Benchmark Achievement Level Descriptors (Benchmark ALDs)

Overview and Purpose

The development of Achievement Level Descriptors (ALDs) is a critical step in communicating student performance in terms of levels or categories of performance on any standardized assessment. For Minnesota Comprehensive Assessments (MCAs), ALDs are developed in collaboration with educators during the first year of full implementation. The ALDs provide a description of grade-level student performance on MCAs for each of the achievement levels of Exceeds the Standards, Meets the Standards, Partially Meets the Standards, and Does Not Meet the Standards. These statements are included on a student's MCA score report to aid families in score interpretation. More detail regarding the development of the MCA Achievement Level Descriptors is on Testing 1, 2, 3.

Over the years, educators have requested more specific descriptions of the knowledge, skills and abilities of students who typically score in each of the different MCA achievement levels beyond what the traditional ALDs offer. In response to this need, Minnesota Department of Education (MDE) staff collaborated to outline more specific descriptions, the Benchmark ALDs for Mathematics and Reading. The purpose of Benchmark ALDs is to

1. promote equity for all students across the state by clarifying expected learning outcomes for instruction and local assessment of Minnesota Academic Standards in Reading and Mathematics; and
2. support teachers' analysis of the depth of their curriculum, instruction, and classroom assessments.

The Mathematics and Reading Benchmark ALDs were developed by

- reviewing test questions and test data for all operational MCA III questions, in many cases 800–1,000 questions per grade;
- grouping items within each benchmark based on student performance on the items relative to their overall performance on the MCAs; and
- reviewing the achievement level groupings of questions within each benchmark for commonalities in the skills, understanding and context needed to correctly answer the items. Each Benchmark ALD describes some of the skills typically demonstrated by students whose overall performance on the MCAs is at that achievement level. These skills are in addition to the descriptions at the lower achievement levels.

Released Examples

Where possible, released examples that illustrate skills described in the benchmark and achievement level are listed in the document. To view examples, click on "Released Example" in the Benchmark ALD tables or go to the Minnesota Question Tool (https://public.education.mn.gov/nqt/). Once at the Minnesota Question Tool (MQT) site, you can enter or copy and paste the released example identification number into the "Search by Question ID" field. Note that within the MQT you can find additional questions that are aligned to the academic standards but are not specifically listed in the Benchmark ALD tables.

Example items are not currently available for all benchmarks and achievement levels in the Benchmark ALD tables. MDE will update the document as more released examples become available.

Training Module

Watch the training module to learn how to use the Benchmark ALDs to evaluate the rigor of classroom assessments and instructional materials: https://testing123.education.mn.gov/test/plan/success/.

This module will help educators understand how the Benchmark ALDs can be used to facilitate the learning outcomes defined in the Minnesota K–12 Academic Standards in Mathematics and Reading and to evaluate the rigor of classroom assessment and instruction.

Grade 8 Mathematics Benchmark Achievement Level Descriptors
Number & Operation

Read, write, compare, classify and represent real numbers, and use them to solve problems in various contexts. (8.1.1)

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8.1.1.1 **Classify real numbers as rational or irrational. Know that when a square root of a positive integer is not an integer, then it is irrational. Know that the sum of a rational number and an irrational number is irrational, and the product of a non-zero rational number and an irrational number is irrational.**	Recognizes some perfect squares (e.g., 16, 36)	Classifies numbers written with a square root symbol as rational or irrational (e.g., $\sqrt{2}$, $\sqrt{16}$, $\sqrt{36}$)	Evaluates expressions involving square root symbols, and appropriately classifies resulting value as rational or irrational Distinguishes between $\sqrt{(x + y)}$ and $(\sqrt{x} + \sqrt{y})$ Recognizes pi as irrational Recognizes 0 as rational **Released Examples:** 282063, 45064	Evaluates expressions involving square root symbols and 0, and appropriately classifies resulting value as rational or irrational Consistently evaluates multi-term expressions involving one or more square root symbols using sums and products, and classifies the result as rational or irrational Consistently recognizes repeating decimals as rational numbers **Released Examples:** 280053, 281028, 286116

