West Virginia College & Career Readiness
Standards and Mathematical Habits of Mind (WVBE Policy 2520.2B)

Mathematical Understandings developed in the 7th Grade

Ratios and Proportional Reasoning	• Analyze proportional relationships (e.g.by graphing in the coordinate plane), and distinguish proportional relationships from other kinds of mathematical relationships (e.g., Buying 10 times as many items will cost you 10 times as much, but taking 10 times as many aspirin will not lower your fever 10 times as much.).
The Number System	• Solve percent problems (e.g., tax, tips, and markups and markdowns). • Solve word problems that have a combination of whole numbers, fractions, and decimals (e.g., A woman making $25 per hour receives a 10% raise; she will make an additional 1⁄10 of his or her salary an hour, or $2.50, for a new salary of $27.50.)
Expressions and Equations	• Solve equations such as 1⁄2 (x – 3) = 3⁄4 quickly and accurately, and write equations of this kind to solve word problems.
Geometry	• Solve problems involving scale drawings.
Statistics and Probability	• Use statistics to draw inferences and make comparisons (e.g., deciding which candidate is likely to win an election based on a survey).

All West Virginia teachers are responsible for classroom instruction that integrates **content standards and mathematical habits of mind**.

A complete listing of the **West Virginia College and Career Ready Standards** for seventh grade mathematics are located at the end of this document.

WV Next Generation Standards to WV College and Career Ready Standards Renumbering

Next Gen # → CCRS#	Next Gen # → CCRS#	Next Gen # → CCRS#	Next Gen # → CCRS#
M.7.RP.1 M.7.1	M.7.EE.2 M.7.8	M.7.G.5 M.7.15	M.7.SP.4 M.7.22
M.7.RP.2 M.7.2	M.7.EE.3 M.7.9	M.7.G.6 M.7.16	M.7.SP.5 M.7.23
M.7.RP.3 M.7.3	M.7.EE.4 M.7.10	M.7.SP.1 M.7.17	M.7.SP.6 M.7.24
M.7.NS.1 M.7.4	M.7.G.1 M.7.11	M.7.SP.2 M.7.18	M.7.SP.7 M.7.25
M.7.NS.2 M.7.5	M.7.G.2 M.7.12	M.7.19	M.7.SP.8 M.7.26
M.7.NS.3 M.7.6	M.7.G.3 M.7.13	M.7.20	
M.7.EE.1 M.7.7	M.7.G.4 M.7.14	M.7.SP.3 M.7.21	

The Mathematical Habits of Mind

The Mathematical Habits of Mind describe ways in which developing students of mathematics increasingly engage with the subject matter as they grow in mathematical maturity and expertise throughout the elementary, middle and high school years.

Summary of Mathematical Habits of Mind	Questions to Develop Mathematical Thinking
MHM1. Make sense of problems and persevere in solving them. ● Interpret and make meaning of the problem looking for starting points. Analyze what is given to explain to themselves the meaning of the problem. ● Plan a solution pathway instead of jumping to a solution. ● Can monitor their progress and change the approach if necessary. ● See relationships between various representations. ● Relate current situations to concepts or skills previously learned and connect mathematical ideas to one another. ● Can understand various approaches to solutions. ● Continually ask themselves; "Does this make sense?"	● How would you describe the problem in your own words? ● How would you describe what you are trying to find? ● What do you notice about? ● What information is given in the problem? ● Describe the relationship between the quantities. ● Describe what you have already tried. ● What might you change? ● Talk me through the steps you've used to this point. ● What steps in the process are you most confident about? ● What are some other strategies you might try? ● What are some other problems that are similar to this one? ● How might you use one of your previous problems to help you begin? ● How else might you organize, represent, and show?
MHM2. Reason abstractly and quantitatively. ● Make sense of quantities and their relationships. ● Are able to decontextualize (represent a situation symbolically and manipulate the symbols) and contextualize (make meaning of the symbols in a problem) quantitative relationships. ● Understand the meaning of quantities and are flexible in the use of operations and their properties. ● Create a logical representation of the problem. ● Attends to the meaning of quantities, not just how to compute them.	● What do the numbers used in the problem represent? ● What is the relationship of the quantities? ● How is _____ related to _____? ● What is the relationship between _____and _____? ● What does _____ mean to you? (e.g. symbol, quantity, ● diagram) ● What properties might we use to find a solution? ● How did you decide in this task that you needed to use? ● Could we have used another operation or property to solve this task? Why or why not?
MHM3. Construct viable arguments and critique the reasoning of others. ● Analyze problems and use stated mathematical assumptions, definitions, and established results in constructing arguments. ● Justify conclusions with mathematical ideas. ● Listen to the arguments of others and ask useful questions to determine if an argument makes sense. ● Ask clarifying questions or suggest ideas to improve/revise the argument. ● Compare two arguments and determine correct or flawed logic.	● What mathematical evidence would support your solution? ● How can we be sure that _____? / How could you prove that _____? Will it still work if _____? ● What were you considering when _____? ● How did you decide to try that strategy? ● How did you test whether your approach worked? ● How did you decide what the problem was asking you to find? (What was unknown?) ● Did you try a method that did not work? Why didn't it work? ● Would it ever work? Why or why not? ● What is the same and what is different about _____? ● How could you demonstrate a counter-example?
MHM4. Model with mathematics. ● Understand this is a way to reason quantitatively and abstractly (able to decontextualize and contextualize). ● Apply the math they know to solve problems in everyday life. ● Are able to simplify a complex problem and identify important quantities to look at relationships. ● Represent mathematics to describe a situation either with an equation or a diagram and interpret the results of a mathematical situation. ● Reflect on whether the results make sense, possibly improving or revising the model. ● Ask themselves, "How can I represent this mathematically?"	● What number model could you construct to represent the problem? ● What are some ways to represent the quantities? ● What's an equation or expression that matches the diagram, number line, chart, or table? ● Where did you see one of the quantities in the task in your equation or expression? ● Would it help to create a diagram, graph, or table? ● What are some ways to visually represent? ● What formula might apply in this situation?

