

Seventh Grade Math Standards

The standards for middle school continue the work started in elementary grades in these four strands: Data, Probability, and Statistical Reasoning (DPSR); Measurement, Geometry, and Spatial Reasoning (MGSR); Numerical Reasoning (NR); and Patterns, Algebra, and Functional Reasoning (PAFR). Woven throughout all four strands are concepts building on students' understanding with problem solving to provide context to the problems they are solving, which will foster critical thinking and collaboration skills.

In the DPSR strand, seventh graders will continue their analysis of data sets by creating and analyzing displays, including stem-and-leaf plots and histograms. Students will calculate and interpret problems using both experimental and theoretical probability. Students will make connections and understand probabilities written as fractions, decimals, and percentages.

In the MGSR strand, seventh graders will be working with two- and three-dimensional figures to solve problems involving area, surface area, and volume. Through exploration and discovery, students will develop an understanding of how to find the circumference and area of circles. This will be the first time these concepts have been introduced. Students will identify congruent angles and solve equations relating to angles formed when lines intersect. Distance between points on the coordinate plane will be found and connected back to the area and perimeter of polygons.

In the NR strand, seventh graders will extend their understanding of operations to include all rational numbers, promoting student understanding of how rational numbers are used in real-world situations.

In PAFR, seventh graders will expand on what was learned in sixth grade to develop an understanding of proportional relationships. Students will represent algebraic concepts using tables, graphs, verbal descriptions, and equations. Students will distinguish proportional relationships from non-proportional relationships while making the connection between unit rate and constant of proportionality. The extension of this knowledge will lead to the ability to solve single- and multi-step problems while working with expressions and linear equations. Students will be provided with multiple opportunities to solve a variety of percentage problems.

Mathematical Process Standards

Standard	Indicator	Indicator Insight
PROBLEM SOLVING	MPS.PS.1 Make sense of problems and persevere in solving them strategically.	Experience problems that are interesting and relevant to students' lives, demonstrating the impact of mathematics. Interpret the meaning of a problem by imagining the situation, considering multiple entry points, making a plan, and choosing a solution pathway. Demonstrate flexibility in approaching the problem. When the solution pathway does not lead to a solution, look for another way. Recognize that multiple representations (concrete models, drawings, expressions, equations, verbal descriptions, tables, diagrams, and graphs) are related to each other and can help students solve the problem. Compare other students' approaches to solving the problem and understand there can be multiple ways to solve a problem. To find a correct solution, consider simpler forms of the original problem. Have students continually ask themselves if a solution is reasonable.
REPRESENTATION & COMMUNICATION	MPS.RC.1 Explain ideas using precise and contextually appropriate mathematical language, tools, and models.	Engage in mathematical discourse to explain or justify a conjecture. Solve problems collaboratively. Collaborate with others by posing clarifying questions that help deepen overall understanding of the concept. Be specific with explanations by using objects, drawings, pictures, and symbolic representations. Use a variety of forms to present results to an audience. Use properties of operations to justify the equivalence of expressions. Make decisions about which tools are necessary to use, or not use, in specific situations. Demonstrate proficiency in choosing technology tools that will aid in understanding a concept or formulating a solution to the problem. Attend to precision when checking work and labeling measurements, along with making revisions as needed.
CONNECTIONS	MPS.C.1 Demonstrate a deep and flexible conceptual understanding of mathematical ideas, operations, and relationships while making real-world connections.	Make connections applying number sense with real-world contexts. Understand that fractions, decimals, and percentages are rational numbers. Make sense of missing numbers in equations by using the relationships among addition, subtraction, multiplication, and division. Understand that a complex problem is made up of many smaller problems needing to be solved to get to a "final solution." Have students generate their own mathematical problems using the world around them.

Standard	Indicator	Indicator Insight
ANALYZE & JUSTIFY	MPS.AJ.1 Use critical thinking skills to reason both abstractly and quantitatively.	Compare arguments, determine if the logic used is reasonable, and be able to explain any errors or flaws found.
		Construct written and verbal arguments using objects, numbers, drawings, diagrams, mathematical activities, and mathematical symbols.
		Make sense of both symbols and numbers.
		Reason inductively about data, making reasonable arguments that consider the context from which the data arose.
		Have students review their position as new evidence is presented and revise their position, if necessary.
STRUCTURE & PATTERNS	MPS.SP.1 Identify and apply regularity in repeated reasoning to make generalizations.	Recognize complex mathematical objects and situations as being composed of multiple parts.
		Apply a variety of strategies to find solutions for a problem in context.
		Notice patterns and structure in repeated calculations and look for generalizations, general methods, and shortcuts.
		Check for reasonableness and needed adjustments in strategies while solving problems.

Data, Probability, and Statistical Reasoning

7.DPSR.1. Analyze data sets to identify their statistical elements.