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8.1.1.2 **Compare real numbers; locate real numbers on a number line. Identify the square root of a positive integer as an integer, or if it is not an integer, locate it as a real number between two consecutive positive integers**	Evaluates perfect squares written with a square root symbol (e.g.,$\sqrt{100}$), and locates on a number line Evaluates the square of a decimal number and locates on a number line **Released Examples:** 281014, 284655	Distinguishes between taking the square root of a number and taking half of that number Evaluates and compares numbers written with a square root symbol that are not perfect squares and locates between two whole numbers on a number line **Released Examples:** 281017, 281038	Evaluates numbers written with a square root symbol, and locates to the nearest whole number or nearest tenth on a number line Distinguishes between squaring a number and doubling it Interprets number sentences with two or more of the same inequality signs as statements of order (between, greatest to least, or least to greatest) **Released Examples:** 281308, 282405, 285508	Evaluates numbers written with a square root symbol to the thousandths place (with or without a number line) **Released Example:** 284503

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8.1.1.3 **Determine rational approximations for solutions to problems involving real numbers.**	Identifies the radical symbol ($\sqrt{n}$) as meaning square root of a number	Distinguishes between taking the square root of a number and taking half of that number Rounds the square root of a whole number less than 150 to the nearest integer **Released Examples:** 282184, 283063	Determines rational approximations for whole number square roots in order to solve two-step problems in context, equations of the form $x^2 = a$, and simple numeric expressions **Released Examples:** 283054, 283087	Consistently distinguishes between problem-solving strategies for one-dimensional solutions and problem-solving strategies for two-dimensional solutions Solves multi-step problems involving rational approximations of real numbers **Released Example:** 285602

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8.1.1.4 **Know and apply the properties of positive and negative integer exponents to generate equivalent numerical expressions.**	Applies the properties of exponents to simplify expressions with the same base Simplifies expressions with exponents to find equivalent expressions with the same base	Distinguishes between n^m and $n \cdot m$ Applies rules for multiplying terms involving the same base raised to different powers **Released Example:** 280539	Calculates the square or cube of a negative number Simplifies multi-step expressions with one or more variables and involving exponents and/or coefficients Applies rules for negative exponents when dividing monomials involving the same base raised to different powers when the larger exponent(s) occur in the numerator Understands that multiplying and dividing exponentials uses properties of exponents while multiplying and dividing coefficients uses other algebraic rules **Released Examples:** 44407, 281336	Applies properties of exponents to simplify expressions with multi-factor terms and involving products and quotients of monomials to exponential powers Works backwards from given simplified expression to fill in missing exponents in an unsimplified version of the expression **Released Examples:** 280195, 780873

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8.1.1.5 **Express approximations of very large and very small numbers using scientific notation; understand how calculators display numbers in scientific notation. Multiply and divide numbers expressed in scientific notation, and express the answer in scientific notation, using the correct number of significant digits when physical measurements are involved.**	Finds the smallest or largest value in a list of numbers in scientific notation Recognizes that numbers written in scientific notation with positive exponents involve moving the decimal point to the right or multiplying by powers of ten and with negative exponents involve moving the decimal point to the left or dividing by powers of ten **Released Example:** 281026	Orders a list of numbers written in scientific notation Matches large and small numbers expressed in standard notation with the equivalent scientific notation and vice versa Consistently distinguishes the meaning of the exponent in scientific notation from the number of zeros in a number in standard form **Released Example:** 283707	Consistently converts very large and very small numbers between standard and scientific notations Multiplies and divides numbers in scientific notation **Released Examples:** 283032, 285620	Solves real-world problems involving numbers written in scientific notation requiring the use of multiplication or division including when final answer needs to be re-written in scientific notation **Released Example:** 283726

Algebra

Understand the concept of function in real-world and mathematical situations, and distinguish between linear and non-linear functions. (8.2.1)

