

WGSD Curriculum – Math 6th Grade

In Grade 6, instructional time will focus on four critical areas: (1) connecting ratio and rate to whole number multiplication and division and using concepts of ratio and rate to solve problems; (2) completing understanding of division of fractions and extending the notion of number to the system of rational numbers, which includes negative numbers; (3) writing, interpreting, and using expressions and equations and (4) developing understanding of statistical thinking.

While the content learning goals describe the mathematics students should be able to understand and do, the first eight learning goals (The Standards for Mathematical Practice) describe how students should engage with these mathematical concepts and skills as they grow in mathematical maturity and expertise. Teachers will connect the mathematical practices to mathematical content in all mathematics instruction. These learning goals merit the most time, resources, innovation, and focus necessary to qualitatively improve the instruction, assessment, and student achievement in mathematics.

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Mathematical Practices

<u>High Priority Standards</u> CCSS.Math.Practice.MP1	
<u>Learning Goal</u>	<u>Proficiency Scale</u>
Students will be able to make sense of problems and persevere in solving them.	<p>4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal.</p> <p>3: Student demonstrates mastery with the learning goal as evidenced by:</p> <ul style="list-style-type: none"> • Discussing, explaining, and solving a problem with multiple representations and in multiple ways. • Struggling with various attempts over time. • Learning from previous solution attempts. • Checking answers using a different method or strategy. <p>2: Student demonstrates he/she is nearing proficiency by:</p> <ul style="list-style-type: none"> • Explaining his/her thought processes when solving a problem and representing it in several ways. • Trying several approaches in find a solution and seeking hints only if stuck. <p>1: Student demonstrates a limited understanding or skill with the learning goal by:</p> <ul style="list-style-type: none"> • Explaining their thought processes when solving a problem one way. • Staying with a challenging problem for more than one attempt.
<u>Learning Targets</u> <ul style="list-style-type: none"> • Explain the meaning of a problem and look for efficient ways to solve it • Use concrete objects or pictures to help conceptualize and solve problems • Checks their thinking by asking themselves, “Does this make sense?” • Listens to the strategies of others and tries different approaches • Uses a different strategies to check answers • Takes time to thoughtfully consider problems 	
<u>Learning Design</u> <ul style="list-style-type: none"> • Provides time and facilitates discussion in problem solutions • Facilitates discourse in the classroom so that students UNDERSTAND the approaches of others • Provides opportunities for students to explain themselves, the meaning of a problem, etc. • Provides opportunities for students to connect concepts to “their” world 	

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- Provides students TIME to think and become “patient” problem solvers
- Facilitates and encourages students to check their answers using different methods (not calculators)
- Provides problems that focus on relationships and are “generalizable”

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<u>High Priority Standards</u> CCSS.Math.Practice.MP2	
<u>Learning Goal</u>	<u>Proficiency Scale</u>
Students will be able to reason abstractly and quantitatively.	<p>4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal.</p> <p>3: Student demonstrates mastery with the learning goal as evidenced by:</p> <ul style="list-style-type: none"> • Converting situations into symbols to solve problems. • Converting mathematical equations into meaningful situations. <p>2: Student demonstrates he/she is nearing proficiency by translating situations into symbols to solve problems.</p> <p>1: Student demonstrates a limited understanding or skill with the learning goal by reasoning with models or pictorial representations to solve problems.</p>
<u>Learning Targets</u> <ul style="list-style-type: none"> • Recognize that a number represents a specific quantity • Connect the quantity to written symbols and create a logical representation of the problem at hand • Consider both the appropriate units involved and the meaning of quantities • Write simple expressions that record calculations with numbers and symbols • Represent or round numbers using place value concepts 	
<u>Learning Design</u> <ul style="list-style-type: none"> • Provides a range of representations of math problem situations and encourages various solutions • Provides opportunities for students to make sense of quantities and their relationships in problem situations • Provides problems that require flexible use of properties of operations and objects • Emphasizes quantitative reasoning which entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them and/or rules; and knowing and flexibly using different properties of operations and objects 	

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<u>High Priority Standards</u> CCSS.Math.Practice.MP3	
<u>Learning Goal</u>	<u>Proficiency Scale</u>
Students will be able to construct viable arguments and critique the reasoning of others.	<p>4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal.</p> <p>3: Student demonstrates mastery with the learning goal as evidenced by:</p> <ul style="list-style-type: none"> Justifying and explaining, with accurate language and vocabulary, why his/her solution is correct. Comparing his/her strategy to other students' strategies, asking questions, and making connections with his/her own thinking. Explaining the reasoning of others. <p>2: Student demonstrates he/she is nearing proficiency by:</p> <ul style="list-style-type: none"> Explaining his/her thinking and the thinking of others with accurate vocabulary. Explaining other students' solutions and identifying strengths and weaknesses of the strategy. <p>1: Student demonstrates a limited understanding or skill with the learning goal by:</p> <ul style="list-style-type: none"> Explaining his/her solution. Discussing other ideas, approaches, and strategies.
<u>Learning Targets</u> <ul style="list-style-type: none"> Construct arguments using concrete referents, such as objects, pictures, and drawings Refine their mathematical communication skills by answering questions like "How do you know?" and "Can you show me another way?" Refine their mathematical communication skills by asking others questions like "How do you know?" and "How did you get that?" Explain their thinking to others and respond to others' thinking 	
<u>Learning Design</u> <ul style="list-style-type: none"> Provides ALL students opportunities to understand and use stated assumptions, definitions, and previously established results in constructing arguments Provides ample time for students to make conjectures and build a logical progression of statements to explore the truth of their conjectures Provides opportunities for students to construct arguments and critique arguments of peers Facilitates and guides students in recognizing and using counterexamples Encourages and facilitates students justifying their conclusions, communicating, and responding to the arguments of others Asks useful questions to clarify and/or improve students' arguments 	

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Mathematical Practices

<u>High Priority Standards</u>	
CCSS.Math.Practice.MP4, TILS 5.C.a: Recognize that there are a variety of ways to share information, TILS 5.C.c: Effectively share information	
<u>Learning Goal</u>	<u>Proficiency Scale</u>
Students will be able to model with mathematics.	<p>4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal.</p> <p>3: Student demonstrates mastery with the learning goal as evidenced by:</p> <ul style="list-style-type: none"> Recognizing math in everyday situations. Using a variety of models, symbolic representations, and technology tools to represent the solution to a problem and accurately explain the solution representation. <p>2: Student demonstrates he/she is nearing proficiency by:</p> <ul style="list-style-type: none"> Recognize math in everyday situations, when prompted. Using models and symbols to represent and solve a problem. <p>1: Student demonstrates a limited understanding or skill with the learning goal by using models to represent and solve a problem with teacher support.</p>
<u>Learning Targets</u>	
<ul style="list-style-type: none"> Represents problem situations in multiple ways including numbers, words (mathematical language), drawing pictures, using objects, acting out, making a chart, list, or graph, creating equations, etc. and use all of these representations as needed Connect different representations and explain the connections Evaluate results in the context of the situation and reflect on whether the results make sense Evaluate the utility of models to determine which models are most useful and efficient to solve problems 	
<u>Learning Design</u>	
<ul style="list-style-type: none"> Provides problem situations that apply to everyday life Provides rich tasks that focus on conceptual understanding, relationships, etc. 	

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<u>High Priority Standards</u> CCSS.Math.Practice.MP5	
<u>Learning Goal</u> Students will be able to use appropriate tools strategically.	<u>Proficiency Scale</u> 4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal. 3: Student demonstrates mastery with the learning goal as evidenced by combining various tools to explore and solve a problem as well as justifying his/her tool selection and problem solution. 2: Student demonstrates he/she is nearing proficiency by selecting from a variety of provided tools the ones that can be used to solve a problem and explaining his/her reasoning for the selection. 1: Student demonstrates a limited understanding or skill with the learning goal by using the appropriate tool, when provided, to find a solution.
<u>Learning Targets</u> <ul style="list-style-type: none"> Consider the available tools (including, but not limited to estimation, graph paper, manipulatives, table, list, etc.) when solving a mathematical problem and decide when certain tools might be helpful For example, they may use unit cubes to fill a rectangular prism and a ruler to measure the dimensions Use graph paper to accurately create graphs and solve problems or make predictions from real world data 	
<u>Learning Design</u> <ul style="list-style-type: none"> Provides a variety of tools and technology for students to explore to deepen their understanding of math concepts Provides problem solving tasks that require students to consider a variety of tools for solving (Tools might include pencil/paper, concrete models, manipulatives, ruler, protractor, calculator, spreadsheet, computer algebra system, statistical package, or dynamic geometry software, etc.) 	

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<u>High Priority Standards</u> CCSS.Math.Practice.MP6	
<u>Learning Goal</u> Students will be able to attend to precision.	<u>Proficiency Scale</u> 4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal. 3: Student demonstrates mastery with the learning goal as evidenced by using appropriate symbols, vocabulary, and labeling to communicate effectively and exchange ideas. 2: Student demonstrates he/she is nearing proficiency by incorporating appropriate vocabulary and symbols in most mathematical communications. 1: Student demonstrates a limited understanding or skill with the learning goal by communicating his/her reasoning and solution to others, with support.
<u>Learning Targets</u> <ul style="list-style-type: none"> • Use clear and precise language in their discussions with others and in their own reasoning • Specify units of measure and state the meaning of the symbols used • Report answers that appropriately address the context of a problem 	
<u>Learning Design</u> <ul style="list-style-type: none"> • Facilitates, encourages and expects precision in communication • Provides opportunities for students to explain and/or write their reasoning to others 	

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<u>High Priority Standards</u> CCSS.Math.Practice.MP7	
<u>Learning Goal</u>	<u>Proficiency Scale</u>
Students will be able to look for and make use of structure.	<p>4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal.</p> <p>3: Student demonstrates mastery with the learning goal as evidenced by:</p> <ul style="list-style-type: none"> • Noticing mathematical expressions as component parts. • Using mathematical generalizations to identify the most efficient solution to mathematical tasks. <p>2: Student demonstrates he/she is nearing proficiency by composing and decomposing number situations and relationships in order to simplify solutions.</p> <p>1: Student demonstrates a limited understanding or skill with the learning goal by looking for structure or patterns within mathematics to help him/her solve problems efficiently.</p>
<u>Learning Targets</u>	
<ul style="list-style-type: none"> • Look closely to discover a pattern or structure <ul style="list-style-type: none"> ○ For instance, students use properties of operations as strategies to add, subtract, multiply and divide with whole numbers, fractions, and decimals. • Examine numerical patterns and relate them to a rule or a graphical representation 	
<u>Learning Design</u>	
<ul style="list-style-type: none"> • Provides opportunities and time for students to explore patterns and relationships to solve problems • Provides rich tasks and facilitates pattern seeking and understanding of relationships in numbers rather than following a set of steps and/or procedures 	

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<u>High Priority Standards</u> CCSS.Math.Practice.MP8	
<u>Learning Goal</u>	<u>Proficiency Scale</u>
Students will be able to look for and express regularity in repeated reasoning.	<p>4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal.</p> <p>3: Student demonstrates mastery with the learning goal as evidenced by:</p> <ul style="list-style-type: none"> • Connecting prior knowledge to an unfamiliar mathematical situation. • Creating a model or equation that unifies the various aspects of a problem. • Noticing patterns, making generalizations, and predicting patterns. <p>2: Student demonstrates he/she is nearing proficiency by finding and explaining patterns.</p> <p>1: Student demonstrates a limited understanding or skill with the learning goal by connecting prior knowledge to new situations and noticing patterns with prompting from a teacher or peer.</p>
<u>Learning Targets</u> <ul style="list-style-type: none"> • Notice repetitive actions in computation and look for more shortcut methods • Use repeated reasoning to understand algorithms and make generalizations about patterns 	
<u>Learning Design</u> <ul style="list-style-type: none"> • Provides problem situations that allow students to explore regularity and repeated reasoning • Provides rich tasks that encourage students to use repeated reasoning to form generalizations and provides opportunities for students to communicate these generalizations 	

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The Number System

High Priority Standards

6.NS.A.1 Compute and interpret quotients of positive fractions. a) Solve problems involving division of fractions by fractions.

Learning Goal

Students will be able to multiply and divide fractions by fractions.

