Grade 7

Strand 1—Number & Operation (Online MCA, 12–16 items) (Paper MCA, 12-16 items)

Standard 7.1.1: Read, write, represent and compare positive and negative rational numbers, expressed as integers, fractions and decimals.

(Online MCA, 4–6 items)

(Paper MCA, 4–6 items)

Benchmarks

7.1.1.1

Know that every rational number can be written as the ratio of two integers or as a terminating or repeating decimal. Recognize that π is not rational, but that it can be approximated by rational numbers such as 22/7 and 3.14.

Item Specifications

- Allowable notation: . . . . , π (written as a symbol, not as “pi”)
- Vocabulary allowed in items: terminating, repeating, and vocabulary given at previous grades

---

7.1.1.2

Understand that division of two integers will always result in a rational number. Use this information to interpret the decimal result of a division problem when using a calculator.

Item Specifications

- Vocabulary allowed in items: terminating, repeating, and vocabulary given at previous grades

---

7.1.1.3

Locate positive and negative rational numbers on a number line, understand the concept of opposites, and plot pairs of positive and negative rational numbers on a coordinate grid.

Item Specifications

- Vocabulary allowed in items: opposite, coordinate, origin, and vocabulary given at previous grades

---

7.1.1.4

Compare positive and negative rational numbers expressed in various forms using the symbols <, >, =, ≤, and ≥.

Item Specifications

- Vocabulary allowed in items: vocabulary given at previous grades

7.1.1.5

Recognize and generate equivalent representations of positive and negative rational numbers, including equivalent fractions.

Item Specifications

- Vocabulary allowed in items: vocabulary given at previous grades

Standard 7.1.2: Calculate with positive and negative rational numbers, and rational numbers with whole number exponents, to solve real-world and mathematical problems.

(Online MCA, 8–10 items)

(Paper MCA, 8–10 items)

Benchmarks

7.1.2.1

Add, subtract, multiply and divide positive and negative rational numbers that are integers, fractions and terminating decimals; use efficient and generalizable procedures, including standard algorithms; raise positive rational numbers to whole-number exponents.

Item Specifications

- Items must not have context
- Vocabulary allowed in items: vocabulary given at previous grades

---

7.1.2.2

Use real-world contexts and the inverse relationship between addition and subtraction to explain why the procedures of arithmetic with negative rational numbers make sense.

Item Specifications

- Vocabulary allowed in items: inverse and vocabulary given at previous grades

---

7.1.2.3

Understand that calculators and other computing technologies often truncate or round numbers.

Item Specifications

- Assessed within 7.1.2.4

7.1.2.4

Solve problems in various contexts involving calculations with positive and negative rational numbers and positive integer exponents, including computing simple and compound interest.

Item Specifications

- Vocabulary allowed in items: simple interest, compound interest, and vocabulary given at previous grades

7.1.2.5

Use proportional reasoning to solve problems involving ratios in various contexts.

Item Specifications

- Vocabulary allowed in items: proportion and vocabulary given at previous grades

---

7.1.2.6

Demonstrate an understanding of the relationship between the absolute value of a rational number and distance on a number line. Use the symbol for absolute value.

Item Specifications

- Vocabulary allowed in items: absolute value and vocabulary given at previous grades

Strand 2—Algebra (Online MCA, 13–18 items) (Paper MCA, 16-20 items)

Standard 7.2.1: Understand the concept of proportionality in real-world and mathematical situations, and distinguish between proportional and other relationships.

(Online MCA, 1–2 items)

(Paper MCA, 1–2 items)

Benchmarks

7.2.1.1

Understand that a relationship between two variables, x and y, is proportional if it can be expressed in the form $y/x = k$ or $y = kx$. Distinguish proportional relationships from other relationships, including inversely proportional relationships ($xy = k$ or $y = k/x$).

Item Specifications

- Vocabulary allowed in items: proportional, inversely, and vocabulary given at previous grades

---

7.2.1.2

Understand that the graph of a proportional relationship is a line through the origin whose slope is the unit rate (constant of proportionality). Know how to use graphing technology to examine what happens to a line when the unit rate is changed.