Indicator #	Indicator	Indicator Insight
7.DPSR.1.1	Create stem-and-leaf plots to represent numerical data sets in mathematical and real-world situations.	Teach using data displays, not just numerical sets. This is the students' first exposure to stem-and-leaf plots.
7.DPSR.1.2	Use the shape of the graph to select the measure of center (mean, median, or mode) that best describes the data set.	This indicator continues the work with spread and center started in sixth grade. The shape includes <i>right skew</i> , <i>left skew</i> , <i>symmetric</i> , <i>uniform</i> , <i>bimodal</i> (two modes), and <i>outliers</i> . This is students' first introduction to mean.
7.DPSR.1.3	Calculate and interpret the measures of center (<i>mean</i> , <i>median</i> , <i>mode</i>) and spread (<i>mean absolute deviation</i> , <i>interquartile range</i> , <i>range</i>) in mathematical and real-world situations.	" <i>Measure of spread</i> " and " <i>measure of variability</i> " should be used interchangeably. Compare the difference between <i>mean</i> , <i>median</i> , and <i>mode</i> . Include all rational numbers in the data sets. This is the students' first exposure to mean absolute deviation.
7.DPSR.1.4	Create histograms to represent data sets and interpret histograms to answer questions or draw conclusions about data sets.	Connecting a stem-and-leaf plot to a histogram can be helpful for students. Intervals are also called bins.

7.DPSR.2. Calculate and interpret probability.

Indicator #	Indicator	Indicator Insight
7.DPSR.2.1	Identify the sample space for a simple event.	Simple events were introduced in fifth grade. Distinguish between sample size (sixth grade) and sample space (unique outcomes).
7.DPSR.2.2	Calculate and interpret the theoretical probability of a simple random event.	This is the students' introduction to theoretical probability.
7.DPSR.2.3	Calculate and interpret the experimental probability of a random event related to a simple experiment.	Conduct actual probability experiments and interpret the results.
7.DPSR.2.4	Compare and contrast the experimental and theoretical probabilities for a simple experiment.	Simple experiments include randomly selecting a card from a deck, tossing a coin, rolling a die, spinning a spinner, and randomly selecting a colored tile from a bag. Represent the probability as a fraction, decimal, or percent. Use P(event) notation.

Measurement, Geometry, and Spatial Reasoning**7.MGSR.1. Determine the measurements of geometric figures.**

Indicator #	Indicator	Indicator Insight
7.MGSR.1.1	Identify the parts of a circle. Limit the parts to <i>center</i> , <i>radius</i> , <i>diameter</i> , and <i>chord</i> .	Understand the definition of a circle. Be able to distinguish between diameter and other chords. Understand the relationship between radius and diameter.
7.MGSR.1.2	Describe the relationship between the <i>radius</i> , <i>diameter</i> , and <i>circumference</i> of a circle.	Physically explore the attributes of the circumference of a circle as a measure of length using concrete materials. Identify π through a variety of patterns and relationships. These relationships are another application of proportional reasoning.

Indicator #	Indicator	Indicator Insight
7.MGSR.1.3	Solve mathematical and real-world situations involving circumference or area of circles.	Practice finding the exact area or circumference of a circle using Pi. Find estimates of area and circumference using the approximations for π ($\pi \approx 3.14$, $\pi \approx 3$, or $\pi \approx \frac{22}{7}$). Use the formulas to find missing parts in the circumference formula. Find the area from a given circumference. The expectation is not to find the radius or diameter when given the area because that involves finding the square root, and seventh grade indicators do not include finding square roots.
7.MGSR.1.4	Determine if three given side lengths can form a triangle using the <i>Triangle Inequality Theorem</i> .	Use exploration activities to discover patterns to form a triangle leading to the <i>Triangle Inequality Theorem</i> .
7.MGSR.1.5	In mathematical and real-world situations, find the volume of right prisms and right pyramids having triangular or quadrilateral bases.	Include trapezoidal bases. The formula was discovered in sixth grade. A trapezoid is defined as a quadrilateral with exactly one pair of parallel sides.
7.MGSR.1.6	In mathematical and real-world situations, find the surface area of right prisms and right pyramids having triangular or quadrilateral bases.	Include trapezoidal bases. Find actual measurements of some figures using rulers to continue the practice from elementary grades.

7.MGSR.2. Determine angle and/or side relationships.

Indicator #	Indicator	Indicator Insight
7.MGSR.2.1	Determine the measure of the third angle given the measure of the other two angles of a triangle using the <i>Triangle Sum Theorem</i> .	The intent of this indicator is to develop a conceptual understanding of the angles inside of a triangle. Write equations to find the missing angle measure.
7.MGSR.2.2	Solve mathematical and real-world situations involving dimensions and areas of geometric figures including scale drawings and scale factors.	Find the scale factor of similar figures using both the sides and the areas.
7.MGSR.2.3	Identify the relationships and measures among angles formed by two intersecting lines, given the measure of one angle. Limit to supplementary, complementary, vertical, and adjacent relationships.	Use given angle measurements to solve for unknown angle measurements.
7.MGSR.2.4	Write and solve equations to solve mathematical and real-world situations involving the relationships among angles formed by two intersecting lines. Limit to supplementary, complementary, vertical, and adjacent relationships.	Instead of a measurement of the angle, there is an algebraic expression that will be used to find the angle measurement. It is not the expectation of this indicator to have variables on both sides of the equation.