Summary of Mathematical Habits of Mind	Questions to Develop Mathematical Thinking
MHM5. Use appropriate tools strategically. ● Use available tools recognizing the strengths and limitations of each. ● Use estimation and other mathematical knowledge to detect possible errors. ● Identify relevant external mathematical resources to pose and solve problems. ● Use technological tools to deepen their understanding of mathematics.	● What mathematical tools could we use to visualize and represent the situation? ● What information do you have? ● What do you know that is not stated in the problem? ● What approach are you considering trying first? ● What estimate did you make for the solution? ● In this situation would it be helpful to use a graph, number line, ruler, diagram, calculator, or manipulative? ● Why was it helpful to use _____? ● What can using a _____ show us, that _____ may not? ● In what situations might it be more informative or helpful to use. ?
MHM6. Attend to precision. ● Communicate precisely with others and try to use clear mathematical language when discussing their reasoning. ● Understand meanings of symbols used in mathematics and can label quantities appropriately. ● Express numerical answers with a degree of precision appropriate for the problem context. ● Calculate efficiently and accurately.	● What mathematical terms apply in this situation? ● How did you know your solution was reasonable? ● Explain how you might show that your solution answers the problem. ● Is there a more efficient strategy? ● How are you showing the meaning of the quantities? ● What symbols or mathematical notations are important in this problem? ● What mathematical language, definitions, or properties can you use to explain _____? ● How could you test your solution to see if it answers the problem?
MHM7. Look for and make use of structure. ● Apply general mathematical rules to specific situations. ● Look for the overall structure and patterns in mathematics. ● See complicated things as single objects or as being composed of several objects.	● What observations do you make about _____? ● What do you notice when _____? ● What parts of the problem might you eliminate, or simplify? ● What patterns do you find in _____? ● How do you know if something is a pattern? ● What ideas that we have learned before were useful in solving this problem? ● What are some other problems that are similar to this one? ● How does this relate to _____? ● In what ways does this problem connect to other mathematical concepts?
MHM8. Look for and express regularity in repeated reasoning. ● See repeated calculations and look for generalizations and shortcuts. ● See the overall process of the problem and still attend to the details. ● Understand the broader application of patterns and see the structure in similar situations. ● Continually evaluate the reasonableness of their intermediate results.	● Will the same strategy work in other situations? ● Is this always true, sometimes true or never true? ● How would we prove that _____? ● What do you notice about _____? ● What is happening in this situation? ● What would happen if _____? ● Is there a mathematical rule for _____? ● What predictions or generalizations can this pattern support? ● What mathematical consistencies do you notice?

Strategies for Teaching and Learning

- Students should be actively engaged in developing their own understanding.
- Mathematics should be represented in as many ways as possible by using graphs, tables, pictures, symbols and words.
- Interdisciplinary and cross curricular strategies should be used to reinforce and extend the learning activities.
- Appropriate manipulatives and technology should be used to enhance student learning.
- Students should be given opportunities to revise their work based on teacher feedback, peer feedback, and metacognition which includes self-assessment and reflection.
- Students should write about the mathematical ideas and concepts they are learning.
- Consideration of all students should be made during the planning and instruction. Teachers need to consider the following:
    - What level of support do my struggling students need in order to be successful?
    - In what way can I deepen the understanding of those students who are already competent?
    - What real life connections can I make that will help my students utilize mathematical skills?
- Teachers should engage in formative assessment in order to drive instruction to meet the needs of all learners.
- Teacher questioning should drive student learning forward. See questions to develop mathematical habits.