Item Specifications

- Vocabulary allowed in items: proportional, origin, slope, and vocabulary given at previous grades

Standard 7.2.2: Recognize proportional relationships in real-world and mathematical situations; represent these and other relationships with tables, verbal descriptions, symbols and graphs; solve problems involving proportional relationships and explain results in the original context.

(Online MCA, 5–7 items)

(Paper MCA, 6–8 items)

Benchmarks

7.2.2.1

Represent proportional relationships with tables, verbal descriptions, symbols, equations and graphs; translate from one representation to another. Determine the unit rate (constant of proportionality or slope) given any of these representations.

Item Specifications

- Vocabulary allowed in items: proportional, origin, slope, and vocabulary given at previous grades

---

7.2.2.2

Solve multi-step problems involving proportional relationships in numerous contexts.

Item Specifications

- Contexts may include (but are not limited to) discounts, tax, and percent of change
- Vocabulary allowed in items: proportional and vocabulary given at previous grades

---

7.2.2.3

Use knowledge of proportions to assess the reasonableness of solutions.

Item Specifications

- Assessed within 7.2.2.1 and 7.2.2.2

7.2.2.4

Represent real-world or mathematical situations using equations and inequalities involving variables and positive and negative rational numbers.

Item Specifications

- Vocabulary allowed in items: vocabulary given at previous grades

Standard 7.2.3: Apply understanding of order of operations and algebraic properties to generate equivalent numerical and algebraic expressions containing positive and negative rational numbers and grouping symbols; evaluate such expressions.

(Online MCA, 3–4 items)

(Paper MCA, 4–6 items)

Benchmarks

7.2.3.1

Use properties of algebra to generate equivalent numerical and algebraic expressions containing rational numbers, grouping symbols and whole number exponents. Properties of algebra include associative, commutative and distributive laws.

Item Specifications

- Items must not have context
- Vocabulary allowed in items: simplify and vocabulary given at previous grades

7.2.3.2

Evaluate algebraic expressions containing rational numbers and whole number exponents at specified values of their variables.

Item Specifications

- Expressions contain no more than 3 variables
- Vocabulary allowed in items: evaluate, substitute, and vocabulary given at previous grades

---

7.2.3.3

Apply understanding of order of operations and grouping symbols when using calculators and other technologies.

Item Specifications

- Assessed within 7.2.3.1 and 7.2.3.2

Standard 7.2.4: Represent real-world and mathematical situations using equations with variables. Solve equations symbolically, using the properties of equality. Also solve equations graphically and numerically. Interpret solutions in the original context.

(Online MCA, 4–5 items)

(Paper MCA, 4–6 items)

Benchmarks

7.2.4.1

Represent relationships in various contexts with equations involving variables and positive and negative rational numbers. Use the properties of equality to solve for the value of a variable. Interpret the solution in the original context.

Item Specifications

- Vocabulary allowed in items: vocabulary given at previous grades

---

7.2.4.2

Solve equations resulting from proportional relationships in various contexts.

Item Specifications

- Vocabulary allowed in items: vocabulary given at previous grades

Strand 3—Geometry & Measurement (Online MCA, 7–9 items) (Paper MCA, 8-10 items)

Standard 7.3.1: Use reasoning with proportions and ratios to determine measurements, justify formulas and solve real-world and mathematical problems involving circles and related geometric figures.

(Online MCA, 3–4 items)

(Paper MCA, 4–5 items)

Benchmarks

7.3.1.1

Demonstrate an understanding of the proportional relationship between the diameter and circumference of a circle and that the unit rate (constant of proportionality) is π. Calculate the circumference and area of circles to solve problems in various contexts.

Item Specifications

- Allowable notation: π (written as a symbol, not as “pi”)
- Items may assess finding the area and arc length of a sector
- Items do not assess finding the perimeter of a sector
- Vocabulary allowed in items: radius, diameter, circumference, and vocabulary given at previous grades

---

7.3.1.2

Calculate the volume and surface area of cylinders and justify the formulas used.

Item Specifications

- Units must be consistent throughout an item; conversions are not allowed
- Vocabulary allowed in items: radius, diameter, circumference, cylinder, lateral area, and vocabulary given at previous grades

Standard 7.3.2: Analyze the effect of change of scale, translations and reflections on the attributes of two-dimensional figures.

