



## SEVENTH GRADE

### *Mathematics Standards for the Archdiocese of Detroit*

#### **Ratios & Proportional Relationships**

*Analyze proportional relationships and use them to solve real-world and mathematical problems.*

<b>7.RP.A.1</b>	Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units. <i>For example, if a person walks <math>1/2</math> mile in each <math>1/4</math> hour, compute the unit rate as the complex fraction <math>^{1/2}/_{1/4}</math> miles per hour, equivalently 2 miles per hour.</i>
<b>7.RP.A.2</b>	Convert ratio quantities between different systems of units, such as feet per second to miles per hour.
<b>7.RP.A.3</b>	Solve proportion problems using such methods as unit rate, scaling, finding equivalent fractions, cross products, and solving the proportion equation $a/b=c/d$ ; know how to see patterns about proportional situations in tables.
<b>7.RP.A.4</b>	Calculate rates of change including speed.
<b>7.RP.A.5</b>	Recognize and represent proportional relationships between quantities.
<b>7.RP.A.5a</b>	Decide whether two quantities are in a proportional relationship, e.g., by testing for equivalent ratios in a table or graphing on a coordinate plane and observing whether the graph is a straight line through the origin.
<b>7.RP.A.5b</b>	Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.
<b>7.RP.A.5c</b>	Represent proportional relationships by equations. <i>For example, if total cost <math>t</math> is proportional to the number <math>n</math> of items purchased at a constant price <math>p</math>, the relationship between the total cost and the number of items can be expressed as <math>t = pn</math>.</i>
<b>7.RP.A.5d</b>	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.
<b>7.RP.A.6</b>	Use proportional relationships to solve multistep ratio and percent problems. Examples: simple interest, tax, markups and markdowns, gratuities and commissions, fees, percent increase and decrease, percent error.

#### **The Number System**

*Apply and extend previous understandings of operations with fractions.*

<b>7.NS.A.1</b>	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 diagram.
<b>7.NS.A.1a</b>	Describe situations in which opposite quantities combine to make 0. <i>For example, a hydrogen atom has 0 charge because its two constituents are oppositely charged.</i>
<b>7.NS.A.1b</b>	Understand $p + q$ as 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.
<b>7.NS.A.1c</b>	Understand subtraction of rational numbers as adding the opposite, e.g. $p - q = p + (-q)$ . 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.
<b>7.NS.A.1d</b>	Apply properties of operations as strategies to add and subtract rational numbers.
<b>7.NS.A.2</b>	Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers.
<b>7.NS.A.2a</b>	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>7.NS.A.2b</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 $-(p/q) = (-p)/q = p/(-q)$ . Interpret quotients of rational numbers by describing real-world contexts.
<b>7.NS.A.2c</b>	Apply properties of operations as strategies to multiply and divide rational numbers.
<b>7.NS.A.2d</b>	Convert a rational number to a decimal using long division; know that the decimal form of a rational number terminates in 0s or eventually repeats.
<b>7.NS.A.2e</b>	Recognize the difference between rational or irrational numbers.
<b>7.NS.A.3</b>	Solve real-world and mathematical problems involving the four operations with rational numbers fluently.
<b>7.NS.A.4</b>	Estimate results of computations with rational numbers.
<b>7.NS.A.5</b>	Estimate values of square root and cube root.
<b>Expressions &amp; Equations</b>	
<i>Use properties of operations to generate equivalent expressions.</i>	
<b>7.EE.A.1</b>	Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.
<b>7.EE.A.2</b>	Understand that rewriting an expression in different forms in a problem context can shed light on the problem and how the quantities in it are related. <i>For example, <math>a + 0.05a = 1.05a</math> means that “increase by 5%” is the same as “multiply by 1.05.”</i>
<b><i>Solve real-life and mathematical problems using numerical and algebraic expressions and equations.</i></b>	
<b>7.EE.B.3</b>	Solve multi-step real-life mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically.
<b>7.EE.B.3a</b>	Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of