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8.2.1.1 **Understand that a function is a relationship between an independent variable and a dependent variable in which the value of the independent variable determines the value of the dependent variable. Use functional notation, such as *f*(*x*), to represent such relationships.**	Recognizes that a function is a relationship between *x* and *f*(*x*)	Solves for *x* or *f*(*x*) when a linear function is represented in function notation as *f*(*x*) = *mx* + *b* in context Understands that *x* represents the input value and *f*(*x*) represents the output value	Solves problems using function notation with a given value such as *f*(*a*) by substituting the number "*a*" into the function equation for *x* Identifies function *f*(*x*) that matches a list of input-output pairs	Understands and explains the components of a function, identifying the dependent and independent variable Solves real-world problems involving linear relationships and using variables other than *x* and *y* **Released Examples:** 285249, 286055

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8.2.1.2 **Use linear functions to represent relationships in which changing the input variable by some amount leads to a change in the output variable that is a constant times that amount.**	Finds the next values in a linear pattern from an input-output table	Uses simple linear functions to solve problems in real-world contexts involving changes to the input value Identifies linear functions that model real-world problems	Consistently finds changes in a dependent variable given changes in the independent variable for real-world linear functions	Explains how the dependent variable changes when there is a change to the independent variable from mathematical and real-world described linear situations Finds changes in an independent variable given changes in the dependent variables for linear functions **Released Examples:** 285247, 286149

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8.2.1.3 **Understand that a function is linear if it can be expressed in the form *f*(*x*) = *mx* + *b* or if its graph is a straight line.**	Understands that the graph of a linear function is a straight line with a constant slope	Distinguishes linear functions from non-linear functions symbolically and graphically	Identifies sets of ordered pairs that, when graphed, represent a linear function **Released Example:** 284007	Distinguishes linear functions from non-linear functions written symbolically when linear functions are represented in novel forms Understands that horizontal lines represent linear functions with a slope of zero, and vertical lines do not represent functions **Released Examples:** 284008, 285252

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8.2.1.4 **Understand that an arithmetic sequence is a linear function that can be expressed in the form $f(x) = mx + b$, where $x = 0, 1, 2, 3, \ldots$.**	Continues a pattern in a list of numbers that represent an arithmetic sequence	Identifies the common difference in an arithmetic sequence Finds terms of an arithmetic sequence given in symbolic form	Identifies the function used to create the given terms of an arithmetic sequence Understands that the equation $f(x) = mx + b$ can be used to represent an arithmetic sequence where m represents the common difference between each term	Finds the nth term of a sequence given a symbolic representation and the domain Distinguishes arithmetic from non-arithmetic sequences when the sequence is provided as a list or symbolically Consistently finds a symbolic representation for an arithmetic sequence given a list of numbers and with domains starting at 0 or 1 **Released Example:** 284085

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8.2.1.5 **Understand that a geometric sequence is a non-linear function that can be expressed in the form $f(x) = ab^x$, where $x = 0, 1, 2, 3, \ldots$.**	Computes the next term in a list of terms representing a geometric sequence	Understands that the difference between successive terms in a geometric sequence is not constant **Released Example:** 285257	Identifies a geometric function symbolically when given the domain and a sequence of numbers Computes terms of a sequence when given the domain and sequence in $f(x) = a(b)^x$ form	Identifies symbolic representation of a geometric sequence when given ordered pairs or points on a graph **Released Example:** 283026

Recognize linear functions in real-world and mathematical situations; represent linear functions and other functions with tables, verbal descriptions, symbols and graphs; solve problems involving these functions and explain results in the original context. (8.2.2)

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8.2.2.1 **Represent linear functions with tables, verbal descriptions, symbols, equations and graphs; translate one representation to another.**	Translates from a simple linear equation or graph to values given in an input-output table	Translates between linear equations with a scale of 1 or 2 and input-output tables, including the use of negative integers Translates between graphs of linear functions and tables of values, including the use of negative integers **Released Examples:** 283232, 280099	Translates between various representations of linear functions (tables, equations, and graphs with the same scale on both axes), with negative integers, simple fractions (denominators less than 5), and simple decimals for slope and *y*-intercept values Relates steepness in graphs to benchmark values of *m* in equations of the form $y = mx + b$ **Released Examples:** 283096, 283246	Translates between various representations of linear functions with rational numbers for slope and *y*-intercept values Interprets graphs with scales other than 1, including when different scales are used for two axes **Released Example:** 42706