Proficiency Scale

- 4: Demonstrates an in-depth inference or advanced application, or innovates with the learning goal.
- 3: Student demonstrates mastery with the learning goal as evidenced by:
- Applying and extending previous understandings of multiplication and division to divide a fraction by a fraction.
 - Using visual models in settings where smaller fractions are divided by larger fractions.
 - Applying the fact that a fraction multiplied or divided by 1 in the form of a/a is equivalent to the original fraction.
- 2: Student demonstrates he/she is nearing proficiency by:
- Recognizing and recalling specific vocabulary, such as: factor, product, dividend, divisor, quotient, mixed number, improper fraction, numerator, denominator, reciprocal.
 - Performing processes such as:
 - Applying and extending previous understandings of multiplication and division to divide a whole number by a fraction between 0 and 1.
 - Dividing a mixed number by a whole number.
 - Connecting to a visual model.
- 1: Student demonstrates a limited understanding or skill with the learning goal by:
- Applying and extending previous understandings of multiplication to multiply a fraction by a fraction and being able to connect to a visual model.
 - Applying and extending previous understandings of division to divide a fraction by a whole number and being able to connect to a visual model.
 - Describing the effect that a fraction greater than or less than 1 has on a whole number when multiplied.
 - Using or creating visual models when multiplying a whole number by a fraction between 0 and 1.

Learning Targets

- Apply and extend previous understandings of multiplication and division to fractions.
- Interpret and compute quotients of fractions, and solve word problems involving division of fractions by fractions, e.g., by using visual fraction models and equations to represent the problem
 - For example, create a story context for $(2/3) \div (3/4)$ and use a visual fraction model to show the quotient; use the relationship between multiplication and division to explain that $(2/3) \div (3/4) = 8/9$ because $3/4$ of $8/9$ is $2/3$. (In general, $(a/b) \div (c/d) = ad/bc$.) How much chocolate will each person get if 3 people share $1/2$ lb of chocolate equally? How many $3/4$ -cup servings are in $2/3$ of a cup of yogurt? How wide is a rectangular strip of land with length $3/4$ mi and area $1/2$ square mi?

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Number Sense and Operations

High Priority Standards

6.NS.B.2 Demonstrate fluency with division of multi-digit whole numbers.

6.NS.B.3 Demonstrate fluency with addition, subtraction, multiplication and division of decimals.

6.NS.B.4 Find common factors and multiples. a) Find the greatest common factor (GCF) and the least common multiple (LCM). b) Use the distributive property to express a sum of two whole numbers with a common factor as a multiple of a sum of two whole numbers.

Learning Goal

Students will be able to compute fluently with multi-digit numbers and find common factors and multiples.

Proficiency Scale

4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal.

3: Student demonstrates mastery with the learning goal as evidenced by:

- Dividing multi-digit numbers fluently.
- Adding, subtracting, multiplying, and dividing multi-digit decimal numbers.
- Finding the greatest common factor of two numbers less than or equal to 100.
- Finding the least common multiple of two whole numbers less than or equal to 12.
- Making generalizations regarding multiples and factors of sets of numbers (e.g., state that a particular set of numbers is relatively prime).

2: Student demonstrates he/she is nearing proficiency by:

- Recognizing and recalling specific vocabulary, such as: addend, sum, difference, product, dividend, divisor, quotient, common factor, GCF, common multiple, LCM, distributive property.
- Performing processes such as:
 - Dividing multi-digit whole numbers.
 - Adding and subtracting multi-digit decimal numbers.
 - Finding common factors of two numbers less than or equal to 100.
 - Finding multiples of two numbers less than or equal to 12.

1: Student demonstrates a limited understanding or skill with the learning goal by:

- Adding, subtracting, and multiplying multi-digit whole numbers and decimals to hundredths.
- Using the distributive property to express the sum of two whole numbers with a common factor.

Learning Targets

- Fluently divide multi-digit numbers using a standard algorithm
- Fluently add, subtract, multiply, and divide multi-digit decimals using a standard algorithm for each operation

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- Find the greatest common factor of two whole numbers less than or equal to 100
- Find the least common multiple of two whole numbers less than or equal to 12
- Use the distributive property to express a sum of two whole numbers 1–100 with a common factor
 - *For example, express $36 + 8$ as $4(9 + 2)$*

Learning Design

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Number Sense and Operations

High Priority Standards

6.NS.C.5 Use positive and negative numbers to represent quantities.

6.NS.C.6 Locate a rational number as a point on the number line. a. Locate rational numbers on a horizontal or vertical number line. b. Write, interpret and explain problems of ordering of rational numbers. c. Understand that a number and its opposite (additive inverse) are located on opposite sides of zero on the number line.

6.NS.C.7 Understand that the absolute value of a rational number is its distance from 0 on the number line.

6.NS.C.8 Extend prior knowledge to generate equivalent representations of rational numbers between fractions, decimals and percentages (limited to terminating decimals and/or benchmark fractions of $\frac{1}{3}$ and $\frac{2}{3}$).

Learning Goal

Students will understand the system of rational numbers.

Proficiency Scale

4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal.

3: Student demonstrates mastery with the learning goal as evidenced by:

- Applying and extending previous understandings of numbers to relate statements of inequality to relative positions on a number line.
- Placing points with rational coordinates on a coordinate plane.
- Solving problems involving the distance between points when they share a coordinate.
- Explaining absolute value and ordering by using number lines and models.
- Relating reflection across axes to changes in sign.

2: Student demonstrates he/she is nearing proficiency by:

- Recognizing and recalling specific vocabulary, such as: absolute value, coordinates, coordinate plane, integer, rational number, quadrant, axis (axes), inequality.
- Performing processes such as:
 - Applying and extending previous understandings of whole numbers to order rational numbers and interpreting statements of their order in the context of a situation.
 - Placing all rational numbers on a number line.
 - Placing integer pairs on a coordinate plane with various axis increments.
 - Relating changes in sign to placements on opposite sides of the number line.
 - Explaining the absolute value of a number as its distance from zero on a number line.

1: Student demonstrates a limited understanding or skill with the learning goal by:

- Placing all integers on a number line.
- Placing integer pairs on a coordinate plane with one-unit increments on both axes.

Learning Targets

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- Understand that positive and negative numbers are used together to describe quantities having opposite directions or values (e.g., temperature above/below zero, elevation above/below sea level, credits/debits, positive/negative electric charge); use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation
- Understand a rational number as a point on the number line. Extend number line diagrams and coordinate axes familiar from previous grades to represent points on the line and in the plane with negative number coordinates
 - Recognize opposite signs of numbers as indicating locations on opposite sides of 0 on the number line; recognize that the opposite of the opposite of a number is the number itself, e.g., $-(-3) = 3$, and that 0 is its own opposite
 - Understand signs of numbers in ordered pairs as indicating locations in quadrants of the coordinate plane; recognize that when two ordered pairs differ only by signs, the locations of the points are related by reflections across one or both axes
 - Find and position integers and other rational numbers on a horizontal or vertical number line diagram; find and position pairs of integers and other rational numbers on a coordinate plane
- Understand ordering and absolute value of rational numbers
 - Interpret statements of inequality as statements about the relative position of two numbers on a number line diagram
 - *For example, interpret $-3 > -7$ as a statement that -3 is located to the right of -7 on a number line oriented from left to right*
 - Write, interpret, and explain statements of order for rational numbers in real-world contexts
 - *For example, write $-3^{\circ}\text{C} > -7^{\circ}\text{C}$ to express the fact that -3°C is warmer than -7°C*
 - Understand the absolute value of a rational number as its distance from 0 on the number line; interpret absolute value as magnitude for a positive or negative quantity in a real-world situation
 - *For example, for an account balance of -30 dollars, write $|-30| = 30$ to describe the size of the debt in dollars*
 - Distinguish comparisons of absolute value from statements about order
 - *For example, recognize that an account balance less than -30 dollars represents a debt greater than 30 dollars*
- Solve real-world and mathematical problems by graphing points in all four quadrants of the coordinate plane. Include use of coordinates and absolute value to find distances between points with the same first coordinate or the same second coordinate

Learning Design

Ratios & Proportional Relationships

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High Priority Standards

6.RP.A.1 Understand a ratio as a comparison of two quantities and represent these comparisons.

6.RP.A.2 Understand the concept of a unit rate associated with a ratio, and describe the meaning of unit rate.

6.RP.A.3 Solve problems involving ratios and rates. a. Create tables of equivalent ratios, find missing values in the tables and plot the pairs of values on the Cartesian coordinate plane. b. Solve unit rate problems. c. Solve percent problems. d. Convert measurement units within and between two systems of measurement.

Learning Goal

Students will understand ratio concepts and use ratio reasoning to solve problems.

Proficiency Scale

- 4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal.
- 3: Student demonstrates mastery with the learning goal as evidenced by:
- Using ratio reasoning to solve and understand the concept of unit rates in unfamiliar or multi-step problems, including unit pricing and constant speed.
 - Solving percent problems by finding the whole, given a part and the percent.
 - Describing a ratio relationship between any two number quantities (denominators less than or equal to 12).
 - Identifying relationships between models or representations.
- 2: Student demonstrates he/she is nearing proficiency by:
- Recognizing and recalling specific vocabulary, such as: ratio, rate, unit rate, proportion, percent.
 - Performing processes such as:
 - Describing the concept of unit rate in straightforward problems.
 - Solving one-step problems requiring ratio reasoning.
- 1: Student demonstrates a limited understanding or skill with the learning goal by:
- Describing a ratio relationship between two whole number quantities.
 - Finding missing values in tables that display a proportional relationship.
 - Finding a percent as a rate per hundred.
 - Converting measurement units.

Learning Targets

- Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities
 - For example, “The ratio of wings to beaks in the bird house at the zoo was 2:1, because for every 2 wings there was 1 beak.” “For every vote candidate A received, candidate C received nearly three votes.”
- Understand the concept of a unit rate a/b associated with a ratio $a:b$ with $b \neq 0$, and use rate language in the context of a ratio relationship

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- *For example, “This recipe has a ratio of 3 cups of flour to 4 cups of sugar, so there is $\frac{3}{4}$ cup of flour for each cup of sugar.” “We paid \$75 for 15 hamburgers, which is a rate of \$5 per hamburger.”¹*
- Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations
 - Make tables of equivalent ratios relating quantities with whole-number measurements, find missing values in the tables, and plot the pairs of values on the coordinate plane. Use tables to compare ratios
 - Solve unit rate problems including those involving unit pricing and constant speed
 - *For example, if it took 4 hours to mow 7 lawns, then at that rate, how many lawns could be mowed in 32 hours? At what rate were lawns being mowed?*
 - Find a percent of a quantity as a rate per 100 (e.g., 30% of a quantity means $\frac{30}{100}$ times the quantity); solve problems involving finding the whole, given a part and the percent
 - Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities

Learning Design

¹ Expectations for unit rates in this grade are limited to non-complex fractions.

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Expressions, Equations and Inequalities

High Priority Standards

6.EE1.A.1 Describe the difference between an expression and an equation.

6.EE1.A.2 Create and evaluate expressions involving variables and whole number exponents. a. Identify parts of an expression using mathematical terminology. b. Evaluate expressions at specific values of the variables. c. Evaluate non-negative rational number expressions. d. Write and evaluate algebraic expressions. e. Understand the meaning of the variable in the context of the situation.

6.EE1.A.3 Identify and generate equivalent algebraic expressions using mathematical properties.

Learning Goal

Students will be able to apply
arithmetic to algebraic expressions.

Proficiency Scale

4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal.

3: Student demonstrates mastery with the learning goal as evidenced by:

- Writing and evaluating numerical expressions with whole number exponents and expressions from formulas in real-world problems.
- Applying and extending previous understandings of arithmetic to evaluate expressions with variables that include whole number exponents.
- Applying properties of operations to generate equivalent expressions.

2: Student demonstrates he/she is nearing proficiency by:

- Recognizing and recalling specific vocabulary, such as: coefficient, term, sum, product, difference, quotient, factor, variable, expression, exponent, base, order of operations, arithmetic properties (distributive, associative, commutative).
- Performing processes such as:
 - Evaluating numerical expressions with nonnegative integer exponents (that do not need to be distributed across a set of parentheses).
 - Applying and extending previous understandings of arithmetic to evaluate expressions with variables that do not contain exponents.
 - Writing one- and two-step algebraic expressions that introduce a variable.
 - Identifying equivalent expressions.