	answers using mental computation and estimation strategies. <i>For example: If a woman making \$25 an hour gets a 10% raise, she will make an additional 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 <math>9\frac{3}{4}</math> inches long in the center of a door that is <math>27\frac{1}{2}</math> 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.</i>
<b>7.EE.B.4</b>	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.
<b>7.EE.B.4a</b>	Solve word problems leading to equations of the form $px + q = r$ and $p(x + q) = r$ , where $p$ , $q$ , and $r$ are specific rational numbers. Solve equations of these forms fluently.
<b>7.EE.B.4b</b>	Solve word problems leading to inequalities of the form $px + q > r$ or $px + q < r$ , where $p$ , $q$ , and $r$ are specific rational numbers. Graph the solution set of the inequality and interpret it in the context of the problem. <i>For example: 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.</i>
<b>7.EE.B.5</b>	Add, subtract, and multiply simple algebraic expressions e.g., $(92x+8y) - 5x+y$ , or $x(x+2)$ and justify using properties of real numbers.
<b>7.EE.B.6</b>	Identify and combine like terms in polynomials.
<i>Understand and Apply Directly Proportional Relationships and Relate to Linear Relationships</i>	
<b>7.EE.C.7</b>	Given a directly proportional or other linear situation, graph and interpret the slope and intercept(s) in terms of the original situation; evaluate $y=mx+b$ for specific $x$ values (weight vs. volume of water, base cost plus cost per unit).
<b>7.EE.C.8</b>	For directly proportional or linear situations, solve applied problems using graphs and equations (e.g., the heights and volume of a container with uniform cross-section; height of water in a tank being filled at a constant rate; degrees; degrees Celsius and degrees Fahrenheit; distance and time under constant speed).
<b>7.EE.C.9</b>	Recognize and use directly proportional relationships of the form $y=mx$ , and distinguish from linear relationships of the form $y=mx+b$ , $b$ non-zero; understand that in a directly proportional relationship between two quantities, one quantity is a constant multiple of the other quantity.
<i>Understand and Represent Linear Functions</i>	
<b>7.EE.D.10</b>	Find and interpret the $x$ and/or $y$ intercepts of a linear equation or function. Know that the solution to a linear equation of the form $ax+b=0$ corresponds to the point at which the graph of $y=ax+b$ crosses the $x$ -axis.
<b>7.EE.D.11</b>	Represent linear functions in the form $y=x+b$ , $y=mx$ , $y=mx+b$ , and graph, interpreting slope and $y$ intercept.

<b>7.EE.D.12</b>	Calculate the slope from the graph of a linear function as the ratio of “rise/run” for a pair of points on the graph, and express the answer as a fraction and a decimal; understand that the linear functions have slope that is a constant rate of change.
<b>7.EE.D.13</b>	From applied situations, generate and solve linear equations of the form $ax+b=c$ and $ax+b=cx+d$ , and interpret solutions.
<i>Understand and Solve Problems About Inversely Proportional Relationships</i>	
<b>7.EE.E.14</b>	Recognize inversely proportional relationships in contextual situations; know that quantities are inversely proportional if their product is constant, (e.g., the length and width of a rectangle with fixed area, and the inversely proportional relationship is of the form $y=k/x$ where $x$ is some non-zero number).
<b>7.EE.E.15</b>	Know that the graph of $y=k/x$ is not a line, know its shape, and know that it crosses neither the $x$ nor the $y$ axis.
<b>Geometry</b>	
<i>Draw construct, and describe geometrical figures and describe the relationships between them.</i>	
<b>7.G.A.1</b>	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. Recognize that they are similar figures.
<b>7.G.A.2</b>	Draw (freehand, with ruler and protractor, and with technology) geometric shapes with given conditions. Focus on constructing triangles from three measures of angles or sides, noticing when the conditions determine a unique triangle, more than one triangle, or no triangle.
<b>7.G.A.3</b>	Describe the two-dimensional figures that result from slicing three-dimensional figures, as in plane sections of right rectangular prisms and right rectangular pyramids.
<i>Solve real-life and mathematical problems involving angle measure, area, surface area, and volume.</i>	
<b>7.G.B.4</b>	Know the formulas for the area and circumference of a circle and use them to solve problems; give an informal derivation of the relationship between the circumference and area of a circle.
<b>7.G.B.5</b>	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.
<b>7.G.B.6</b>	Explore trigonometric ratios of right triangles (sine, cosine, and tangent).
<b>7.G.B.7</b>	Understand that in similar polygons, corresponding angles are congruent and the ratios of corresponding sides are equal; understand the concepts of similar figures and scale factor.
<b>7.G.B.8</b>	Show that two triangles are similar using the criteria: corresponding angles are congruent (AAA similarity); the ratios of two pairs of corresponding sides are equal and the included angles are congruent (SAS similarity); ratios of all pairs of corresponding sides are equal (SSS similarity); use this criteria to solve problems and to justify arguments.