West Virginia College and Career Ready Standards – Mathematics Grade 7

Ratios and Proportional Relationships

Analyze proportional relationships and use them to solve real-world and mathematical problems.	
M.7.1	Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units. (e.g., If a person walks 1/2 mile in each 1/4 hour, compute the unit rate as the complex fraction 1/2/1/4 miles per hour, equivalently 2 miles per hour.)
M.7.2	Recognize and represent proportional relationships between quantities. a. 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. Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams and verbal descriptions of proportional relationships. c. Represent proportional relationships by equations. (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. Focus special attention on the points (0,0) and (1,r) where r is the unit rate.
M.7.3	Use proportional relationships to solve multistep ratio and percent problems (e.g., simple interest, tax, markups and markdowns, gratuities and commissions, fees, percent increase and decrease, and/or percent error).

The Number System

Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers.	
M.7.4	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. a. Describe situations in which opposite quantities combine to make 0. (e.g., A hydrogen atom has 0 charge because its two constituents are oppositely charged.) 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. (i.e., To add "p + q" on the number line, start at "0" and move to "p" then move |q| 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.
M.7.5	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 –(p/q) = (–p)/q = 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 rational number to a decimal using long division; know that the decimal form of a rational number terminates in 0s or eventually repeats.
M.7.6	Solve real-world and mathematical problems involving the four operations with rational numbers. Instructional Note: Computations with rational numbers extend the rules for manipulating fractions to complex fractions.

Expressions and Equations

Use properties of operations to generate equivalent expressions.	
M.7.7	Apply properties of operations as strategies to add, subtract, factor and expand linear expressions with rational coefficients.
M.7.8	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. (e.g., a + 0.05a = 1.05a means that "increase by 5%" is the same as "multiply by 1.05.")
Solve real-life and mathematical problems using numerical and algebraic expressions and equations.	
M.7.9	Solve multi-step real-life 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; and 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 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 3/4 inches long in the center of a door that is 27 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.)
M.7.10	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. a. 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. Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach. (e.g., The perimeter of a rectangle is 54 cm. Its length is 6 cm. What is its width? An arithmetic solution similar to "54 – 6 – 6 divided by 2" may be compared with the reasoning involved in solving the equation 2w – 12 = 54. An arithmetic solution similar to "54/2 – 6" may be compared with the reasoning involved in solving the equation 2(w – 6) = 54.) 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. (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.)

Geometry

Draw, construct and describe geometrical figures and describe the relationships between them.	
M.7.11	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.
M.7.12	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.
M.7.13	Describe the two-dimensional figures that result from slicing three-dimensional figures, as in plane sections of right rectangular prisms and right rectangular pyramids.
Solve real-life and mathematical problems involving angle measure, area, surface area, and volume.	

M.7.14	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.
M.7.15	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.
M.7.16	Solve real-world and mathematical problems involving area, volume and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms.

Statistics and Probability

Use random sampling to draw inferences about a population.	
M.7.17	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.
M.7.18	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. (e.g., 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.)
Draw informal comparative inferences about two populations.	
M.7.19	Recognize that a measure of center for a numerical data set summarizes all of its values with a single number, while a measure of variation describes how its values vary with a single number.
M.7.20	Summarize numerical data sets in relation to their context, such as by: a. Reporting the number of observations. b. Describing the nature of the attribute under investigation, including how it was measured and its units of measurement. c. Giving quantitative measures of center (median and/or mean) and variability (interquartile range and/or mean absolute deviation), as well as describing any overall pattern and any striking deviations from the overall pattern with reference to the context in which the data were gathered. Relating the choice of measures of center and variability to the shape of the data distribution and the context in which the data were gathered.
M.7.21	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. (e.g., 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.)
M.7.22	Use measures of center and measures of variability for numerical data from random samples to draw informal comparative inferences about two populations. (e.g., 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.)
Investigate chance processes and develop, use, and evaluate probability models.	
M.7.23	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.
M.7.24	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. (e.g., 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.)
M.7.25	Develop a probability model and use it to find probabilities of events. Compare probabilities from a model to observed frequencies; if the agreement is not good, explain possible sources of the discrepancy. a. Develop a uniform probability model by assigning equal probability to all outcomes, and use the model to determine probabilities of events. (e.g., 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.) b. Develop a probability model (which may not be uniform) by observing frequencies in data generated from a chance process. (e.g., 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?)
M.7.26	Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation. 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, 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. 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?)