1: Student demonstrates a limited understanding or skill with the learning goal by:

- Evaluating numerical expressions without exponents.
- Writing one- or two-step numerical expressions.
- Identifying parts of an expression.

Learning Targets

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- Write and evaluate numerical expressions involving whole-number exponents
- Write, read, and evaluate expressions in which letters stand for numbers
 - Write expressions that record operations with numbers and with letters standing for numbers
 - *For example, express the calculation “Subtract y from 5” as $5 - y$*
 - Identify parts of an expression using mathematical terms (sum, term, product, factor, quotient, coefficient); view one or more parts of an expression as a single entity.
 - *For example, describe the expression $2(8 + 7)$ as a product of two factors; view $(8 + 7)$ as both a single entity and a sum of two terms*
 - Evaluate expressions at specific values of their variables. Include expressions that arise from formulas used in real-world problems. Perform arithmetic operations, including those involving whole-number exponents, in the conventional order when there are no parentheses to specify a particular order (Order of Operations)
 - *For example, use the formulas $V = s^3$ and $A = 6s^2$ to find the volume and surface area of a cube with sides of length $s = \frac{1}{2}$*
- Apply the properties of operations to generate equivalent expressions
 - *For example, apply the distributive property to the expression $3(2 + x)$ to produce the equivalent expression $6 + 3x$; apply the distributive property to the expression $24x + 18y$ to produce the equivalent expression $6(4x + 3y)$; apply properties of operations to $y + y + y$ to produce the equivalent expression $3y$*
- Identify when two expressions are equivalent (i.e., when the two expressions name the same number regardless of which value is substituted into them)
 - *For example, the expressions $y + y + y$ and $3y$ are equivalent because they name the same number regardless of which number y stands for*

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Expressions, Equations and Inequalities

High Priority Standards

- 6.EE1.B.4 Use substitution to determine whether a given number in a specified set makes a one-variable equation or inequality true.
- 6.EE1.B.5 Understand that if any solutions exist, the solution set for an equation or inequality consists of values that make the equation or inequality true.
- 6.EE1.B.6 Write and solve equations using variables to represent quantities, and understand the meaning of the variable in the context of the situation.
- 6.EE1.B.7 Solve one-step linear equations in one variable involving nonnegative rational numbers.
- 6.EE1.B.8 Recognize that inequalities may have infinitely many solutions. a. Write an inequality represent a constraint or condition. b. Graph the solution set of an inequality.

Learning Goal

Students will be able to reason about and solve one-variable equations and inequalities.

Proficiency Scale

4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal.

3: Student demonstrates mastery with the learning goal as evidenced by:

- Writing one-variable equations (*in the form $x + p = q$ or $px = q$, where p and q are positive numbers*).
- Writing one-variable inequalities (*in the form $x + p \leq q$ or $px \leq q$, where p and q are positive numbers*).
- Reasoning about and solving equations and inequalities by writing and graphing their solutions on a number line.

2: Student demonstrates he/she is nearing proficiency by:

- Recognizing and recalling specific vocabulary, such as: expression, equation, inequality, variable, equal to, greater than, less than.
- Performing processes such as:
 - Solving one-variable equations (*in the form $x + p = q$ or $px = q$, where p and q are positive numbers*).
 - Solving one-variable inequalities (*in the form $x + p \leq q$ or $px \leq q$, where p and q are positive numbers*).
 - Identifying and using variables when writing expressions and equations.
 - Identifying when a variable represents any number in a specified set.

1: Student demonstrates a limited understanding or skill with the learning goal by using substitution to determine when a given number makes an equation or inequality true.

Learning Targets

- Understand solving an equation or inequality as a process of answering a question: which values from a specified set, if any, make the equation or inequality

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true? Use substitution to determine whether a given number in a specified set makes an equation or inequality true

- Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set (*jac's example .. $p < 5$ so $p = \{0, 1, 2, 3, 4\}$*)
- Solve real-world and mathematical problems by writing and solving equations of the form $x + p = q$ and $px = q$ for cases in which p , q and x are all nonnegative rational numbers
- Write an inequality of the form $x > c$ or $x < c$ to represent a constraint or condition in a real-world or mathematical problem. Recognize that inequalities of the form $x > c$ or $x < c$ have infinitely many solutions; represent solutions of such inequalities on number line diagrams

Learning Design

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Expressions, Equations and Inequalities

High Priority Standards

6.EE1.C.9 Identify and describe relationships between two variables that change in relationship to one another. a. Write an equation to express one quantity, the dependent variable, in terms of the other quantity, the independent variable. b. Analyze the relationship between the dependent and independent variables using graphs, tables and equations and relate these representations to each other.

Learning Goal

Students will be able to represent
and analyze quantitative
relationships between dependent
and independent variables.

Proficiency Scale

- 4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal.
- 3: Student demonstrates mastery with the learning goal as evidenced by using graphs, tables, or context to analyze the relationship between dependent and independent variables and relating them to a linear equation.
- 2: Student demonstrates he/she is nearing proficiency by:
- Recognizing and recalling specific vocabulary, such as: dependent variable, independent variable, expressions, equations, coordinate plane, rational numbers, x-axis, y-axis, ordered pairs.
 - Performing processes such as:
 - Using variables to represent and analyze two quantities that change in relationship to each other (*in the form $y = kx$ or $y = x + c$ or $y = x - c$ with rational numbers*).
 - Identifying and creating an equation that expresses one quantity in terms of another.
 - Using graphs and tables to represent the relationship.
- 1: Student demonstrates a limited understanding or skill with the learning goal by:
- Identifying a table that represents a relationship between two variables of the forms $y = kx$ and $y = x + c$ with rational numbers.
 - Plotting points corresponding to equations on coordinate planes.

Learning Targets

- Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation
 - *For example, in a problem involving motion at constant speed, list and graph ordered pairs of distances and times, and write the equation $d = 65t$ to represent the relationship between distance and time*

Learning Design

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Geometry and Measurement

High Priority Standards

- 6.GM.A.1 Find the area of polygons by composing or decomposing the shapes into rectangles or triangles.
- 6.GM.A.2 Find the volume of right rectangular prisms. a. Understand that the volume of a right rectangular prism can be found by filling the prism with multiple layers of the base. b. Apply $V = l * w * h$ and $V = Bh$ to find the volume of right rectangular prisms.
- 6.GM.A.4 Solve problems using nets. a. Represent three-dimensional figures using nets made up of rectangles and triangles. b. Use nets to find the surface area of three-dimensional figures whose sides are made up of rectangles and triangles.
- 6.GM.A.3 Solve problems by graphing points in all four quadrants of the Cartesian coordinate plane. d. Construct polygons in the Cartesian coordinate plane.

Learning Goal

Students will be able to solve real-world and mathematical problems involving area, surface area, and volume.

Proficiency Scale

- 4: Demonstrates an in-depth inference or advanced application, or innovates with the learning goal.
- 3: Student demonstrates mastery with the learning goal as evidenced by:
- Solving problems that involve finding areas of polygons (*especially quadrilaterals and triangles*).
 - Solving problems that involve volume of right rectangular prisms with all sides expressed as a fraction or a mixed number (*using formulas*).
 - Solving problems by finding surface areas of three-dimensional shapes composed of rectangles and triangles (*using nets*).
 - Solving problems by drawing polygons in the four-quadrant coordinate plane.
- 2: Student demonstrates he/she is nearing proficiency by:
- Recognizing and recalling specific vocabulary, such as: triangle, quadrilateral, polygon, prism, vertex, edge, face, area, surface area, volume, net, coordinate plane.
 - Performing processes such as:
 - Finding areas of special quadrilaterals and triangles.
 - Drawing polygons in the four-quadrant coordinate (*plane with scales in one-unit increments, given integer-valued coordinates for the vertices*).
 - Finding the volume of right rectangular prisms (*with one side expressed as a fraction or a mixed number*).
 - Using coordinates to find the length of a side (*joining points with the same first coordinate or same second coordinate*).
 - Representing 3-dimensional figures using nets made up of rectangles and triangles.
- 1: Student demonstrates a limited understanding or skill with the learning goal by:
- Finding areas of right triangles.
 - Drawing polygons with positive coordinates on a grid (*with a scale in one-unit increments, given nonnegative integer-valued coordinates for the vertices*).
 - Finding the volume of right rectangular prisms (*with sides expressed as whole numbers*).

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	<u>Learning Targets</u>
<ul style="list-style-type: none">• Find the area of right triangles, other triangles, special quadrilaterals, and polygons by composing into rectangles or decomposing into triangles and other shapes; apply these techniques in the context of solving real-world and mathematical problems• Find the volume of a right rectangular prism with fractional edge lengths by packing it with unit cubes of the appropriate unit fraction edge lengths, and show that the volume is the same as would be found by multiplying the edge lengths of the prism. Apply the formulas $V = l w h$ and $V = b h$ to find volumes of right rectangular prisms with fractional edge lengths in the context of solving real-world and mathematical problems• Draw polygons in the coordinate plane given coordinates for the vertices; use coordinates to find the length of a side joining points with the same first coordinate or the same second coordinate. Apply these techniques in the context of solving real-world and mathematical problems• Represent three-dimensional figures using nets made up of rectangles and triangles, and use the nets to find the surface area of these figures. Apply these techniques in the context of solving real-world and mathematical problems	
	<u>Learning Design</u>

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Data Analysis, Statistics and Probability

High Priority Standards

- 6.DSP.A.1 Recognize a statistical question as one that anticipates variability in the data related to the question and accounts for it in the answers.
- 6.DSP.A.2 Understand that a set of data collected to answer a statistical question has a distribution which can be described by its center, spread and overall shape.
- 6.DSP.A.3 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 from a single number.

Learning Goal

Students will develop understanding of statistical variability.

Proficiency Scale

- 4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal.
- 3: Student demonstrates mastery with the learning goal as evidenced by:
- Posing statistical questions and understanding that the responses to a statistical question have a distribution described by its center, spread, and overall shape.
 - Describing that a measure of center summarizes all of its values with a single number, while a measure of variation describes how its values vary with a single number.
 - Identifying a reasonable center and spread with respect to a context.
 - Justifying the reasonableness of their identified center and spread with respect to an unfamiliar context.
 - Creating or completing a data set with given measures (e.g., mean, median, mode, interquartile range).
- 2: Student demonstrates he/she is nearing proficiency by:
- Recognizing and recalling specific vocabulary, such as: mean, median, mode, range, central tendency, center, spread, interquartile range, variability.
 - Performing processes such as:
 - Classifying questions that lead to variable responses as statistical questions and vice versa.
 - Relating the concept of varying responses to the notion of a range of possible responses.
 - Explaining that the responses to a statistical question will have a representative center and a given set of numerical data.
 - Identifying a reasonable measure of central tendency with respect to a familiar context.
- 1: Student demonstrates a limited understanding or skill with the learning goal by identifying questions that lead to variable responses posed in familiar contexts and recognizing that such questions are statistical questions.

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Learning Targets

- Recognize a statistical question as one that anticipates variability in the data related to the question and accounts for it in the answers
 - *For example, “How old am I?” is not a statistical question, but “How old are the students in my school?” is a statistical question because one anticipates variability in students’ ages*
- Understand that a set of data collected to answer a statistical question has a distribution which can be described by its center, spread, and overall shape
- 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

Learning Design

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Data Analysis, Statistics and Probability

High Priority Standards

6.DSP.B.4 Display and interpret data. a. Use dot plots, histograms and box plots to display and interpret numerical data. b. Create and interpret circle graphs.

6.DSP.B.5 Summarize numerical data sets in relation to the context. a. Report the number of observations. b. Describe the nature of the attribute under investigation, including how it was measured and its units of measurement. c. Give 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 of the data. d. Analyze the choice of measures of center and variability based on the shape of the data distribution and/or the context of the data.

Learning Goal

Students will be able to summarize
and describe distributions.

Proficiency Scale

4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal.

