Grade 7 Overview

In Grade 7, instructional time should focus on three areas: (1) developing understanding of and applying proportional relationships; (2) developing understanding of operations with rational numbers and working with expressions and linear equations; and (3) drawing inferences about populations based on samples. Please note that while every standard/topic in the grade level has not been included in this overview, all standards should be included in instruction.

1. Through their learning in the ***Ratios and Proportional Relationships*** domain, students:
   - extend their understanding of ratios and develop understanding of proportionality to solve single- and multi-step problems;
   - use their understanding of ratios and proportionality to solve a wide variety of percent problems;
   - solve problems about scale drawings by relating corresponding lengths between the objects or by using the fact that relationships of lengths within an object are preserved in similar objects;
   - graph proportional relationships and understand the unit rate informally as a measure of the steepness of the related line; and
   - distinguish proportional relationships from other relationships.
2. Through their learning in the ***Number System*** and the ***Expressions, Equations, and Inequalities*** domains, students:
   - develop a unified understanding of number, recognizing fractions, decimals (that have a finite or a repeating decimal representation), and percents as different representations of rational numbers;
   - extend addition, subtraction, multiplication, and division to all rational numbers, maintaining the properties of operations and the relationships between addition and subtraction, and multiplication and division;
   - explain and interpret the rules for adding, subtracting, multiplying, and dividing with negative numbers by applying properties of operations, and view negative numbers in terms of everyday contexts; and
   - use the arithmetic of rational numbers as they formulate expressions and equations in one variable and use these equations to solve problems.
3. Through their learning in the ***Statistics and Probability*** domain, students:
   - build on their previous work with single data distributions to compare two data distributions and address questions about differences between populations;
   - begin informal work with random sampling to generate data sets and learn about the importance of representative samples for drawing inferences; and
   - extend previous understandings of simple probabilities in grade 6 to calculate probabilities of compound events.

Mathematical Practices

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

NY-7.RP	Ratios and Proportional Relationships
Analyze proportional relationships and use them to solve real-world and mathematical problems.	
1. Compute unit rates associated with ratios of fractions.	Coherence: NY-6.RP.2, NY-6.RP.3b → NY-7.RP.1 e.g., If a person walks $\frac{1}{2}$ mile in each $\frac{1}{4}$ hour, compute the rate as the complex fraction $\frac{\frac{1}{2}}{\frac{1}{4}}$ miles per hour, equivalently 2 miles per hour with 2 being the unit rate. Note: Problems may include ratios of lengths, areas, and other quantities measured in like or different units, including across measurement systems.
2. Recognize and represent proportional relationships between quantities.	
a. Decide whether two quantities are in a proportional relationship.	Note: Strategies include but are not limited to the following: testing for equivalent ratios in a table and/or graphing on a coordinate plane and observing whether the graph is a straight line through the origin.
b. Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.	Coherence: NY-6.RP.3a → NY-7.RP.2b → NY-8.EE.6, NY-8.F.2, NY-8.F.4
c. Represent a proportional relationship using an equation.	Coherence: NY-7.RP.2c → NY-8.EE.5 e.g., If total cost t is proportional to the number n of items purchased at a constant price p, the relationship between the total cost and the number of items can be expressed as $t = pn$.
d. Explain what a point (x, y) on the graph of a proportional relationship means in terms of the situation, with special attention to the points (0, 0) and (1, r) where r is the unit rate.	Coherence: NY-7.RP.2d → NY-8.F.5
3. Use proportional relationships to solve multistep ratio and percent problems.	Coherence: NY-6.RP.3c → NY-7.RP.3 Note: Examples of percent problems include: simple interest, tax, markups and markdowns, gratuities and commissions, fees, percent increase and decrease, and percent error.

Connecting the Standards for Mathematical Practice to Mathematical Content:

- Proportional relationships (NY-7.RP.2 & 3) present opportunities for modeling (MP.4). For example, the number of people who live in an apartment building might be taken as proportional to the number of stories in the building for modeling purposes.[14]

NY-7.NS The Number System

Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers.

1. Apply and extend previous understandings of addition and subtraction to add and subtract rational numbers. Represent addition and subtraction on a horizontal or vertical number line.
   a. Describe situations in which opposite quantities combine to make 0.
   b. Understand addition of rational numbers; $p + q$ is the number located a distance $|q|$ from p, in the positive or negative direction depending on whether q is positive or negative. Show that a number and its opposite have a sum of 0 (are additive inverses). Interpret sums of rational numbers by describing real-world contexts.
   c. Understand subtraction of rational numbers as adding the additive inverse, $p – q = p + (–q)$. Show that the distance between two rational numbers on the number line is the absolute value of their difference, and apply this principle in real-world contexts.
   d. Apply properties of operations as strategies to add and subtract rational numbers.

