

Grade 8

Strand 1—Number & Operation

(Online MCA, 6–8 items)

(Paper MCA, 6-8 items)

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

(Online MCA, 6–8 items)

(Paper MCA, 6–8 items)

Benchmarks

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.

Item Specifications

- Allowable notation: $\sqrt{18}$
 - Vocabulary allowed in items: irrational, real, square root, radical, and vocabulary given at previous grades
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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.

Item Specifications

- Allowable notation: $\sqrt{18}$
 - Vocabulary allowed in items: square root, radical, consecutive, and vocabulary given at previous grades
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8.1.1.3

Determine rational approximations for solutions to problems involving real numbers.

Item Specifications

- Allowable notation: $\sqrt{18}$
- Vocabulary allowed in items: square root, radical, consecutive, and vocabulary given at previous grades

8.1.1.4

Know and apply the properties of positive and negative integer exponents to generate equivalent numerical expressions.

Item Specifications

- Allowable notation: $-x^2$, $(-x)^2$, -3^2 , $(-3)^2$
- Expressions may be numeric or algebraic
- Vocabulary allowed in items: vocabulary given at previous grades

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.

Item Specifications

- Vocabulary allowed in items: scientific notation, significant digits, standard form, and vocabulary given at previous grades

Strand 2—Algebra

(Online MCA, 18–29 items)

(Paper MCA, 24–30 items)

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

(Online MCA, 4–5 items)

(Paper MCA, 4–5 items)

Benchmarks

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.

Item Specifications

- Vocabulary allowed in items: independent, dependent, constant, coefficient, and vocabulary given at previous grades

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.

Item Specifications

- Vocabulary allowed in items: independent, dependent, constant, coefficient, and vocabulary given at previous grades

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.

Item Specifications

- Vocabulary allowed in items: linear, constant, coefficient, and vocabulary given at previous grades
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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 $x = 0, 1, 2, 3, \dots$

Item Specifications

- Vocabulary allowed in items: n^{th} term, arithmetic sequence, geometric sequence, linear function, non-linear function, progression, common difference, and vocabulary given at previous grades
 - Allowable notation: items must specify the domain as $x=0, 1, 2, 3, \dots$ or $x = 1, 2, 3, 4, \dots$
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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 $x = 0, 1, 2, 3, \dots$

Item Specifications

- Vocabulary allowed in items: n^{th} term, arithmetic sequence, geometric sequence, linear function, non-linear function, exponential, progression, common ratio, and vocabulary given at previous grades
- Allowable notation: items must specify the domain as $x=0, 1, 2, 3, \dots$ or $x = 1, 2, 3, 4, \dots$

Standard 8.2.2: 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.

(Online MCA, 4–6 items)

(Paper MCA, 4–6 items)

Benchmarks

8.2.2.1

Represent linear functions with tables, verbal descriptions, symbols, equations and graphs; translate one representation to another.

Item Specifications

- Vocabulary allowed in items: linear function, and vocabulary given at previous grades

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.

Item Specifications

- Coordinates used for determining slope must contain integer values
 - Vocabulary allowed in items: linear function, intercept, and vocabulary given at previous grades
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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.

Item Specifications

- Vocabulary allowed in items: linear function, intercept, coefficient, constant, and vocabulary given at previous grades
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8.2.2.4

Represent arithmetic sequences using equations, tables, graphs and verbal descriptions, and use them to solve problems.

Item Specifications

- Vocabulary allowed in items: n^{th} term, arithmetic sequence, geometric sequence, linear function, non-linear function, progression, and vocabulary given at previous grades
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8.2.2.5

Represent geometric sequences using equations, tables, graphs and verbal descriptions, and use them to solve problems.

Item Specifications

- Vocabulary allowed in items: n^{th} term, arithmetic sequence, geometric sequence, linear function, non-linear function, progression, and vocabulary given at previous grades

Standard 8.2.3: Generate equivalent numerical and algebraic expressions and use algebraic properties to evaluate expressions.