3: Student demonstrates mastery with the learning goal as evidenced by:

- Summarizing or displaying data in box plots and finding the interquartile range.
- Using the interquartile range along with the measures of center to describe overall patterns in a data distribution, such as symmetry and clusters, and any striking deviations.
- Examining a data set in context and explaining the choice of the mean or median, as it relates to the data.
- Finding mean absolute deviation and identify outliers with reference to the context of the situation.
- Predicting effects on the mean and median, given a change in data points.

2: Student demonstrates he/she is nearing proficiency by:

- Recognizing and recalling specific vocabulary such as: mean, median, mode, range, interquartile range, measures of center, distribution, symmetry, cluster, deviation, mean absolute deviation, outlier, data point, number line, box plot, dot plot, histogram.
- Performing processes such as:
 - Calculating mean and median.
 - Explaining how mean and median can be different or the same.
 - Using the measure of center to summarize data with respect to the context.

1: Student demonstrates a limited understanding or skill with the learning goal by:

- Summarizing or displaying numerical data on a number line, in dot plots, and in histograms.
- Finding the median of an odd number of data points.
- Finding the mean when data points are nonnegative integers.

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Learning Targets

- Display numerical data in plots on a number line, including dot plots, histograms, and box plots
- Summarize numerical data sets in relation to their context, such as by:
 - Reporting the number of observations
 - Describing the nature of the attribute under investigation, including how it was measured and its units of measurement
 - 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

Learning Design

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Standards for Mathematical Practices Observation Tool created by Melisa Hancock for KATM/KSDE CCSS Summer Academy 2011

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In Grade 7, instructional time will focus on four critical areas: (1) developing understanding of and applying proportional relationships; (2) developing understanding of operations with rational numbers and working with expressions and linear equations; (3) solving problems involving scale drawings and informal geometric constructions, and working with two- and three-dimensional shapes to solve problems involving area, surface area, and volume and (4) drawing inferences about populations based on samples.

While the content learning goals describe the mathematics students should be able to understand and do, the first eight learning goals (The Standards for Mathematical Practice) describe how students should engage with these mathematical concepts and skills as they grow in mathematical maturity and expertise. Teachers will connect the mathematical practices to mathematical content in all mathematics instruction. These learning goals merit the most time, resources, innovation, and focus necessary to qualitatively improve the instruction, assessment, and student achievement in mathematics.

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Mathematical Practices

<u>High Priority Standards</u> CCSS.Math.Practice.MP1	
<u>Learning Goal</u>	<u>Proficiency Scale</u>
<p>Students will be able to make sense of problems and persevere in solving them.</p>	<p>4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal.</p> <p>3: Student demonstrates mastery with the learning goal as evidenced by:</p> <ul style="list-style-type: none"> • Discussing, explaining, and solving a problem with multiple representations and in multiple ways. • Struggling with various attempts over time. • Learning from previous solution attempts. • Checking answers using a different method or strategy. <p>2: Student demonstrates he/she is nearing proficiency by:</p> <ul style="list-style-type: none"> • Explaining his/her thought processes when solving a problem and representing it in several ways. • Trying several approaches in find a solution and seeking hints only if stuck. <p>1: Student demonstrates a limited understanding or skill with the learning goal by:</p> <ul style="list-style-type: none"> • Explaining their thought processes when solving a problem one way. • Staying with a challenging problem for more than one attempt.
<u>Learning Targets</u> <ul style="list-style-type: none"> • Explain the meaning of a problem and look for efficient ways to solve it • Use concrete objects or pictures to help conceptualize and solve problems • Checks their thinking by asking themselves, “Does this make sense?” • Listens to the strategies of others and tries different approaches • Uses a different strategies to check answers • Takes time to thoughtfully consider problems 	
<u>Learning Design</u> <ul style="list-style-type: none"> • Provides time and facilitates discussion in problem solutions • Facilitates discourse in the classroom so that students UNDERSTAND the approaches of others • Provides opportunities for students to explain themselves, the meaning of a problem, etc. • Provides opportunities for students to connect concepts to “their” world 	

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- Provides students TIME to think and become “patient” problem solvers
- Facilitates and encourages students to check their answers using different methods (not calculators)
- Provides problems that focus on relationships and are “generalizable”

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Mathematical Practices

<u>High Priority Standards</u> CCSS.Math.Practice.MP2	
<u>Learning Goal</u>	<u>Proficiency Scale</u>
Students will be able to reason abstractly and quantitatively.	<p>4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal.</p> <p>3: Student demonstrates mastery with the learning goal as evidenced by:</p> <ul style="list-style-type: none"> • Converting situations into symbols to solve problems. • Converting mathematical equations into meaningful situations. <p>2: Student demonstrates he/she is nearing proficiency by translating situations into symbols to solve problems.</p> <p>1: Student demonstrates a limited understanding or skill with the learning goal by reasoning with models or pictorial representations to solve problems.</p>
<u>Learning Targets</u> <ul style="list-style-type: none"> • Recognize that a number represents a specific quantity • Connect the quantity to written symbols and create a logical representation of the problem at hand • Consider both the appropriate units involved and the meaning of quantities • Write simple expressions that record calculations with numbers and symbols • Represent or round numbers using place value concepts 	
<u>Learning Design</u> <ul style="list-style-type: none"> • Provides a range of representations of math problem situations and encourages various solutions • Provides opportunities for students to make sense of quantities and their relationships in problem situations • Provides problems that require flexible use of properties of operations and objects • Emphasizes quantitative reasoning which entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them and/or rules; and knowing and flexibly using different properties of operations and objects 	

WGSD Curriculum – Math 7th Grade
Mathematical Practices

<p style="text-align: center;"><u>High Priority Standards</u> CCSS.Math.Practice.MP3</p>	
<p style="text-align: center;"><u>Learning Goal</u></p>	<p style="text-align: center;"><u>Proficiency Scale</u></p>
<p>Students will be able to construct viable arguments and critique the reasoning of others.</p>	<p>4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal.</p> <p>3: Student demonstrates mastery with the learning goal as evidenced by:</p> <ul style="list-style-type: none"> Justifying and explaining, with accurate language and vocabulary, why his/her solution is correct. Comparing his/her strategy to other students' strategies, asking questions, and making connections with his/her own thinking. Explaining the reasoning of others. <p>2: Student demonstrates he/she is nearing proficiency by:</p> <ul style="list-style-type: none"> Explaining his/her thinking and the thinking of others with accurate vocabulary. Explaining other students' solutions and identifying strengths and weaknesses of the strategy. <p>1: Student demonstrates a limited understanding or skill with the learning goal by:</p> <ul style="list-style-type: none"> Explaining his/her solution. Discussing other ideas, approaches, and strategies.
<p style="text-align: center;"><u>Learning Targets</u></p> <ul style="list-style-type: none"> Construct arguments using concrete referents, such as objects, pictures, and drawings Refine their mathematical communication skills by answering questions like "How do you know?" and "Can you show me another way?" Refine their mathematical communication skills by asking others questions like "How do you know?" and "How did you get that?" Explain their thinking to others and respond to others' thinking 	
<p style="text-align: center;"><u>Learning Design</u></p> <ul style="list-style-type: none"> Provides ALL students opportunities to understand and use stated assumptions, definitions, and previously established results in constructing arguments Provides ample time for students to make conjectures and build a logical progression of statements to explore the truth of their conjectures Provides opportunities for students to construct arguments and critique arguments of peers Facilitates and guides students in recognizing and using counterexamples Encourages and facilitates students justifying their conclusions, communicating, and responding to the arguments of others Asks useful questions to clarify and/or improve students' arguments 	

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Mathematical Practices

<u>High Priority Standards</u>	
CCSS.Math.Practice.MP4, TILS 5.C.a: Recognize that there are a variety of ways to share information, TILS 5.C.c: Effectively share information	
<p style="text-align: center;"><u>Learning Goal</u></p> <p>Students will be able to model with mathematics.</p>	<p style="text-align: center;"><u>Proficiency Scale</u></p> <p>4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal.</p> <p>3: Student demonstrates mastery with the learning goal as evidenced by:</p> <ul style="list-style-type: none"> • Recognizing math in everyday situations. • Using a variety of models, symbolic representations, and technology tools to represent the solution to a problem and accurately explain the solution representation. <p>2: Student demonstrates he/she is nearing proficiency by:</p> <ul style="list-style-type: none"> • Recognize math in everyday situations, when prompted. • Using models and symbols to represent and solve a problem. <p>1: Student demonstrates a limited understanding or skill with the learning goal by using models to represent and solve a problem with teacher support.</p>
<p style="text-align: center;"><u>Learning Targets</u></p> <ul style="list-style-type: none"> • Represents problem situations in multiple ways including numbers, words (mathematical language), drawing pictures, using objects, acting out, making a chart, list, or graph, creating equations, etc. and use all of these representations as needed • Connect different representations and explain the connections • Evaluate results in the context of the situation and reflect on whether the results make sense • Evaluate the utility of models to determine which models are most useful and efficient to solve problems 	
<p style="text-align: center;"><u>Learning Design</u></p> <ul style="list-style-type: none"> • Provides problem situations that apply to everyday life • Provides rich tasks that focus on conceptual understanding, relationships, etc. 	

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Mathematical Practices

<u>High Priority Standards</u> CCSS.Math.Practice.MP5	
<u>Learning Goal</u> Students will be able to use appropriate tools strategically.	<u>Proficiency Scale</u> 4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal. 3: Student demonstrates mastery with the learning goal as evidenced by combining various tools to explore and solve a problem as well as justifying his/her tool selection and problem solution. 2: Student demonstrates he/she is nearing proficiency by selecting from a variety of provided tools the ones that can be used to solve a problem and explaining his/her reasoning for the selection. 1: Student demonstrates a limited understanding or skill with the learning goal by using the appropriate tool, when provided, to find a solution.
<u>Learning Targets</u> <ul style="list-style-type: none"> Consider the available tools (including, but not limited to estimation, graph paper, manipulatives, table, list, etc.) when solving a mathematical problem and decide when certain tools might be helpful For example, they may use unit cubes to fill a rectangular prism and a ruler to measure the dimensions Use graph paper to accurately create graphs and solve problems or make predictions from real world data 	
<u>Learning Design</u> <ul style="list-style-type: none"> Provides a variety of tools and technology for students to explore to deepen their understanding of math concepts Provides problem solving tasks that require students to consider a variety of tools for solving (Tools might include pencil/paper, concrete models, manipulatives, ruler, protractor, calculator, spreadsheet, computer algebra system, statistical package, or dynamic geometry software, etc.) 	

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Mathematical Practices

<u>High Priority Standards</u> CCSS.Math.Practice.MP6	
<u>Learning Goal</u> Students will be able to attend to precision.	<u>Proficiency Scale</u> 4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal. 3: Student demonstrates mastery with the learning goal as evidenced by using appropriate symbols, vocabulary, and labeling to communicate effectively and exchange ideas. 2: Student demonstrates he/she is nearing proficiency by incorporating appropriate vocabulary and symbols in most mathematical communications. 1: Student demonstrates a limited understanding or skill with the learning goal by communicating his/her reasoning and solution to others, with support.
<u>Learning Targets</u> <ul style="list-style-type: none"> • Use clear and precise language in their discussions with others and in their own reasoning • Specify units of measure and state the meaning of the symbols used • Report answers that appropriately address the context of a problem 	
<u>Learning Design</u> <ul style="list-style-type: none"> • Facilitates, encourages and expects precision in communication • Provides opportunities for students to explain and/or write their reasoning to others 	

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Mathematical Practices

<u>High Priority Standards</u> CCSS.Math.Practice.MP7	
<u>Learning Goal</u> Students will be able to look for and make use of structure.	<u>Proficiency Scale</u> 4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal. 3: Student demonstrates mastery with the learning goal as evidenced by: <ul style="list-style-type: none"> • Noticing mathematical expressions as component parts. • Using mathematical generalizations to identify the most efficient solution to mathematical tasks. 2: Student demonstrates he/she is nearing proficiency by composing and decomposing number situations and relationships in order to simplify solutions. 1: Student demonstrates a limited understanding or skill with the learning goal by looking for structure or patterns within mathematics to help him/her solve problems efficiently.
<u>Learning Targets</u> <ul style="list-style-type: none"> • Look closely to discover a pattern or structure <ul style="list-style-type: none"> ○ For instance, students use properties of operations as strategies to add, subtract, multiply and divide with whole numbers, fractions, and decimals. • Examine numerical patterns and relate them to a rule or a graphical representation 	
<u>Learning Design</u> <ul style="list-style-type: none"> • Provides opportunities and time for students to explore patterns and relationships to solve problems • Provides rich tasks and facilitates pattern seeking and understanding of relationships in numbers rather than following a set of steps and/or procedures 	