   Coherence: NY-6.NS.5, NY-6.NS.6, NY-6.NS.7 → NY-7.NS.1

2. Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers.
   a. Understand that multiplication is extended from fractions to rational numbers by requiring that operations continue to satisfy the properties of operations, particularly the distributive property, leading to products such as $(–1)(–1) = 1$ and the rules for multiplying signed numbers. Interpret products of rational numbers by describing real-world contexts.
   b. Understand that integers can be divided, provided that the divisor is not zero, and every quotient of integers (with non-zero divisor) is a rational number. If p and q are integers, then $–(\frac{p}{q}) = \frac{-p}{q} = \frac{p}{-q}$. Interpret quotients of rational numbers by describing real-world contexts.
   c. Apply properties of operations as strategies to multiply and divide rational numbers.
   d. Convert a fraction to a decimal using long division; know that the decimal form of a rational number terminates in 0s or eventually repeats.

   Coherence: NY-6.NS.1 → NY-7.NS.2 → NY-8.NS.1

3. Solve real-world and mathematical problems involving the four operations with rational numbers.

   Note: Computations with rational numbers extend the rules for manipulating fractions to complex fractions limited to $\frac{\frac{a}{b}}{\frac{c}{d}}$ where *a, b, c,* and *d* are integers and *b, c,* and $d \neq 0$.

   Coherence: NY-6.NS.3 → NY-7.NS.3

Within-Grade Connections:

- Because rational number arithmetic (NY-7.NS.1 – 3) underlies the problem solving detailed in NY-7.EE.3 as well as the solution of linear expressions and equations (NY-7.EE.1 & 2 and NY-7.EE.4), this work should likely begin at or near the start of the year.[14]

NY-7.EE	Expressions, Equations, and Inequalities	
Use properties of operations to generate equivalent expressions.		
1.	Add, subtract, factor, and expand linear expressions with rational coefficients by applying the properties of operations.	Coherence: NY-6.EE.3 → NY-7.EE.1 → NY-8.EE.7
2.	Understand that rewriting an expression in different forms in real-world and mathematical problems can reveal and explain how the quantities are related.	Coherence: NY-6.EE.4 → NY-7.EE.2 → NY-8.EE.8c e.g., $a + 0.05a$ and $1.05a$ are equivalent expressions meaning that "increase by 5%" is the same as "multiply by 1.05."

NY-7.EE	Expressions, Equations, and Inequalities	
Solve real-life and mathematical problems using numerical and algebraic expressions, equations, and inequalities.		
3.	Solve multi-step real-world and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate. Assess the reasonableness of answers using mental computation and estimation strategies.	e.g., • If a woman making \$25 an hour gets a 10% raise, she will make an additional $\frac{1}{10}$ of her salary an hour, or \$2.50, for a new salary of \$27.50. • If you want to place a towel bar $9\frac{3}{4}$ inches long in the center of a door that is $27\frac{1}{2}$ inches wide, you will need to place the bar about 9 inches from each edge; this estimate can be used as a check on the exact computation.

4. Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities.	Note: Solving equations that contain variables on both sides is not an expectation in grade 7.
a. Solve word problems leading to equations of the form $px + q = r$ and $p(x + q) = r$, where p, q, and r are rational numbers. Solve equations of these forms fluently. Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach.	Coherence: NY-6.EE.7 → NY-7.EE.4a → NY-8.EE.7, NY-8.F.3 e.g., The perimeter of a rectangle is 54 cm. Its length is 6 cm. What is its width? Notes: • The words *leading to* in the standard may require students to simplify or combine like terms on the same side of the equation before it is in the form stated in the standard. • This standard is a fluency expectation for grade 7.
b. Solve word problems leading to inequalities of the form $px + q > r$, $px + q \geq r$, $px + q \leq r$, or $px + q < r$, where p, q, and r are rational numbers. Graph the solution set of the inequality on the number line and interpret it in the context of the problem.	Coherence: NY-6.EE.8 → NY-7.EE.4b e.g., As a salesperson, you are paid \$50 per week plus \$3 per sale. This week you want your pay to be at least \$100. Write an inequality for the number of sales you need to make, and describe the solutions. Note: The words *leading to* in the standard may require students to simplify or combine like terms on the same side of the equation before it is in the form stated in the standard.

Note on *Fluency* with Procedures:

- *Fluency* with procedures *(procedural fluency)* means students are accurate, efficient, flexible, and know when and how to use them appropriately. Developing fluency requires understanding why and how a procedure works. Understanding makes learning procedures easier, less susceptible to common errors, less prone to forgetting, and easier to apply in new situations. Students also need opportunities to practice on a moderate number of carefully selected problems after they have established a strong conceptual foundation of the mathematical basis for the procedure.[12],[13]

Within-Grade Connections:

- The work leading to meeting standards NY-7.EE.1 – 4 could be divided into two phases, one centered on addition and subtraction (e.g., solving $x + q = r$) in relation to rational number addition and subtraction (NY-7.NS.1) and another centered on multiplication and division (e.g., solving $px + q = r$ and $p(x + q) = r$) in relation to rational number multiplication and division (NY-7.NS.2).[14]
- Meeting standard NY-7.EE.3 in its entirety will involve using rational number arithmetic (NY-7.NS.1 – 3) and percents (NY-7.RP.3). Work leading to meeting this standard could be organized as a recurring activity that tracks the students' ongoing acquisition of new skills in rational number arithmetic and percents.[14]