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8.2.2.2 **Identify graphical properties of linear functions including slopes and intercepts. Know that the slope equals the rate of change and that the *y*-intercept is zero when the function represents a proportional relationship.**	Recognizes that slope involves a change in vertical distance and horizontal distance Recognizes intercepts on the graph of a linear function	Distinguishes between slopes and intercepts Recognizes that slope is a ratio of the vertical distance to the horizontal distance from one point to another (from left to right) on a graphed line Calculates slope between two points on a coordinate grid **Released Examples:** 283712, 284507	Consistently recognizes that the slope of a line on a graph is positive for lines that rise up from left to right and negative for lines that fall down from left to right Recognizes *m* as slope and *b* as *y*-intercept when equations of functions are given in $y = mx + b$ form Calculates the slope of a graphed line and no specific points **Released Examples:** 283734, 284509	Finds the slope and *y*-intercept when equations are in standard form **Released Examples:** 283035, 285504

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8.2.2.3 **Identify how coefficient changes in the equation *f*(*x*) = *mx* + *b* affect the graphs of linear functions. Know how to use graphing technology to examine these effects.**	Recognizes that the value of *m* is the "steepness" of the line in the form *y* = *mx*	Recognizes that linear equations have a slope and *y*-intercept	Consistently distinguishes a slope's relationship to the value of *m* from the *y*-intercept's relationship to the value of *b* for equations in the form *y* = *mx* + *b* Identifies how adding, subtracting, or multiplying an integer to the slope of a linear function affects the graph or equation of that function Understands and uses the terms linear function and slope **Released Examples:** 44834, 283146	Relates changes in steepness of linear functions, including by fractional multipliers, to changes in a described context, and vice versa Describes how changes to the slope and/or *y*-intercept of linear functions affect the *x*- and *y*-intercepts **Released Example:** 45288

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8.2.2.4 **Represent arithmetic sequences using equations, tables, graphs and verbal descriptions, and use them to solve problems.**	Recognizes the difference between terms in a list of numbers representing an arithmetic sequence	Differentiates between a variable rate of change and a fixed rate of change	Solves for a missing value in a sequence presented in a table Solves for a future value in a sequence presented in a verbal description or context Uses equations to represent arithmetic sequences presented as tables, graphs, or verbal descriptions **Released Examples:** 45074, 286125	Solves for a future value in a sequence presented as a list of numbers Uses equations to represent arithmetic sequences presented in any form **Released Example:** 284087

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8.2.2.5 **Represent geometric sequences using equations, tables, graphs and verbal descriptions, and use them to solve problems.**	Generates the next term of geometric sequences represented by lists or tables **Released Example:** 280554	Generates first three or four terms of geometric sequences represented by equations, tables, or graphs **Released Example:** 284024	Generates specified terms (other than the next) of geometric sequences represented by equations Recognizes equations that represent given geometric sequences **Released Example:** 285600	Generates terms of geometric sequences represented by verbal descriptions **Released Examples:** 285618, 282150

Generate equivalent numerical and algebraic expressions and use algebraic properties to evaluate expressions. (8.2.3)

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8.2.3.1 **Evaluate algebraic expressions, including expressions containing radicals and absolute values, at specified values of their variables.**	Evaluates simple algebraic expressions, including rational expressions and containing exponents of 2, for values that are positive rational numbers	Evaluates algebraic expressions, including one type of expression (radical or rational) and/or containing exponents of 2, for values that are positive and negative rational numbers **Released Examples:** 44793, 285269	Consistently evaluates algebraic expressions containing absolute value, radicals, and rational expressions for values that are positive and negative rational numbers Evaluates multiple expressions for a particular value of a variable **Released Examples:** 44549, 280144, 285263	Evaluates complex algebraic expressions containing multiple terms that use exponents, absolute values, radicals, and parentheses, and which contain fractions and decimals Uses a sophisticated understanding of order of operations to evaluate expressions in which the arguments of the expressions themselves contain one or more algebraic expressions such as absolute value, radicals, and exponents **Released Examples:** 284692, 285617