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Mathematical Practices

<u>High Priority Standards</u> CCSS.Math.Practice.MP8	
<u>Learning Goal</u> Students will be able to look for and express regularity in repeated reasoning.	<u>Proficiency Scale</u> 4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal. 3: Student demonstrates mastery with the learning goal as evidenced by: <ul style="list-style-type: none"> • Connecting prior knowledge to an unfamiliar mathematical situation. • Creating a model or equation that unifies the various aspects of a problem. • Noticing patterns, making generalizations, and predicting patterns. 2: Student demonstrates he/she is nearing proficiency by finding and explaining patterns. 1: Student demonstrates a limited understanding or skill with the learning goal by connecting prior knowledge to new situations and noticing patterns with prompting from a teacher or peer.
<u>Learning Targets</u> <ul style="list-style-type: none"> • Notice repetitive actions in computation and look for more shortcut methods • Use repeated reasoning to understand algorithms and make generalizations about patterns 	
<u>Learning Design</u> <ul style="list-style-type: none"> • Provides problem situations that allow students to explore regularity and repeated reasoning • Provides rich tasks that encourage students to use repeated reasoning to form generalizations and provides opportunities for students to communicate these generalizations 	

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Number Sense and Operations

High Priority Standards

7.NS.A.1 Apply and extend previous understandings of numbers to add and subtract rational numbers. a. Add and subtract rational numbers. b. Represent addition and subtraction on a horizontal or vertical number line. c. Describe situations and show that a number and its opposite have a sum of 0 (additive inverses). d. Understand subtraction of rational numbers as adding the additive inverse. e. Determine the distance between two rational numbers on the number line is the absolute value of their difference. f. Interpret sums and differences of rational numbers.

7.NS.A.2 Apply and extend previous understandings of numbers to multiply and divide rational numbers. a. Multiply and divide rational numbers. b. Determine that a number and its reciprocal have a product of 1 (multiplicative inverse). c. Understand that every quotient of integers (with non-zero divisor) is a rational number. d. Convert a rational number to a decimal. e. Understand that all rational numbers can be written as fractions or decimal numbers that terminate or repeat. f. Interpret products and quotients of rational numbers by describing real-world contexts.

7.NS.A.3 Solve problems involving the four arithmetic operations with rational numbers.

Learning Goal

Students will be able to solve problems using all operations with fractions.

Proficiency Scale

- 4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal.
- 3: Student demonstrates mastery with the learning goal as evidenced by:
- Solving mathematical and real-world problems using the four operations on rational numbers.
 - Converting between fractions and decimals.
 - Apply understanding of subtraction as the same as adding the additive inverse.
 - Describing addition as a movement of a specific distance on a number line in either direction depending on the sign of the number being added.
- 2: Student demonstrates he/she is nearing proficiency by:
- Recognizing and recalling specific vocabulary, such as: absolute value, opposite, rational number, additive inverse, distributive property, integer.
 - Performing processes such as:
 - Applying and extending previous understandings and properties of addition and subtraction to add and subtract with rational numbers.
 - Identifying the absolute value of a rational number and understanding when opposites combine to make 0.
 - Converting between familiar fractions and decimals.
- 1: Student demonstrates a limited understanding or skill with the learning goal by:
- Adding, subtracting, multiplying, and dividing nonnegative rational numbers.
 - Adding, subtracting, multiplying, and dividing rational numbers with a number line or other manipulative.

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Learning Targets

- 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
 - Describe situations in which opposite quantities combine to make 0
 - *For example, a hydrogen atom has 0 charge because its two constituents are oppositely charged*
 - 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
 - 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
 - Apply properties of operations as strategies to add and subtract rational numbers
- Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers
 - 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
 - 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
 - Apply properties of operations as strategies to multiply and divide rational numbers
 - 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
- Solve real-world and mathematical problems involving the four operations with rational numbers¹

Learning Design

<http://robertkaplinsky.com/work/temperature-drop/>

¹ Computations with rational numbers extend the rules for manipulating fractions to complex fractions.

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Expressions, Equations, and Inequalities

High Priority Standards

7.EE1.A.1 Apply properties of operations to simplify and to factor linear algebraic expressions with rational coefficients.

7.EE1.A.2 Understand how to use equivalent expressions to clarify quantities in a problem.

Learning Goal

Students will be able to use properties of operations to generate equivalent expressions.

Proficiency Scale

4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal.

3: Student demonstrates mastery with the learning goal as evidenced by:

- Applying properties of operations as strategies to factor and expand linear expressions with rational coefficients.
- Rewriting an expression to shed light on how quantities are related in a familiar problem-solving context.

2: Student demonstrates he/she is nearing proficiency by:

- Recognizing and recalling specific vocabulary, such as: coefficient, expression, equation, linear.
- Performing processes such as:
 - Applying properties of operations as strategies to factor and expand linear expressions with integer coefficients.
 - Adding and subtracting linear expressions with rational coefficients.

1: Student demonstrates a limited understanding or skill with the learning goal by applying properties of operations as strategies to add and subtract linear expressions with integer coefficients.

Learning Targets

- Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients
- 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
 - For example, $a + 0.05a = 1.05a$ means that “increase by 5%” is the same as “multiply by 1.05.”

Learning Design

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Expressions, Equations and Inequalities

High Priority Standards

7.EE1.B.3 Solve multi-step problems posed with rational numbers. a. Convert between equivalent forms of the same number. b. Assess the reasonableness of answers using mental computation and estimation strategies.

7.EE1.B.4 Write and/or solve linear equations and inequalities in one variable. a. Write and/or solve equations of the form $x + p = q$ and $px = q$ in which p and q are rational numbers. b. Write and/or solve two-step equations of the form $px + q = r$ and $p(x + q) = r$, where p , q and r are rational numbers, and interpret the meaning of the solution in the context of the problem. c. Write, solve and/or graph inequalities of the form $px + q > r$ or $px + q < r$, where p , q and r are rational numbers.

Learning Goal

Students will be able to solve real-life and mathematical problems using numerical and algebraic expressions and equations.

Proficiency Scale

4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal.

3: Student demonstrates mastery with the learning goal as evidenced by:

- Solving and graphing solution sets to inequalities with one variable.
- Using variables to represent and reason with quantities in real-world and mathematical situations.
- Constructing equations with variables to solve problems.
- Constructing inequalities with more than one variable to solve problems.

2: Student demonstrates he/she is nearing proficiency by:

- Recognizing and recalling specific vocabulary, such as: inequality, expression, equation, coefficient.
- Performing processes such as:
 - Solving multi-step problems with rational numbers and solving equations in the form of $px + q = r$ or $p(x + q) = r$, where p , q , and r are rational numbers.
 - Using variables to represent quantities in familiar real-world and mathematical situations.
 - Constructing equations with variables to solve familiar problems with help.

1: Student demonstrates a limited understanding or skill with the learning goal by:

- Solving multi-step problems with integers or common fractions with denominators of 2 through 10, 25, 50, or 100 and decimals to the hundredths place.
- Solving equations in the form of $px + q = r$, where p , q , and r are integers
- Distinguishing between inequalities and equations with integer coefficients with or without real-world context.

Learning Targets

- 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

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reasonableness of answers using mental computation and estimation strategies

- *For example: 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*
- 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
 - 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
 - *For example, the perimeter of a rectangle is 54 cm. Its length is 6 cm. What is its width?*
 - 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
 - *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*

Learning Design

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Ratios & Proportional Relationships

High Priority Standards

7.RP.A.1 Compute unit rates, including those that involve complex fractions, with like or different units.

7.RP.A.2 Recognize and represent proportional relationships between quantities. a. Determine when two quantities are in a proportional relationship. b. Identify and/or compute the constant of proportionality (unit rate). c. Explain what a point (x, y) on the graph of a proportional relationship means in terms of the situation. d. Recognize that the graph of any proportional relationship will pass through the origin.

7.RP.A.3 Solve problems involving ratios, rates, percentages and proportional relationships.

Learning Goal

Students will be able to analyze proportional relationships and use them to solve real-world and mathematical problems.

Proficiency Scale

- 4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal.
- 3: Student demonstrates mastery with the learning goal as evidenced by:
- Solving real-world problems involving proportional relationships and measurement conversions that involve identifying relationships. Problems and solutions are presented in various formats (e.g., verbal, table, graph).
 - Identifying, representing, and analyzing proportional relationships in various formats.
 - Finding unit rates associated with ratios of fractions.
 - Using unit rates to solve one-step problems involving rational numbers.
 - Analyzing a graph of a proportional relationship in order to explain what the points (x, y) and (1, r) represent, where r is the unit rate, and using this information to solve problems.
- 2: Student demonstrates he/she is nearing proficiency by:
- Recognizing and recalling specific vocabulary, such as: ratio, proportion, unit rate, proportional relationship.
 - Performing processes such as:
 - Finding whole number unit rates in relationships presented in graphs, tables, or verbal formats in familiar contexts.
 - Identifying proportional relationships presented in equation formats and finding unit rates involving whole numbers.
- 1: Student demonstrates a limited understanding or skill with the learning goal by:
- Identifying proportional relationships presented in graphs, tables, or verbal formats in familiar contexts.

Learning Targets

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- Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units
 - *For example, if a person walks $\frac{1}{2}$ mile in each $\frac{1}{4}$ hour, compute the unit rate as the complex fraction $\frac{1/2}{1/4}$ miles per hour, equivalently 2 miles per hour*
- Recognize and represent proportional relationships between quantities
 - 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
 - Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships
 - Represent proportional relationships by equations
 - *For example, 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 $t = pn$*
 - 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
- 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

Learning Design

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Geometry and Measurement

High Priority Standards

7.RP.A.3 Solve problems involving ratios, rates, percentages and proportional relationships.

7.GM.A.2 Use a variety of tools to construct geometric shapes. a. Determine if provided constraints will create a unique triangle through construction. b. Construct special quadrilaterals given specific parameters.

7.GM.A.3 Describe two-dimensional cross sections of pyramids, prisms, cones and cylinders.

Learning Goal

Students will be able to draw, construct, and describe geometrical figures and describe the relationships between them.

Proficiency Scale

4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal.

3: Student demonstrates mastery with the learning goal as evidenced by:

- Computing actual lengths and areas from a scale drawing.
- Reproducing a scale drawing using a different scale.
- Describing the two-dimensional figures that result from slicing cones, spheres, cylinders, pyramids, and prisms.

2: Student demonstrates he/she is nearing proficiency by:

- Recognizing and recalling specific vocabulary, such as: plane, prism, pyramid, cone, sphere, cylinder, scale factor, scale drawing, similar.
- Performing processes such as:
 - Describing geometric shapes with given conditions and determining whether or not a set of any three given angle or side-length measures can result in a unique triangle, more than one triangle, or no triangle at all.
 - Describing the relationship between a geometric figure and its scale drawing by finding the scale factor between them.
 - Describing the two-dimensional figures that result from slicing prisms and pyramids by planes that are parallel to a face.

1: Student demonstrates a limited understanding or skill with the learning goal by drawing or constructing geometric shapes with given conditions by freehand, with ruler and protractor, and by using technology.

Learning Targets

- 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
- 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
- Describe the two-dimensional figures that result from slicing three-dimensional figures, as in plane sections of right rectangular prisms and right rectangular pyramids

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Geometry and Measurement

High Priority Standards

7.GM.A.4 Understand concepts of circles. a. Analyze the relationships among the circumference, the radius, the diameter, the area and Pi in a circle. b. Know and apply the formulas for circumference and area of circles to solve problems.

7.GM.B.5 Use angle properties to write and solve equations for an unknown angle.

7.GM.B.6 Understand the relationship between area, surface area and volume. a. Find the area of triangles, quadrilaterals and other polygons composed of triangles and rectangles. b. Find the volume and surface area of prisms, pyramids and cylinders.

Learning Goal

Students will be able to solve real-life and mathematical problems involving angle measure, area, surface area, and volume.