(Online MCA, 2–4 items)

(Paper MCA, 3–5 items)

Benchmarks

8.2.3.1

Evaluate algebraic expressions, including expressions containing radicals and absolute values, at specified values of their variables.

Item Specifications

- Items must not have context
 - Directives may include: simplify, evaluate
 - Vocabulary allowed in items: vocabulary given at previous grades
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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.

Item Specifications

- Items must not have context
- Vocabulary allowed in items: associative, commutative, distributive, identity, property, order of operations, and vocabulary given at previous grades

Standard 8.2.4: 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.

(Online MCA, 8–14 items)

(Paper MCA, 10–15 items)

Benchmarks

8.2.4.1

Use linear equations to represent situations involving a constant rate of change, including proportional and non-proportional relationships.

Item Specifications

- Vocabulary allowed in items: vocabulary given at previous grades

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.

Item Specifications

Vocabulary allowed in items: vocabulary given at previous grades

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.

Item Specifications

- Items must not have context
 - Vocabulary allowed in items: slope-intercept form, point-slope form, standard form, and vocabulary given at previous grades
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8.2.4.4

Use linear inequalities to represent relationships in various contexts.

Item Specifications

- Inequalities contain no more than 1 variable
 - Vocabulary allowed in items: vocabulary given at previous grades
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8.2.4.5

Solve linear inequalities using properties of inequalities. Graph the solutions on a number line.

Item Specifications

- Vocabulary allowed in items: vocabulary given at previous grades
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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.

Item Specifications

- Vocabulary allowed in items: vocabulary given at previous grades
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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.

Item Specifications

- Vocabulary allowed in items: system of equations, undefined, infinite, intersecting, identical, and vocabulary given at previous grades

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.

Item Specifications

- 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.

Item Specifications

- Allowable notation: ± 3
- Items may assess the interpretation of square roots based on the context of the item
- Vocabulary allowed in items: square root and vocabulary given at previous grades

Strand 3—Geometry & Measurement

(Online MCA, 6–8 items)

(Paper MCA, 8-10 items)

Standard 8.3.1: Solve problems involving right triangles using the Pythagorean Theorem and its converse.

(Online MCA, 3–4 items)

(Paper MCA, 3–5 items)

Benchmarks

8.3.1.1

Use the Pythagorean Theorem to solve problems involving right triangles.

Item Specifications

- Congruent angle marks may be used
 - Vocabulary allowed in items: Pythagorean Theorem and vocabulary given at previous grades
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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.

Item Specifications

- Graphs are not provided when finding horizontal or vertical distance
- Vocabulary allowed in items: Pythagorean Theorem and vocabulary given at previous grades

8.3.1.3

Informally justify the Pythagorean Theorem by using measurements, diagrams and computer software.

Item Specifications

- Not assessed on the MCA-III

Standard 8.3.2: Solve problems involving parallel and perpendicular lines on a coordinate system.

(Online MCA, 3–4 items)

(Paper MCA, 3–5 items)

Benchmarks

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.

Item Specifications

- Vocabulary allowed in items: vocabulary given at previous grades
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8.3.2.2

Analyze polygons on a coordinate system by determining the slopes of their sides.

Item Specifications

- Vocabulary allowed in items: vocabulary given at previous grades
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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.

Item Specifications

- Vocabulary allowed in items: vocabulary given at previous grades

Strand 4—Data Analysis & Probability

(Online MCA, 6–7 items)

(Paper MCA, 6–8 items)

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

(Online MCA, 6–7 items)

(Paper MCA, 6–8 items)

Benchmarks

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.

Item Specifications

- Data sets are limited to no more than 30 data points
 - Vocabulary allowed in items: scatterplot, line of best fit, correlation and vocabulary given at previous grades
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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.

Item Specifications

- Vocabulary allowed in items: scatterplot, line of best fit, and vocabulary given at previous grades
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8.4.1.3

Assess the reasonableness of predictions using scatterplots by interpreting them in the original context.

Item Specifications

- Vocabulary allowed in items: scatterplot, line of best fit, and vocabulary given at previous grades