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8.2.3.2 **Justify steps in generating equivalent expressions by identifying the properties used, including the properties of algebra. Properties include the associative, commutative and distributive laws and the order of operations, including grouping symbols.**	Understands that simplifying exponents and multiplication precedes simplifying addition and subtraction	Understands and uses the distributive property to simplify expressions Understands that commutativity involves a change in position **Released Examples:** 284020, 285275	Understands and uses the commutative property to simplify expressions Identifies errors in the simplification of an expression using understanding of properties of algebra Understands that applying the associative property changes the position of grouping symbols when no other properties have been used	Justifies multiple steps when simplifying complex expressions (sometimes containing multiple grouping symbols) by identifying and distinguishing between the associative, commutative, and distributive properties and by applying order of operations Understands how to apply and distinguish between the associative, commutative, and identity properties of addition and multiplication **Released Examples:** 284018, 285506

Represent real-world and mathematical situations using equations and inequalities involving linear expressions. Solve equations and inequalities symbolically and graphically. Interpret solutions in the original context. (8.2.4)

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8.2.4.1 **Use linear equations to represent situations involving a constant rate of change, including proportional and non-proportional relationships.**	Identifies the unit rate in familiar real-world situations and connects it to the variable term in a linear function	Identifies equations describing a real-world linear relationship when the unit rate is a positive value Distinguishes between variable and fixed quantities **Released Examples:** 282042, 284098	Recognizes and creates linear equations to model real-world situations when the unit rate is positive or negative Determines the unit rate when provided two input-output pairs, and relates it to the slope in a linear equation	Creates non-proportional linear equations in complex or novel real-world situations, given only input-output pairs, by determining the unit rate and the initial amount **Released Examples:** 286066, 286032, 286036

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8.2.4.2 **Solve multi-step equations in one variable. Solve for one variable in a multi-variable equation in terms of the other variables. Justify the steps by identifying the properties of equalities used.**	Combines like terms	Understands how to solve for an unknown quantity given familiar real-world situations Solves straightforward, one-variable equations with several steps involving whole numbers and addition symbol	Consistently solves multi-step equations with one variable and addition and subtraction symbols that contain multiple terms and grouping symbols, including when presented in novel forms	Solves for one variable in terms of other variables in equations with two, three or four variables and containing grouping symbols and multiple terms **Released Examples:** 283101, 286000
8.2.4.3 **Express linear equations in slope-intercept, point-slope and standard forms, and convert between these forms. Given sufficient information, find an equation of a line.**	Identifies the equation of a line in the form $y = mx$ when given the slope	Identifies the equation of a line in slope-intercept form when given rational values for the slope and *y*-intercept **Released Examples:** 284702, 284701	Converts a linear equation from standard and point-slope forms to slope-intercept form Computes the slope of a line given two ordered pairs and creates an equation of the line in slope-intercept form	Fluently converts between slope-intercept, standard, and point-slope forms of a linear equation Writes an equation of a line given either two points or a point and the slope **Released Examples:** 285614, 284029, 284030

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8.2.4.4 **Use linear inequalities to represent relationships in various contexts.**	Distinguishes a quantity that varies from a fixed quantity when creating linear inequalities in real-world situations	Represents familiar real-world contexts using linear inequalities with proportional and non-proportional relationships	Consistently uses or creates linear inequalities to represent relationships in real-world contexts, and interprets “at least” and “at most” correctly	Fluently solves linear inequalities in novel mathematical and real-world situations and interprets solutions in the context of the problem **Released Examples:** 45280, 286108