Proficiency Scale

- 4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal.
- 3: Student demonstrates mastery with the learning goal as evidenced by:
- Using supplementary, complementary, vertical, and adjacent angles to solve one- or two-step problems with angle measures expressed as variables in degrees.
 - Using formulas for the area and circumference of a circle to solve problems.
 - Solving problems involving the area of polygons, the surface area of three-dimensional objects composed of triangles and/or quadrilaterals, and the volume of right prisms.
 - Solving problems involving surface area and volume of three-dimensional figures with polygonal faces.
 - Using supplementary, complementary, vertical, and adjacent angles to solve multi-step problems with angle measures expressed as variables in degrees.
- 2: Student demonstrates he/she is nearing proficiency by:
- Recognizing and recalling specific vocabulary, such as: supplementary angles, complementary angles, vertical angles, adjacent angles.
 - Performing processes such as:
 - Using supplementary, complementary, vertical, or adjacent angles to solve problems with angles expressed as numerical measurements in degrees.
 - Calculating the circumference of a circle.
 - Calculating the area of circles, quadrilaterals, and polygons .
 - Calculating the volume of right rectangular prisms.
- 1: Student demonstrates a limited understanding or skill with the learning goal by:
- Identifying appropriate formulas for the area and circumference of a circle.
 - Calculating the area of triangles and rectangles and the volume of cubes.
 - Classifying pairs of angles as supplementary, complementary, vertical, or adjacent.
 - Measuring angles with appropriate tools.

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Learning Targets

- 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
- 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
- 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

Learning Design

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Data Analysis, Statistics and Probability

High Priority Standards

7.DSP.A.1 Understand that statistics can be used to gain information about a population by examining a sample of the population. a. Understand that a sample is a subset of a population. b. Understand that generalizations from a sample are valid only if the sample is representative of the population. c. Understand that random sampling is used to produce representative samples and support valid inferences.

7.DSP.A.2 Use data from multiple samples to draw inferences about a population and investigate variability in estimates of the characteristic of interest.

Learning Goal

Students will be able to use random sampling to draw inferences about a population.

Proficiency Scale

- 4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal.
- 3: Student demonstrates mastery with the learning goal as evidenced by:
- Using data from a random sample to draw inferences about a population with an unknown characteristic of interest presented in an unfamiliar context.
 - Generating multiple samples (or simulated samples) of the same size to gauge the variation in estimates or predictions.
- 2: Student demonstrates he/she is nearing proficiency by:
- Recognizing and recalling specific vocabulary, such as: population, sample, random sample, biased sample, unbiased sample, inference.
 - Performing processes such as:
 - Determining whether or not a sample is random.
 - Describing how random samples of an appropriate population are representative samples that support valid results.
 - Using data from a random sample to draw obvious inferences about a population presented in a familiar context.
- 1: Student demonstrates a limited understanding or skill with the learning goal by:
- Describing what a representative sample involves.
 - Identifying biased and unbiased samples of a population.

Learning Targets

- 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
- 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
 - *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*

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Data Analysis, Statistics and Probability

High Priority Standards

7.DSP.B.3 Analyze different data distributions using statistical measures.

7.DSP.B.4 Compare the numerical measures of center, measures of frequency and measures of variability from two random samples to draw inferences about the population.

Learning Goal

Students will be able to draw informal comparative inferences about two populations.

Proficiency Scale

- 4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal.
- 3: Student demonstrates mastery with the learning goal as evidenced by:
- Assessing informally the degree of visual overlap of two numerical data distributions with similar variability, measuring the difference between the centers in any context.
 - Making multiple comparisons between two sets of data based on a graphic representation using measures of center.
 - Using measures of variability for numerical data from random samples to draw informal comparative inferences about two populations.
- 2: Student demonstrates he/she is nearing proficiency by:
- Recognizing and recalling specific vocabulary, such as: mean, median, mode, range, outlier, visual overlap, inter-quartile range, variability, measures of center, dot plot.
 - Performing processes such as:
 - Using range to draw comparisons about two different populations.
 - Making one or two comparisons between two sets of data based on a graphic representation.
- 1: Student demonstrates a limited understanding or skill with the learning goal by:
- Using the mean to compare and draw inferences about two different populations.

Learning Targets

- 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
 - *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*
- Use measures of center and measures of variability for numerical data from random samples to draw informal comparative inferences about two populations
 - *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*

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Data Analysis, Statistics and Probability

High Priority Standards

7.DSP.C.5 Investigate the probability of chance events. a. Determine probabilities of simple events. b. Understand that the probability of a chance event is a number between 0 and 1 that expresses the likelihood of the event occurring.

7.DSP.C.6 Investigate the relationship between theoretical and experimental probabilities for simple events. a. Predict outcomes using theoretical probability. b. Perform experiments that model theoretical probability. c. Compare theoretical and experimental probabilities.

7.DSP.C.7 Explain possible discrepancies between a developed probability model and observed frequencies. a. Develop a uniform probability model by assigning equal probability to all outcomes, and use the model to determine probabilities of events. b. Develop a probability model (which may not be uniform) by observing frequencies in data generated from a chance process.

7.DSP.C.8 Find probabilities of compound events using organized lists, tables, tree diagrams and simulations. a. Represent the sample space of a compound event. b. Design and use a simulation to generate frequencies for compound events.

Learning Goal

Students will investigate chance processes and develop, use, and evaluate probability models.

Proficiency Scale

- 4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal.
- 3: Student demonstrates mastery with the learning goal as evidenced by:
- Finding probabilities of compound events using organized lists, tables, tree diagrams, and simulation.
 - Comparing theoretical and experimental results from a probability experiment.
 - Designing, describing, and constructing a simulation experiment to generate frequencies for compound events.
 - Explaining what might account for differences between theoretical and experimental results and evaluating the associated probability model.
- 2: Student demonstrates he/she is nearing proficiency by:
- Recognizing and recalling specific vocabulary, such as: compound events, equally likely, theoretical probability, experimental probability, relative frequency, simulation.
 - Performing processes such as:
 - Approximating the probability of a chance event by collecting data on the chance process that produces it and observing its long-run relative frequency.
 - Predicting the approximate relative frequency given the probability.
- 1: Student demonstrates a limited understanding or skill with the learning goal by:
- Determining the theoretical probability of a simple event.
 - Explaining how probabilities are numbers between 0 (impossible) and 1 (always) and that a probability around 1/2 indicates an event that is neither unlikely nor likely.

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Learning Targets

- 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 $\frac{1}{2}$ indicates an event that is neither unlikely nor likely, and a probability near 1 indicates a likely event
- 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
 - *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.*
- 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
 - Develop a uniform probability model by assigning equal probability to all outcomes, and use the model to determine probabilities of events
 - *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*
 - Develop a probability model (which may not be uniform) by observing frequencies in data generated from a chance process
 - *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?*
- Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation
 - 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
 - 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
 - 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?*

Learning Design

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Sources:

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Standards for Mathematical Practices Observation Tool created by Melisa Hancock for KATM/KSDE CCSS Summer Academy 2011

WGSD Curriculum – Math 8th Grade

In Grade 8, instructional time will focus on three critical areas: (1) formulating and reasoning about expressions and equations, including modeling an association in bivariate data with a linear equation, and solving linear equations and systems of linear equations; (2) grasping the concept of a function and using functions to describe quantitative relationships and (3) analyzing two- and three-dimensional space and figures using distance, angle, similarity, and congruence, and understanding and applying the Pythagorean Theorem.

While the content learning goals describe the mathematics students should be able to understand and do, the first eight learning goals (The Standards for Mathematical Practice) describe how students should engage with these mathematical concepts and skills as they grow in mathematical maturity and expertise. Teachers will connect the mathematical practices to mathematical content in all mathematics instruction. These learning goals merit the most time, resources, innovation, and focus necessary to qualitatively improve the instruction, assessment, and student achievement in mathematics.

WGSD Curriculum – Math 8th Grade
Mathematical Practices

<u>High Priority Standards</u> CCSS.Math.Practice.MP1	
<u>Learning Goal</u> Students will be able to make sense of problems and persevere in solving them.	<u>Proficiency Scale</u> 4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal. 3: Student demonstrates mastery with the learning goal as evidenced by: <ul style="list-style-type: none"> • Discussing, explaining, and solving a problem with multiple representations and in multiple ways. • Struggling with various attempts over time. • Learning from previous solution attempts. • Checking answers using a different method or strategy. 2: Student demonstrates he/she is nearing proficiency by: <ul style="list-style-type: none"> • Explaining his/her thought processes when solving a problem and representing it in several ways. • Trying several approaches in find a solution and seeking hints only if stuck. 1: Student demonstrates a limited understanding or skill with the learning goal by: <ul style="list-style-type: none"> • Explaining their thought processes when solving a problem one way. • Staying with a challenging problem for more than one attempt.
<u>Learning Targets</u> <ul style="list-style-type: none"> • Explain the meaning of a problem and look for efficient ways to solve it • Use concrete objects or pictures to help conceptualize and solve problems • Checks their thinking by asking themselves, “Does this make sense?” • Listens to the strategies of others and tries different approaches • Uses a different strategies to check answers • Takes time to thoughtfully consider problems 	
<u>Learning Design</u> <ul style="list-style-type: none"> • Provides time and facilitates discussion in problem solutions • Facilitates discourse in the classroom so that students UNDERSTAND the approaches of others • Provides opportunities for students to explain themselves, the meaning of a problem, etc. 	

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- Provides opportunities for students to connect concepts to “their” world
- Provides students TIME to think and become “patient” problem solvers
- Facilitates and encourages students to check their answers using different methods (not calculators)
- Provides problems that focus on relationships and are “generalizable”

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Mathematical Practices

<u>High Priority Standards</u> CCSS.Math.Practice.MP2	
<u>Learning Goal</u>	<u>Proficiency Scale</u>
Students will be able to reason abstractly and quantitatively.	<p>4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal.</p> <p>3: Student demonstrates mastery with the learning goal as evidenced by:</p> <ul style="list-style-type: none"> • Converting situations into symbols to solve problems. • Converting mathematical equations into meaningful situations. <p>2: Student demonstrates he/she is nearing proficiency by translating situations into symbols to solve problems.</p> <p>1: Student demonstrates a limited understanding or skill with the learning goal by reasoning with models or pictorial representations to solve problems.</p>
<u>Learning Targets</u> <ul style="list-style-type: none"> • Recognize that a number represents a specific quantity • Connect the quantity to written symbols and create a logical representation of the problem at hand • Consider both the appropriate units involved and the meaning of quantities • Write simple expressions that record calculations with numbers and symbols • Represent or round numbers using place value concepts 	
<u>Learning Design</u> <ul style="list-style-type: none"> • Provides a range of representations of math problem situations and encourages various solutions • Provides opportunities for students to make sense of quantities and their relationships in problem situations • Provides problems that require flexible use of properties of operations and objects • Emphasizes quantitative reasoning which entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them and/or rules; and knowing and flexibly using different properties of operations and objects 	

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Mathematical Practices

<p style="text-align: center;"><u>High Priority Standards</u> CCSS.Math.Practice.MP3</p>	
<p style="text-align: center;"><u>Learning Goal</u></p>	<p style="text-align: center;"><u>Proficiency Scale</u></p>
<p>Students will be able to construct viable arguments and critique the reasoning of others.</p>	<p>4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal.</p> <p>3: Student demonstrates mastery with the learning goal as evidenced by:</p> <ul style="list-style-type: none"> Justifying and explaining, with accurate language and vocabulary, why his/her solution is correct. Comparing his/her strategy to other students' strategies, asking questions, and making connections with his/her own thinking. Explaining the reasoning of others. <p>2: Student demonstrates he/she is nearing proficiency by:</p> <ul style="list-style-type: none"> Explaining his/her thinking and the thinking of others with accurate vocabulary. Explaining other students' solutions and identifying strengths and weaknesses of the strategy. <p>1: Student demonstrates a limited understanding or skill with the learning goal by:</p> <ul style="list-style-type: none"> Explaining his/her solution. Discussing other ideas, approaches, and strategies.
<p style="text-align: center;"><u>Learning Targets</u></p> <ul style="list-style-type: none"> Construct arguments using concrete referents, such as objects, pictures, and drawings Refine their mathematical communication skills by answering questions like "How do you know?" and "Can you show me another way?" Refine their mathematical communication skills by asking others questions like "How do you know?" and "How did you get that?" Explain their thinking to others and respond to others' thinking 	
<p style="text-align: center;"><u>Learning Design</u></p> <ul style="list-style-type: none"> Provides ALL students opportunities to understand and use stated assumptions, definitions, and previously established results in constructing arguments Provides ample time for students to make conjectures and build a logical progression of statements to explore the truth of their conjectures Provides opportunities for students to construct arguments and critique arguments of peers Facilitates and guides students in recognizing and using counterexamples Encourages and facilitates students justifying their conclusions, communicating, and responding to the arguments of others Asks useful questions to clarify and/or improve students' arguments 	