<b>7.G.B.9</b>	Understand and use the fact that when two triangles are similar with scale factor of $r$ , their areas are related by a factor of $r^2$ .
<b>7.G.B.10</b>	Solve real-world story and mathematical problems involving area, volume and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, circles, cones, pyramids, and right prisms.
<b>Statistics &amp; Probability</b>	
<i>Use random sampling to draw inferences about a population.</i>	
<b>7.SP.A.1</b>	Understand that statistics can be used to gain information about a population by examining a sample of the population; generalizations about a population from a sample are valid only if the sample is representative of that population. Understand that random sampling tends to produce representative samples and support valid inferences.
<b>7.SP.A.2</b>	Use data from a random sample to draw inferences about a population with an unknown characteristic of interest. Generate multiple samples (or simulated samples) of the same size to gauge the variation in estimates or predictions. <i>For example, estimate the mean word length in a book by randomly sampling words from the book; predict the winner of a school election based on randomly sampled survey data. Gauge how far off the estimate or prediction might be.</i>
<b>7.SP.A.3</b>	Represent and interpret data using circle graphs, stem and leaf plots, histograms, and box and whisker plots, and select appropriate representation to address specific questions
<b>7.SP.A.4</b>	Create and interpret scatter plots and find line of best fit; use an estimated line of best fit to answer questions about the data.
<i>Draw informal comparative inferences about two populations.</i>	
<b>7.SP.B.5</b>	Informally assess the degree of visual overlap of two numerical data distributions with similar variabilities, measuring the difference between the centers by expressing it as a multiple of a measure of variability. <i>For example, the mean height of players on the basketball team is 10 cm greater than the mean height of players on the soccer team, about twice the variability (mean absolute deviation) on either team; on a dot plot, the separation between the two distributions of heights is noticeable.</i>
<b>7.SP.B.6</b>	Use measures of center and measures of variability for numerical data from random samples to draw informal comparative inferences about two populations. <i>For example, decide whether the words in a chapter of a seventh-grade science book are generally longer than the words in a chapter of a fourth-grade science book.</i>
<i>Investigate chance processes and develop, use, and evaluate probability models.</i>	
<b>7.SP.C.7</b>	Understand that the probability of a chance event is a number between 0 and 1 that expresses the likelihood of the event occurring. Larger numbers indicate greater likelihood. A probability near 0 indicates an unlikely event, a probability around $1/2$ indicates an event that is neither unlikely nor likely, and a probability near 1 indicates a likely event.
<b>7.SP.C.8</b>	Approximate the probability of a chance event by collecting data on the

	chance process that produces it and observing its long-run relative frequency, and predict the approximate relative frequency given the probability. <i>For example, when rolling a number cube 600 times, predict that a 3 or 6 would be rolled roughly 200 times, but probably not exactly 200 times.</i>
<b>7.SP.C.9</b>	Develop a probability model and use it to find probabilities of events e.g., flipping a coin. Understand the difference between theoretical probability (what should happen) and experimental probability (what does happen) and explain possible sources of the discrepancy.
<b>7.SP.C.9a</b>	Develop a uniform probability model by assigning equal probability to all outcomes, and use the model to determine probabilities of events. <i>For example, if a student is selected at random from a class, find the probability that Jane will be selected and the probability that a girl will be selected.</i>
<b>7.SP.C.9b</b>	Develop a probability model (which may not be uniform) by observing frequencies in data generated from a chance process. <i>For example, find the approximate probability that a spinning penny will land heads up or that a tossed paper cup will land open-end down. Do the outcomes for the spinning penny appear to be equally likely based on the observed frequencies?</i>
<b>7.SP.C.10</b>	Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation.
<b>7.SP.C.10a</b>	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>7.SP.C.10b</b>	Represent sample spaces for compound events using methods such as organized lists, tables and tree diagrams. For an event described in everyday language (e.g., “rolling double sixes”), identify the outcomes in the sample space which compose the event.
<b>7.SP.C.10c</b>	Design and use a simulation to generate frequencies for compound events. For example, 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?