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8.2.4.5 **Solve linear inequalities using properties of inequalities. Graph the solutions on a number line.**	Solves simple linear inequalities involving positive rational numbers and addition	Solves one- and two-step linear inequalities using sums or differences with positive coefficients on the variable term and whole-number solutions	Solves linear inequalities with both positive and negative coefficients on variable terms, and provides solution in symbolic form Understands $x > b$ to mean b is not included in the solution set, and uses an open circle at point b when graphing solutions on the number line Understands $x \geq b$ to mean b is included in the solution set, and uses a closed circle at point b when graphing solutions on the number line **Released Examples:** 284077, 284108	Fluently solves complex linear inequalities (including compound inequalities) with both positive and negative coefficients on variable terms and with variables on both sides of inequality, provides solution in symbolic form, and graphs solution on number line Understands that multiplying or dividing by a negative number in a linear inequality has the effect of reversing the direction of the inequality **Released Examples:** 284045, 285241

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8.2.4.6 **Represent relationships in various contexts with equations and inequalities involving the absolute value of a linear expression. Solve such equations and inequalities and graph the solutions on a number line.**	Identifies the positive solution to an absolute value equation of the form $\|mx\| = k$	Finds one of the two values that satisfy an equation involving the absolute value of a linear expression Identifies both solutions to an absolute value equation of the form $\|mx\| = k$	Solves equations involving the absolute value of a linear expression Graphs inequalities on number lines, using an open circle for an endpoint for < and >, and a closed circle for an endpoint with ≤ or ≥	Solves equations and inequalities involving the absolute value of a linear expression and graphs the solutions on a number line Recognizes the equation or inequality involving the absolute value of a linear expression that best represents a described relationship **Released Examples:** 45112, 286097, 286130

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8.2.4.7 **Represent relationships in various contexts using systems of linear equations. Solve systems of linear equations in two variables symbolically, graphically and numerically.**	Identifies an *x*-value and/or *y*-value that satisfies one equation in a system of linear equations	Identifies the system of equations that represents a described relationship when whole numbers or monetary values are involved and both equations are presented in $ax + by = c$ form **Released Example:** 286026	Identifies the system of equations that represents a described relationship, including situations where fractions or decimals are involved Understands that the point of the intersection of two lines is the solution to the system of equations Solves a simple system of equations involving two variables Distinguishes between the *x*-value and *y*-value of a solution and interprets their meaning in a described relationship with or without context **Released Example:** 286160	Solves real-world problems involving two linear relationships between two variables by creating a system of linear equations and providing solutions in the context of the situation Identifies the system of equations that represents a described relationship when equations are presented in different forms Understands the differences between a system of equations with no solution, one solution, and infinitely many solutions **Released Examples:** 284124, 286161

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8.2.4.8 **Understand that a system of linear equations may have no solution, one solution or an infinite number of solutions. Relate the number of solutions to pairs of lines that are intersecting, parallel or identical. Check whether a pair of numbers satisfies a system of two linear equations in two unknowns by substituting the numbers in both equations.**	Assessed within 8.2.4.7	Assessed within 8.2.4.7	Assessed within 8.2.4.7	Assessed within 8.2.4.7

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8.2.4.9 **Use the relationship between square roots and squares of a number to solve problems.**	Solves one-step, real-world problems by taking the square root of a perfect square that is less than 150	Distinguishes between taking the square root of a perfect square and taking half of that number Finds whole number solutions to one-step and simple two-step mathematical and real-world problems by taking the square or square root of whole numbers **Released Examples:** 283117, 283714	Consistently distinguishes between solution strategies (e.g., squaring or taking the square root) depending on whether the variable is under the radical or the base of the square in the equation or situation Consistently distinguishes between solution strategies (e.g., taking the square root or dividing by 4) when area or perimeter is involved Solves equations involving squares and square roots including when values are not perfect squares and/or when equations involve more than one step **Released Examples:** 283701, 284002	Recognizes the inverse effect of squaring the square root of a number or of taking the square root of a squared number Solves multi-step problems involving squares and square roots in mathematical and real-world contexts **Released Examples:** 280003, 284113

Geometry & Measurement

Solve problems involving right triangles using the Pythagorean Theorem and its converse. (8.3.1)