Connecting the Standards for Mathematical Practice to Mathematical Content:

- When students compare arithmetic and algebraic solutions to the same problem (NY-7.EE.4a), they are identifying correspondences between different approaches (MP.1).[14]
- Solving an equation such as $4 = 8(x - ½)$ requires students to see and make use of structure (MP.7), temporarily viewing $x - ½$ as a single entity.[14]

NY-7.G	Geometry
Draw, construct, and describe geometrical figures and describe the relationships between them.	
1. Solve problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale.	
2. Draw triangles when given measures of angles and/or sides, noticing when the conditions determine a unique triangle, more than one triangle, or no triangle.	Note: Create triangles through the use of freehand drawings, materials (scaffolds may include: pipe cleaners, Legos®, and toothpicks), rulers, protractors, and/or technology.
3. Describe the two-dimensional shapes that result from slicing three-dimensional solids parallel or perpendicular to the base.	Note: Focus of standard is on plane sections resulting from the slicing of right rectangular prisms and right rectangular pyramids.

Within-Grade Connections:

- Students use proportional reasoning (NY-7.RP) when they analyze scale drawings (NY-7.G.1). [14]

Connecting the Standards for Mathematical Practice to Mathematical Content:

- When students notice when given geometric conditions determine a unique triangle, more than one triangle or no triangle (NY-7.G.2), they have an opportunity to construct viable arguments and critique the reasoning of others (MP.3). Such problems also present opportunities for using appropriate tools strategically (MP.5).[14]

NY-7.G	Geometry
Solve real-life and mathematical problems involving angle measure, area, surface area, and volume.	
4. Apply the formulas for the area and circumference of a circle to solve problems.	Coherence: NY-7.G.4 → NY-8.G.9 Note: Students in grade 7 are not expected to calculate the radius of a circle given its area.
5. Use facts about supplementary, complementary, vertical, and adjacent angles in a multi-step problem to write and solve simple equations for an unknown angle in a figure.	Coherence: NY-7.G.5 → NY-8.G.5 Note: Students in grade 7 are limited to solving equations that involve linear expressions on one side of the equation.
6. Solve real-world and mathematical problems involving area of two-dimensional objects composed of triangles and trapezoids.	Coherence: NY-6.G.1, NY-6.G.2, NY-6.G.4 → NY-7.G.6 → NY-8.G.6 Note: The inclusive definition of a trapezoid will be utilized, which defines a trapezoid as "A quadrilateral with *at least* one pair of parallel sides." (This definition includes parallelograms and rectangles.)
Solve surface area problems involving right prisms and right pyramids composed of triangles and trapezoids.	Note: Right prisms include cubes.
Find the volume of right triangular prisms, and solve volume problems involving three-dimensional objects composed of right rectangular prisms.	

NY-7.SP	Statistics and Probability	
Draw informal comparative inferences about two populations.		
1.	Construct and interpret box-plots, find the interquartile range, and determine if a data point is an outlier.	Coherence: NY-6.SP.4, NY-6.SP.5c → NY-7.SP.1 Note: Students in grade 7 are *not* expected to *construct* box-plots that include outliers in the data, but students *are* expected to *interpret* box-plots that may contain outliers.
3.	Informally assess the degree of visual overlap of two quantitative data distributions.	Coherence: NY-6.SP.2 → NY-7.SP.3
4.	Use measures of center and measures of variability for quantitative data from random samples or populations to draw informal comparative inferences about the populations.	Coherence: NY-6.SP.1c, NY-6.SP.3 → NY-7.SP.4 Note: Measures of center are mean, median, and mode. The measures of variation include range and the interquartile range.

NY-7.SP	Statistics and Probability	
Investigate chance processes and develop, use, and evaluate probability models.		
8.	Find probabilities of compound events using organized lists, sample space tables, tree diagrams, and simulation.	Coherence: NY-6.SP.8 → NY-7.SP.8
a.	Understand that, just as with simple events, the probability of a compound event is the fraction of outcomes in the sample space for which the compound event occurs.	
b.	Represent sample spaces for compound events using methods such as organized lists, sample space tables, and tree diagrams. For an event described in everyday language, identify the outcomes in the sample space which compose the event.	e.g., "rolling double sixes"
c.	Design and use a simulation to generate frequencies for compound events.	e.g., Use random digits as a simulation tool to approximate the answer to the question: If 40% of donors have type A blood, what is the probability that it will take at least 4 donors to find one with type A blood?

Within-Grade Connections:

- Probability models draw on proportional reasoning and should be connected to the major work in those standards.[14]
- Students use proportional reasoning and percentages (NY-7.RP) when they extrapolate from random samples and use probability (NY-7.SP.8).[14]