WGSD Curriculum – Math 8th Grade

Mathematical Practices

High Priority Standards	
CCSS.Math.Practice.MP4, TILS 5.C.a: Recognize that there are a variety of ways to share information, TILS 5.C.c: Effectively share information	
<u>Learning Goal</u>	<u>Proficiency Scale</u>
Students will be able to model with mathematics.	<p>4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal.</p> <p>3: Student demonstrates mastery with the learning goal as evidenced by:</p> <ul style="list-style-type: none"> • Recognizing math in everyday situations. • Using a variety of models, symbolic representations, and technology tools to represent the solution to a problem and accurately explain the solution representation. <p>2: Student demonstrates he/she is nearing proficiency by:</p> <ul style="list-style-type: none"> • Recognize math in everyday situations, when prompted. • Using models and symbols to represent and solve a problem. <p>1: Student demonstrates a limited understanding or skill with the learning goal by using models to represent and solve a problem with teacher support.</p>
<u>Learning Targets</u> <ul style="list-style-type: none"> • Represents problem situations in multiple ways including numbers, words (mathematical language), drawing pictures, using objects, acting out, making a chart, list, or graph, creating equations, etc. and use all of these representations as needed • Connect different representations and explain the connections • Evaluate results in the context of the situation and reflect on whether the results make sense • Evaluate the utility of models to determine which models are most useful and efficient to solve problems 	
<u>Learning Design</u> <ul style="list-style-type: none"> • Provides problem situations that apply to everyday life • Provides rich tasks that focus on conceptual understanding, relationships, etc. 	

WGSD Curriculum – Math 8th Grade
Mathematical Practices

<u>High Priority Standards</u> CCSS.Math.Practice.MP5	
<u>Learning Goal</u> Students will be able to use appropriate tools strategically.	<u>Proficiency Scale</u> 4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal. 3: Student demonstrates mastery with the learning goal as evidenced by combining various tools to explore and solve a problem as well as justifying his/her tool selection and problem solution. 2: Student demonstrates he/she is nearing proficiency by selecting from a variety of provided tools the ones that can be used to solve a problem and explaining his/her reasoning for the selection. 1: Student demonstrates a limited understanding or skill with the learning goal by using the appropriate tool, when provided, to find a solution.
<u>Learning Targets</u> <ul style="list-style-type: none"> Consider the available tools (including, but not limited to estimation, graph paper, manipulatives, table, list, etc.) when solving a mathematical problem and decide when certain tools might be helpful For example, they may use unit cubes to fill a rectangular prism and a ruler to measure the dimensions Use graph paper to accurately create graphs and solve problems or make predictions from real world data 	
<u>Learning Design</u> <ul style="list-style-type: none"> Provides a variety of tools and technology for students to explore to deepen their understanding of math concepts Provides problem solving tasks that require students to consider a variety of tools for solving (Tools might include pencil/paper, concrete models, manipulatives, ruler, protractor, calculator, spreadsheet, computer algebra system, statistical package, or dynamic geometry software, etc.) 	

WGSD Curriculum – Math 8th Grade
Mathematical Practices

<u>High Priority Standards</u> CCSS.Math.Practice.MP6	
<u>Learning Goal</u> Students will be able to attend to precision.	<u>Proficiency Scale</u> 4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal. 3: Student demonstrates mastery with the learning goal as evidenced by using appropriate symbols, vocabulary, and labeling to communicate effectively and exchange ideas. 2: Student demonstrates he/she is nearing proficiency by incorporating appropriate vocabulary and symbols in most mathematical communications. 1: Student demonstrates a limited understanding or skill with the learning goal by communicating his/her reasoning and solution to others, with support.
<u>Learning Targets</u> <ul style="list-style-type: none"> • Use clear and precise language in their discussions with others and in their own reasoning • Specify units of measure and state the meaning of the symbols used • Report answers that appropriately address the context of a problem 	
<u>Learning Design</u> <ul style="list-style-type: none"> • Facilitates, encourages and expects precision in communication • Provides opportunities for students to explain and/or write their reasoning to others 	

WGSD Curriculum – Math 8th Grade
Mathematical Practices

<u>High Priority Standards</u> CCSS.Math.Practice.MP7	
<u>Learning Goal</u>	<u>Proficiency Scale</u>
Students will be able to look for and make use of structure.	<p>4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal.</p> <p>3: Student demonstrates mastery with the learning goal as evidenced by:</p> <ul style="list-style-type: none"> • Noticing mathematical expressions as component parts. • Using mathematical generalizations to identify the most efficient solution to mathematical tasks. <p>2: Student demonstrates he/she is nearing proficiency by composing and decomposing number situations and relationships in order to simplify solutions.</p> <p>1: Student demonstrates a limited understanding or skill with the learning goal by looking for structure or patterns within mathematics to help him/her solve problems efficiently.</p>
<u>Learning Targets</u>	
<ul style="list-style-type: none"> • Look closely to discover a pattern or structure <ul style="list-style-type: none"> ○ For instance, students use properties of operations as strategies to add, subtract, multiply and divide with whole numbers, fractions, and decimals. • Examine numerical patterns and relate them to a rule or a graphical representation 	
<u>Learning Design</u>	
<ul style="list-style-type: none"> • Provides opportunities and time for students to explore patterns and relationships to solve problems • Provides rich tasks and facilitates pattern seeking and understanding of relationships in numbers rather than following a set of steps and/or procedures 	

WGSD Curriculum – Math 8th Grade
Mathematical Practices

<u>High Priority Standards</u> CCSS.Math.Practice.MP8	
<u>Learning Goal</u>	<u>Proficiency Scale</u>
Students will be able to look for and express regularity in repeated reasoning.	<p>4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal.</p> <p>3: Student demonstrates mastery with the learning goal as evidenced by:</p> <ul style="list-style-type: none"> • Connecting prior knowledge to an unfamiliar mathematical situation. • Creating a model or equation that unifies the various aspects of a problem. • Noticing patterns, making generalizations, and predicting patterns. <p>2: Student demonstrates he/she is nearing proficiency by finding and explaining patterns.</p> <p>1: Student demonstrates a limited understanding or skill with the learning goal by connecting prior knowledge to new situations and noticing patterns with prompting from a teacher or peer.</p>
<u>Learning Targets</u> <ul style="list-style-type: none"> • Notice repetitive actions in computation and look for more shortcut methods • Use repeated reasoning to understand algorithms and make generalizations about patterns 	
<u>Learning Design</u> <ul style="list-style-type: none"> • Provides problem situations that allow students to explore regularity and repeated reasoning • Provides rich tasks that encourage students to use repeated reasoning to form generalizations and provides opportunities for students to communicate these generalizations 	

WGSD Curriculum – Math 8th Grade

Number Sense and Operations

High Priority Standards

8.NS.A.1 Explore the real number system. a. Know the differences between rational and irrational numbers. b. Understand that all rational numbers have a decimal expansion that terminates or repeats. c. Convert decimals which repeat into fractions and fractions into repeating decimals. d. Generate equivalent representations of rational numbers.
 8.NS.A.2 Estimate the value and compare the size of irrational numbers and approximate their locations on a number line.

Learning Goal

Students will understand that there are numbers that are not rational, and approximate them by rational numbers.

Proficiency Scale

- 4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal.
- 3: Student demonstrates mastery with the learning goal as evidenced by:
- Using rational approximations of irrational numbers to locate them on a number line and to make numerical comparisons.
 - Converting between fractions and repeating decimals.
 - Comparing rational numbers.
- 2: Student demonstrates he/she is nearing proficiency by:
- Recognizing and recalling specific vocabulary, such as: rational, irrational, terminating, repeating, equivalent, simplify, truncate.
 - Performing processes such as:
 - Identifying approximate locations of familiar irrational numbers on a number line.
 - Identifying numbers as rational or irrational.
 - Converting between fractions and terminating decimals.
- 1: Student demonstrates a limited understanding or skill with the learning goal by:
- Identifying square roots of numbers less than 100.
 - Identifying pi as not rational.
 - Describing how every rational number has a decimal expansion.

Learning Targets

- Know that numbers that are not rational are called irrational. Understand informally that every number has a decimal expansion; for rational numbers show that the decimal expansion repeats eventually, and convert a decimal expansion which repeats eventually into a rational number
- Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions (e.g., π^2)
 - For example, by truncating the decimal expansion of $\sqrt{2}$, show that $\sqrt{2}$ is between 1 and 2, then between 1.4 and 1.5, and explain how to continue on to get better approximations

Learning Design

WGSD Curriculum – Math 8th Grade

Expressions, Equations and Inequalities

High Priority Standards

8.EE1.A.1 Know and apply the properties of integer exponents to generate equivalent expressions.

8.EE1.A.2 Investigate concepts of square and cube roots. a. Solve equations of the form $x^2 = p$ and $x^3 = p$, where p is a positive rational number. b. Evaluate square roots of perfect squares less than or equal to 625 and cube roots of perfect cubes less than or equal to 1000. c. Recognize that square roots of non-perfect squares are irrational.

8.EE1.A.3 Express very large and very small quantities in scientific notation and approximate how many times larger one is than the other.

8.EE1.A.4 Use scientific notation to solve problems. a. Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. b. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities.

Learning Goal

Students will be able to work with radicals and integer exponents.

Proficiency Scale

4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal.

3: Student demonstrates mastery with the learning goal as evidenced by:

- Identifying that the square root of 2 is irrational.
- Calculating or approximating to an appropriate degree of precision the square or cube of a rational number.
- Solving quadratic and cubic monomial equations and representing the solution as a square or cube root, respectively.
- Working with and performing operations with scientific notation.
- Working with and applying the properties of integer exponents in order to produce or identify equivalent numerical expressions.

2: Student demonstrates he/she is nearing proficiency by:

- Recognizing and recalling specific vocabulary, such as: base, exponent, coefficient, cube root, square root, squared, cubed, standard form, scientific notation, equivalent, irrational, rational.
- Performing processes such as:
 - Identifying and calculating the cube root of familiar perfect cubes.
 - Calculating the cube of integers.
 - Using appropriate tools (e.g., calculator, pencil and paper) to translate large or small numbers from scientific to standard notation.
 - Working with and applying the properties of integer exponents of degree 2 or less in order to produce or identify equivalent numerical expressions.

1: Student demonstrates a limited understanding or skill with the learning goal by:

- Identifying and calculating square roots of familiar perfect squares.

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- Calculating the square of integers.
- Identifying standard form and scientific notation.

Learning Targets

- Know and apply the properties of integer exponents to generate equivalent numerical expressions
 - For example, $3^2 \times 3^{-5} = 3^{-3} = 1/3^3 = 1/27$
- Use square root and cube root symbols to represent solutions to equations of the form $x^2 = p$ and $x^3 = p$, where p is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that $\sqrt{2}$ is irrational
- Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other
 - *For example, estimate the population of the United States as 3 times 10^8 and the population of the world as 7 times 10^9 , and determine that the world population is more than 20 times larger*
- Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities (e.g., use millimeters per year for seafloor spreading). Interpret scientific notation that has been generated by technology

Learning Design

WGSD Curriculum – Math 8th Grade

Expressions, Equations and Inequalities

High Priority Standards

8.EE1.B.5 Graph proportional relationships. a. Interpret the unit rate as the slope of the graph. b. Compare two different proportional relationships.

8.EE1.B.6 Apply concepts of slope and y-intercept to graphs, equations and proportional relationships. a. Explain why the slope (m) is the same between any two distinct points on a non-vertical line in the Cartesian coordinate plane. b. Derive the equation $y = mx$ for a line through the origin and the equation $y = mx + b$ for a line intercepting the vertical axis at b .

