, or a quadrilateral is a special quadrilateral (such as a rectangle or parallelogram).	Proves statements about geometric figures using coordinates and constructs visual representations on the coordinate plane that meet given conditions for coordinates.
Range	G.GPE.5	Explains why the slopes of parallel lines are equal and the slopes of perpendicular lines are negative reciprocals or one is 0 and the other is undefined.	Creates the equation of a line that passes through a specific point given its slope.	Creates the equation of a line parallel or perpendicular to a given line that passes through a given point.	Creates the equation of a line parallel or perpendicular to a given line that passes through a given point in a context.

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ALD	Standard	Novice	Partially Proficient	Proficient	Advanced
Range	G.GPE.7	Calculates the perimeter of a polygon.	Calculates areas of a rectangle and right triangle given their coordinates.	Calculates areas of any triangle given its coordinates.	Calculates perimeters of polygons and areas of triangles and rectangles using their coordinates from a contextual problem.
Range	G.GMD.2	Calculates the surface area for prisms, pyramids, and cylinders.	Calculates the surface area for prisms, cylinders, pyramids, cones, and spheres.	Calculates the surface area or finds missing side lengths for prisms, cylinders, pyramids, cones, and spheres to solve problems.	Calculates the surface area for prisms, cylinders, pyramids, cones, and spheres to model real-world situations.
Range	G.GMD.3	Substitutes given dimensions into the formulas for the volume of prisms, cylinders, pyramids, cones, and spheres.	Computes the volume of prisms, cylinders, pyramids, cones, and spheres, given a graphic.	Solves problems using the volume formulas for prisms, cylinders, pyramids, cones, and spheres.	Finds the volume of prisms, cylinders, pyramids, cones, and spheres in a real-life context.
Statistics and Probability					
		The Level 1 Student:	**The Level 2 Student:**	**The Level 3 Student:**	**The Level 4 Student:**
Range	S.ID.1	Identifies dot plots, histograms, and box plots for a given set of data.	Graphs numerical data on a real number line using dot plots, histograms, and box plots.	Describes and gives a simple interpretation of a graphical representation of data on dot plots, histograms, and box plots.	Determines and justifies which type of data plot on a real number line would be most appropriate for a set of data. Identifies advantages and disadvantages of different types of data plots.
Range	S.ID.2	Describes informally the center and spread of a single set of data or graph.	Compares informally the similarities or differences in shape, center, or spread between two graphs.	Explains similarities and differences using specific measures of center and spread, given two sets of data or two graphs.	Plots data based on situations with multiple data sets, and then compares and discusses using measures of center and spread. Justifies which measure(s) are most appropriate for comparison. Identifies advantages and disadvantages of using each measure of center and spread.
Range	S.ID.3	Identifies shape, center, and spread of a data set.	Identifies and states the effects of existing outliers.	Interprets similarities and differences between shape, center, and spread in the context of data sets with possible effects from existing outliers.	Plots and interprets data based on contextual situations involving outliers, and then compares and discusses center and spread and explores the manipulation of additional data points.
Range	S.ID.5	Explains data in a two-way frequency table.	Creates a two-way frequency table showing the relationship between two categorical variables.	Finds and interprets joint, marginal, and conditional relative frequencies. Recognizes possible associations and trends in the data.	Given a context, interprets, identifies, and describes associations and trends using a two-way frequency table.
Range	S.ID.6a	Creates a scatter plot of bivariate data.	Determines if a plotted data set is approximately linear.	Creates a scatter plot of bivariate data and estimates a linear function that fits the data. Uses this function to solve problems in the context of the data.	Compares the fit of different functions to data and determines which function has the best fit.

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ALD	Standard	Novice	Partially Proficient	Proficient	Advanced
Range	S.ID.7	Identifies a linear model of bivariate data.	Graphs data in a scatter plot. Identifies the slope and y-intercept from the linear model.	Using a line fitted to the data, interprets the slope (rate of change) and the intercept (constant term) of a linear model in the context of the situation and data.	Using the function that best fits the data, interpolates and extrapolates trends in the data.
Range	S.CP.2	Calculates probabilities for events (including joint probabilities).	Identifies whether events are independent or dependent.	Understands that two events, A and B, are independent, if the probability of A and B occurring together is the product of their probabilities, and uses this characterization to determine if they are independent.	Contrasts several events in a sample space and determines if they are independent by calculating the event probabilities.
Range	S.CP.3	Understands conditional probability and how it applies to real-life events.	Calculates conditional probabilities.	Determines the independence of A and B using conditional probabilities.	Identifies and interprets independence of events in contextual problems, using conditional probabilities.