7.MGSR.3. Graph on the coordinate plane.

Indicator #	Indicator	Indicator Insight
7.MGSR.3.1	Find distances between ordered pairs on the coordinate plane, limited to the same x-coordinate or the same y-coordinate.	Connect to finding the area and perimeter of polygons by calculating vertical and horizontal distances. Make connections to <i>absolute value</i> .

Numerical Reasoning**7.NR.1. Translate among multiple representations of rational numbers.**

Indicator #	Indicator	Indicator Insight
7.NR.1.1	Convert rational numbers into equivalent forms among fractions (including mixed numbers), decimals, and percentages. Exclude the conversion of repeating decimals to fractions.	In sixth grade, denominators were limited. There is no limit to denominators in this indicator.

7.NR.2. Utilize rational numbers in mathematical and real-world situations.

Indicator #	Indicator	Indicator Insight
7.NR.2.1	Compare two rational numbers and write statements using <i>is equal to</i> ($=$), <i>is not equal to</i> ($\neq$), <i>is less than</i> ($<$), <i>is greater than</i> ($>$), <i>is greater than or equal to</i> ($\geq$), and/or <i>is less than or equal to</i> ($\leq$) in mathematical and real-world situations.	Include negative rational numbers. Practice placing all rational numbers on a number line.

Patterns, Algebra, and Functional Reasoning**7.PAFR.1. Use tables, graphs, verbal descriptions, or equations to represent a function.**

Indicator #	Indicator	Indicator Insight
7.PAFR.1.1	Apply proportional reasoning to solve problems in mathematical and real-world situations involving ratios and percentages.	Use a variety of situations, including, but not limited to, markups (percent increase), markdowns (percent decrease), tips, tax, coupons, discounts, commission, percent error, depreciation, and simple interest.
7.PAFR.1.2	Create a model with functions that address a proportional relationship in real-world situations.	Models should include tables, functions and their graphs, equations, diagrams, and verbal descriptions.
7.PAFR.1.3	Identify the constant of proportionality within proportional relationships.	The constant of proportionality is the unit rate. Use tables, graphs, and equations to identify the constant of proportionality. Introduce $y = kx$.

7.PAFR.2. Write, simplify, and evaluate algebraic expressions; write and solve algebraic equations and inequalities.

<i>Indicator #</i>	<i>Indicator</i>	<i>Indicator Insight</i>
7.PAFR.2.1	Write and solve multi-step equations and inequalities in one variable involving rational numbers in mathematical and real-world situations.	Include a fraction bar as a grouping symbol. Combine like terms, but do not include variables on both sides; one side only.
7.PAFR.2.2	Write and evaluate expressions in one variable that model mathematical and real-world situations.	Include all rational numbers when writing and evaluating expressions.
7.PAFR.2.3	Compute unit rates, including those involving complex fractions with like or different units.	Introduce <i>complex fractions</i> also known as <i>compound fractions</i> .
7.PAFR.2.4	Use dimensional analysis to convert units between metric and customary systems.	Include problems with measures of mass, weight, length, and liquid. Convert from metric to customary and customary to metric systems.

7.PAFR.3. Apply mathematical patterns, properties, and algorithms to the set of rational numbers to find sums, differences, products, and quotients and to write equivalent expressions.

<i>Indicator #</i>	<i>Indicator</i>	<i>Indicator Insight</i>
7.PAFR.3.1	Simplify numerical expressions that include integer exponents using the laws of exponents: the <i>Product of Powers</i> , <i>Quotient of Powers</i> , <i>Power of a Power</i> , <i>Power of a Product</i> , <i>Power of a Quotient</i> , <i>Zero Power</i> , and <i>Negative Exponent</i> .	Expose students to expressions and models to look for patterns to create a generalization through examples. Provide experiences to discover the rules.
7.PAFR.3.2	Identify linear expressions that are equivalent.	Combine like terms when needed to show equivalence.
7.PAFR.3.3	Recognize that algebraic expressions may have a variety of equivalent forms and determine an appropriate form for a given real-world situation.	Use the context to determine an equivalent expression that best matches the situation. Know that there can be multiple forms of the same expression.
7.PAFR.3.4	Factor linear expressions with integer coefficients using the greatest common factor (GCF).	Students learned GCF in fifth grade.
7.PAFR.3.5	Apply all operations with rational numbers to solve problems in mathematical and real-world situations.	Include positive and negative fractions and decimals. Develop generalizations through multiple examples with models to find patterns.