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8.3.1.1 **Use the Pythagorean Theorem to solve problems involving right triangles.**	Understands that the hypotenuse is the longest side in a right triangle	Uses the Pythagorean Theorem to find an unknown side length in a right triangle given the other two lengths	Understands that the Pythagorean Theorem is the relationship between the lengths of the legs and the hypotenuse in right triangles Uses the Pythagorean Theorem and strategies such as Pythagorean triples or decomposition of rectangles to flexibly compute multiple missing sides in triangles with a shared side and to compute lengths in real-world contexts **Released Example:** 285015	Uses the Pythagorean Theorem to solve problems related to three-dimensional figures such as triangular prisms Solves multi-step, real-world and mathematical problems involving right triangles (including isosceles) to compute missing lengths in one or multiple triangles Computes length of diagonals in rectangles given area of rectangle and length of one side **Released Example:** 285014

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8.3.1.2 **Determine the distance between two points on a horizontal or vertical line in a coordinate system. Use the Pythagorean Theorem to find the distance between any two points in a coordinate system.**	Finds distance between two points on a vertical or horizontal line if coordinates are both positive integers, or one positive and one negative integer **Released Example:** 285230	Finds distance between two points on vertical or horizontal line when differences involve any combination of negative and positive rational numbers Understands that horizontal lines contain points with the same *y*-value and vertical lines contain points with the same *x*-value Understands distance as a non-negative quantity	Understands shortest distance between two points as the straight line distance (hypotenuse) of a right triangle comprised of vertical and horizontal components Uses the distance formula flexibly to find lengths of segments on a coordinate grid or the distance between two points without reference to a coordinate grid Finds the distance between two points in real-world situations	Finds distance between two points on a coordinate grid with scales other than 1 Finds length of hypotenuse and/or vertical or horizontal distances between points given 3 vertices of a right triangle without a diagram or additional information Determines possible locations of second point when given a point and the distance between the two points **Released Examples:** 286090, 284061

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8.3.1.3 **Informally justify the Pythagorean Theorem by using measurements, diagrams and computer software.**	Not assessed on MCA-III	Not assessed on MCA-III	Not assessed on MCA-III	Not assessed on MCA-III

Solve problems involving parallel and perpendicular lines on a coordinate system. (8.3.2)

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8.3.2.1 **Understand and apply the relationships between the slopes of parallel lines and between the slopes of perpendicular lines. Dynamic graphing software may be used to examine these relationships.**	Understands that parallel lines have the same slope	Understands that slopes of perpendicular lines have opposite signs Determines the slope of a line parallel to a graphed line with two labeled points	Understands that slopes of perpendicular lines are negative reciprocals Graphs a line parallel to a given line using the equation of the line and a point it passes through Identifies the equation of a line, in slope-intercept form, that is parallel or perpendicular to a given equation of a line, in slope-intercept form **Released Examples:** 285290, 283157, 284134	Understands that $y = b$ is a special case of $y = mx + b$ when the slope is 0 and represents a horizontal line in which all y-values are the same Compares slopes of quadrilaterals to determine slopes of missing sides Identifies, graphs, or creates the equation of one or more lines, in any form or representation, that is parallel or perpendicular to a linear function given in any form or representation **Released Examples:** 284127, 285289

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8.3.2.2 **Analyze polygons on a coordinate system by determining the slopes of their sides.**	Identifies the coordinate of a missing vertex on a rectangle when given 3 other vertices and the slope of one side is 0	Recognizes that horizontal and vertical lines are perpendicular Finds slopes of lines or sides of a quadrilateral given figures on a coordinate grid with a scale of 1 Determines slope of a line that connects two given points using the slope formula	Classifies type of quadrilateral given vertices by determining slopes of all sides (e.g., parallelogram, trapezoid) Understands that parallelograms have two sets of parallel sides and thus two different slopes Determines slope of missing side or a missing vertex of quadrilateral by identifying the slopes of remaining sides	Classifies type of polygon formed using only slopes of sides and in the absence of vertices or a diagram Uses the slope formula to determine an unknown coordinate in an ordered pair based on knowledge of polygons Uses information about slopes to determine multiple missing vertices in polygons or to explain why a parallelogram is a rectangle **Released Examples:** 286014, 285017