(Online MCA, 4–5 items)

(Paper MCA, 4–5 items)

Benchmarks

7.3.2.1

Describe the properties of similarity, compare geometric figures for similarity and determine scale factors.

Item Specifications

- Allowable notation: ~ (similar), ≅ (congruent), $\overline{FG}$ (segment FG), *FG* (length of segment FG)
- Vocabulary allowed in items: similar, corresponding, scale factor, and vocabulary given at previous grades

---

7.3.2.2

Apply scale factors, length ratios and area ratios to determine side lengths and areas of similar geometric figures.

Item Specifications

- Allowable notation: ~ (similar), ≅ (congruent), $\overline{FG}$ (segment FG), *FG* (length of segment FG)
- Vocabulary allowed in items: similar, corresponding, scale factor, and vocabulary given at previous grades

---

7.3.2.3

Use proportions and ratios to solve problems involving scale drawings and conversions of measurement units.

Item Specifications

- Conversions are limited to no more than 2 per item
- Vocabulary allowed in items: similar, corresponding, scale drawing, conversion, and vocabulary given at previous grades

---

7.3.2.4

Graph and describe translations and reflections of figures on a coordinate grid, and determine the coordinates of the vertices of the figure after the transformation.

Item Specifications

- Allowable notation: ***J*** and ***J***' (labels for points before and after transformation)
- Allowable translation notation: $(x, y) \rightarrow (x + 3, y - 2)$
- Images may be reflected over vertical lines, horizontal lines and the lines $y = x$ and $y = -x$
- Vocabulary allowed in items: vocabulary given at previous grades

Strand 4—Data Analysis & Probability (Online MCA, 7–9 items) (Paper MCA, 8-10 items)

Standard 7.4.1: Use mean, median and range to draw conclusions about data and make predictions.

(Online MCA, 3–4 items)

(Paper MCA, 3–5 items)

Benchmarks

7.4.1.1

Design simple experiments, and collect data. Determine mean, median and range for quantitative data and from data represented in a display. Use these quantities to draw conclusions about the data, compare different data sets and make predictions.

Item Specifications

- Data displays are limited to no more than 10 categories
- Data displays from previous grades may be used
- Vocabulary allowed in items: stem-and-leaf plot, and vocabulary given at previous grades

---

7.4.1.2

Describe the impact that inserting or deleting a data point has on the mean and the median of a data set. Know how to create data displays using a spreadsheet to examine this impact.

Item Specifications

- Data sets are limited to no more than 10 data points
- Vocabulary allowed in items: outlier and vocabulary given at previous grades

Standard 7.4.2: Display and interpret data in a variety of ways, including circle graphs and histograms.

(Online MCA, 1–2 items)

(Paper MCA, 1–2 items)

Benchmarks

7.4.2.1

Use reasoning with proportions to display and interpret data in circle graphs (pie charts) and histograms. Choose the appropriate data display and know how to create the display using a spreadsheet or other graphing technology.

Item Specifications

- Circle graphs have no more than 6 sectors
- Histograms have no more than 5 intervals
- Vocabulary allowed in items: circle graph, histogram, frequency table, and vocabulary given at previous grades

Standard 7.4.3: Calculate probabilities and reason about probabilities using proportions to solve real-world and mathematical problems.

(Online MCA, 3–4 items)

(Paper MCA, 3–5 items)

Benchmarks

7.4.3.1

Use random numbers generated by a calculator or a spreadsheet or taken from a table to simulate situations involving randomness, make a histogram to display the results and compare the results to known probabilities.

Item Specifications

- Not assessed on the MCA-III

7.4.3.2

Calculate probability as a fraction of sample space or as a fraction of area. Express probabilities as percents, decimals and fractions.

Item Specifications

- Vocabulary allowed in items: vocabulary given at previous grades

---

7.4.3.3

Use proportional reasoning to draw conclusions about and predict relative frequencies of outcomes based on probabilities.

Item Specifications

- Vocabulary allowed in items: vocabulary given at previous grades