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8.3.2.3 **Given a line on a coordinate system and the coordinates of a point not on the line, find lines through that point that are parallel and perpendicular to the given line symbolically and graphically.**	Understands that parallel lines have the same slope	Recognizes *m* as relating to the slope of a line in the equation $y = mx + b$	Finds the equation of, or draws a line parallel to, a given equation of a line, passing through a given point not on that line Understands that the slope, *m*, of a line perpendicular to another line is the opposite reciprocal of *m* in the equation $y = mx + b$ Identifies an equation for a line that is perpendicular to a line given in equation form and passing through a point (0, *b*) not on that line **Released Example:** 286020	Finds equations of lines that are perpendicular or parallel to a given line when equation of given line is in a form other than slope-intercept form Determines the equation of a line and graphs the line that is perpendicular to a line given on a coordinate grid or as an equation and that passes through a given point that is not on the line **Released Examples:** 284513, 43057, 284074

Data Analysis & Probability

Interpret data using scatterplots and approximate lines of best fit. Use lines of best fit to draw conclusions about data. (8.4.1)

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8.4.1.1 **Collect, display and interpret data using scatterplots. Use the shape of the scatterplot to informally estimate a line of best fit and determine an equation for the line. Use appropriate titles, labels and units. Know how to use graphing technology to display scatterplots and corresponding lines of best fit.**	Explains in context the general relationships shown on scatterplots Determines whether scatterplots have positive or negative correlations/slopes Creates scatterplots by plotting data points **Released Example:** 286059	Explains in context the meaning of a positive or negative line of best fit Determines when scatterplots show no relationship between variables Identifies most reasonable line of best fit based on the shape of the data set, when given multiple scatterplots containing lines **Released Example:** 284663	Describes how adding data to scatterplots increases or decreases the strength of the correlation Identifies various scatterplots containing reasonable lines of best fit Matches real-world descriptions of data with correct type of correlation (e.g., strong positive, weak negative) Adds appropriate titles and labels to scatterplots based on real-world descriptions	Draws lines of best fit on scatterplots Finds equations for lines of best fit given scatterplots Answers and justifies real-world questions using multiple real-world scatterplots Identifies when data have non-linear relationships from scatterplots **Released Example:** 285029

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8.4.1.2 **Use a line of best fit to make statements about approximate rate of change and to make predictions about values not in the original data set.**	Uses lines of best fit shown on scatterplots to estimate *x*-values along grid lines given specific *y*-values when both values are within the given grid **Released Example:** 286145	Uses lines of best fit shown on scatterplots to estimate *y*-values given specific *x*-values when one or both values are not along grid lines Estimates rate of change of best fit lines	Uses lines of best fit equations and/or lines of best fit shown on scatterplots to predict expected values on the drawn line with positive or negative correlations, beyond a drawn line but on the graph with positive correlations, and sometimes off of the provided graph with positive slopes **Released Example:** 285202	Interprets meanings in context of positive and negative average rates of change for data shown on scatterplots, either with or without the line of best fit provided Uses lines of best fit equations shown on scatterplots to compare expected values and solve problems

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8.4.1.3 **Assess the reasonableness of predictions using scatterplots by interpreting them in the original context.**	Identifies basic information about data in a scatterplot such as type of correlation, questions the data can answer, and simple predictions of the next point on the graph when the data have a high positive correlation	Identifies most reasonable conclusions in context from scatterplots or lines of best fit, including situations with very low correlations **Released Example:** 284145	Identifies most reasonable conclusions (e.g., slope, prediction) in context from scatterplots and/or lines of best fit, including estimating a line of best fit, all within the bounds of the graph Identifies why a prediction in context is reasonable or not from scatterplots and/or lines of best fit	Identifies most or least reasonable conclusions in context from scatterplots and/or lines of best fit Explains why a prediction in context is reasonable or not from scatterplots with various scales and/or lines of best fit Consistently makes predictions for values that extend past the given scatterplot