Learning Goal

Students will understand the connections between proportional relationships, lines, and linear equations.

Proficiency Scale

4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal.

3: Student demonstrates mastery with the learning goal as evidenced by:

- Communicating that slope is a unit rate of change in a proportional relationship.
- Converting proportional relationships to linear equations in slope-intercept form while also explaining when and why the y-intercept is zero.
- Calculating slope by using the slope formula and right triangles (finding the slope by counting).
- Explaining why the slope is the same between any two distinct points on a non-vertical line in a coordinate plan using similar triangles.

2: Student demonstrates he/she is nearing proficiency by:

- Recognizing and recalling specific vocabulary, such as: linear, line, slope, y-intercept, axis, coordinate plane, graph, origin, point, similar, table, vertical, horizontal, proportional relationship, right triangle method, DNE, independent variable, dependent variable, unit rate.
- Performing processes such as:
 - Comparing two different proportional relationships represented in different ways.
 - Calculating the slope of a line by any method and identifying the y-intercept of a line.

1: Student demonstrates a limited understanding or skill with the learning goal by graphing a proportional relationship on a coordinate plane.

Learning Targets

- Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed
- Use similar triangles to explain why the slope m is the same between any two distinct points on a non-vertical line in the coordinate plane; derive the equation $y = mx$ for a line through the origin and the equation $y = mx + b$ for a line intercepting the vertical axis at b

Learning Design

WGSD Curriculum – Math 8th Grade

Expressions, Equations and Inequalities

High Priority Standards

8.EE1.C.7 Solve linear equations and inequalities in one variable. a. Create and identify linear equations with one solution, infinitely many solutions or no solutions. b. Solve linear equations and inequalities with rational number coefficients, including equations and inequalities whose solutions require expanding expressions using the distributive property and combining like terms.

8.EE1.C.8 Analyze and solve systems of linear equations. a. Graph systems of linear equations and recognize the intersection as the solution to the system. b. Explain why solution(s) to a system of two linear equations in two variables correspond to point(s) of intersection of the graphs. c. Explain why systems of linear equations can have one solution, no solution or infinitely many solutions. d. Solve systems of two linear equations.

Learning Goal

Students will be able to analyze and solve linear equations, inequalities and pairs of simultaneous linear equations.

Proficiency Scale

- 4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal.
- 3: Student demonstrates mastery with the learning goal as evidenced by:
- Classifying systems of linear equations as intersecting, collinear, or parallel.
 - Solving linear systems algebraically and estimating solutions using substitution, graphing and elimination.
 - Showing that a particular linear equation has one solution, no solution, or infinitely many solutions.
 - Solving multi-step linear equations and inequalities in one variable using the distributive property and/or collecting like terms.
- 2: Student demonstrates he/she is nearing proficiency by:
- Recognizing and recalling specific vocabulary, such as: system of equations, coefficient, point of intersection, distributive property, combining like terms, infinite, collinear, empty set, no solution.
 - Performing processes such as:
 - Analyzing and solving systems of linear equations graphically by understanding that the solution of a system of linear equations in two variables corresponds to the point of intersection on a plane.
 - Solving examples of linear equations and inequalities in one variable with rational coefficients with one solution, infinitely many solutions, or no solution.
- 1: Student demonstrates a limited understanding or skill with the learning goal by solving one- and two-step linear equations and inequalities in one variable with integer coefficients.

Learning Targets

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- Solve linear equations and inequalities in one variable
 - Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent equation of the form $x = a$, $a = a$, or $a = b$ results (where a and b are different numbers)
 - Solve linear equations and inequalities with rational number coefficients, including equations and inequalities whose solutions require expanding expressions using the distributive property and collecting like terms
- Analyze and solve pairs of simultaneous linear equations
 - Understand that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously
 - Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations. Solve simple cases by inspection
 - *For example, $3x + 2y = 5$ and $3x + 2y = 6$ have no solution because $3x + 2y$ cannot simultaneously be 5 and 6*
 - Solve real-world and mathematical problems leading to two linear equations in two variables
 - *For example, given coordinates for two pairs of points, determine whether the line through the first pair of points intersects the line through the second pair*

Learning Design

WGSD Curriculum – Math 8th Grade

Functions

High Priority Standards

- 8.F.A.1 Explore the concept of functions. (The use of function notation is not required.) a. Understand that a function assigns to each input exactly one output. b. Determine if a relation is a function. c. Graph a function.
- 8.F.A.2 Compare characteristics of two functions each represented in a different way
- 8.F.A.3 Investigate the differences between linear and nonlinear functions. a. Interpret the equation $y = mx + b$ as defining a linear function, whose parameters are the slope (m) and the yintercept (b). b. Recognize that the graph of a linear function has a constant rate of change c. Give examples of nonlinear functions.

Learning Goal

Students will be able to define,
evaluate, and compare functions.

Proficiency Scale

- 4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal.
- 3: Student demonstrates mastery with the learning goal as evidenced by:
- Classifying functions as linear or nonlinear in different forms (algebraic, graphic, tabular, or verbal description).
 - Producing a function as a rule that assigns to each input exactly one output.
 - Comparing properties of two functions represented in different ways (algebraic, graphic, tabular, or verbal description).
- 2: Student demonstrates he/she is nearing proficiency by:
- Recognizing and recalling specific vocabulary, such as: function, vertical line test, input, output, linear, nonlinear, rate of change.
 - Performing processes such as:
 - Comparing properties of two functions represented in the same way (algebraic, graphic, tabular, or verbal description).
 - Identifying whether or not a relationship that is represented graphically, in a table, or algebraically is a function.
 - Knowing linear equations of the form $y = mx + b$ are functions.
- 1: Student demonstrates a limited understanding or skill with the learning goal by:
- Producing input and output pairs for a given function.
 - Identifying whether an input/output pair satisfies a function.
 - Classifying functions as linear or nonlinear on the basis of their graph.
 - Comparing the properties of two linear functions represented in the same way (graphic or tabular).

Learning Targets

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- Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output
- Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions)
 - *For example, given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has the greater rate of change*
- Interpret the equation $y = mx + b$ as defining a linear function, whose graph is a straight line; give examples of functions that are not linear
 - *For example, the function $A = s^2$ giving the area of a square as a function of its side length is not linear because its graph contains the points (1,1), (2,4) and (3,9), which are not on a straight line*

Learning Design

WGSD Curriculum – Math 8th Grade

Functions

High Priority Standards

8.F.B.4 Use functions to model linear relationships between quantities. a. Explain the parameters of a linear function based on the context of a problem. b. Determine the parameters of a linear function. c. Determine the x-intercept of a linear function.

8.F.B.5 Describe the functional relationship between two quantities from a graph or a verbal description.

Learning Goal

Students will be able to use
functions to model relationships
between quantities.

Proficiency Scale

4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal.

3: Student demonstrates mastery with the learning goal as evidenced by:

- Constructing a function to represent a linear relationship between two quantities.
- Constructing a graph to represent verbally described qualitative features.
- Determining the rate of change and initial value of a function from a graph, a verbal description of a relationship, or from two sets of xy-values given as coordinate pairs or displayed in a table.
- Analyzing a graph of a linear or nonlinear function to qualitatively describe it.

2: Student demonstrates he/she is nearing proficiency by:

- Recognizing and recalling specific vocabulary, such as: rate of change, linear, nonlinear, y-intercept, initial amount, function, coefficient, slope formula, variable.
- Performing processes such as:
 - Constructing a graphical or tabular model to represent a linear relationship between two quantities.
 - Finding the rate of change of a linear relationship displayed in a graph or table.
 - Analyzing a graph of a linear function to qualitatively describe it.

1: Student demonstrates a limited understanding or skill with the learning goal by identifying a function that models a linear relationship between two quantities.

Learning Targets

- Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values
- Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally

Learning Design

WGSD Curriculum – Math 8th Grade

Geometry and Measurement

High Priority Standards

8.GM.A.1 Verify experimentally the congruence properties of rigid transformations. a. Verify that angle measure, betweenness, collinearity and distance are preserved under rigid transformations. b. Investigate if orientation is preserved under rigid transformations.

8.GM.A.2 Understand that two-dimensional figures are congruent if a series of rigid transformations can be performed to map the preimage to the image. a. Describe a possible sequence of rigid transformations between two congruent figures.

8.GM.A.3 Describe the effect of dilations, translations, rotations and reflections on two-dimensional figures using coordinates.

8.GM.A.4 Understand that two-dimensional figures are similar if a series of transformations (rotations, reflections, translations and dilations) can be performed to map the pre-image to the image. a. Describe a possible sequence of transformations between two similar figures.

8.GM.A.5 Explore angle relationships and establish informal arguments. a. Derive the sum of the interior angles of a triangle. b. Explore the relationship between the interior and exterior angles of a triangle. c. Construct and explore the angles created when parallel lines are cut by a transversal. d. Use the properties of similar figures to solve problems.

Learning Goal

Students will understand
congruence and similarity using
physical models, transparencies, or
geometry software.

Proficiency Scale

- 4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal.
- 3: Student demonstrates mastery with the learning goal as evidenced by:
- Describing the impact of a transformation on a figure and its component parts with or without coordinates.
 - Using or describing a sequence of transformations to determine or exhibit the congruence of two figures.
 - Constructing rotations and dilations of figures in a coordinate plane.
- 2: Student demonstrates he/she is nearing proficiency by:
- Recognizing and recalling specific vocabulary, such as: reflections, translations, dilations, rotations, scale factor, image, pre-image, transformation, congruent figures, similar figures, axis of symmetry, point of rotation, symmetry, exterior angle, transversal, supplementary, congruent.
 - Performing processes such as:
 - Constructing reflections and translations of figures in a coordinate plane.
 - Identifying dilations and the results of dilations on figures.
 - Finding missing angle measures in a triangle or in parallel lines cut by a transversal.
 - Identifying the sum of the interior angles of a triangle as equal 180 degrees.
- 1: Student demonstrates a limited understanding or skill with the learning goal by identifying reflections, rotations, and translations and the result of these rigid motions on figures.

Learning Targets

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- Verify experimentally the properties of rotations, reflections, and translations:
 - Lines are taken to lines, and line segments to line segments of the same length
 - Angles are taken to angles of the same measure
 - Parallel lines are taken to parallel lines
- Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that exhibits the congruence between them
- Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates
- Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them
- Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles
 - *For example, arrange three copies of the same triangle so that the sum of the three angles appears to form a line, and give an argument in terms of transversals why this is so*

Learning Design

WGSD Curriculum – Math 8th Grade

Geometry and Measurement

High Priority Standards

- 8.GM.B.6 Use models to demonstrate a proof of the Pythagorean Theorem and its converse.
- 8.GM.B.7 Use the Pythagorean Theorem to determine unknown side lengths in right triangles in two- and three-dimensional contexts.
- 8.GM.B.8 Use the Pythagorean Theorem to find the distance between points in a Cartesian coordinate system.

Learning Goal

Students will understand and apply
the Pythagorean Theorem.

Proficiency Scale

- 4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal.
- 3: Student demonstrates mastery with the learning goal as evidenced by:
- Applying the Pythagorean Theorem to determine the unknown side lengths of right triangles.
 - Finding the distance between two points in a coordinate system in two dimensions.
- 2: Student demonstrates he/she is nearing proficiency by:
- Recognizing and recalling specific vocabulary, such as: right angle, congruent, parallel, perpendicular, leg, hypotenuse, distance formula, Pythagorean theorem, proof, converse.
 - Performing processes such as:
 - Applying the Pythagorean Theorem to determine whether or not a given triangle is a right triangle, given its side lengths.
 - Finding the distance between two points on a horizontal or vertical line in a two-dimensional coordinate system.
- 1: Student demonstrates a limited understanding or skill with the learning goal by identifying the hypotenuse and the legs of a right triangle given the side lengths or an image of a right triangle.

Learning Targets

- Explain a proof of the Pythagorean Theorem and its converse
- Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions
- Apply the Pythagorean Theorem to find the distance between two points in a coordinate system

Learning Design

WGSD Curriculum – Math 8th Grade

Geometry and Measurement

High Priority Standards

8.GM.C.9 Solve problems involving surface area and volume. a. Understand the concept of surface area and find surface area of pyramids. b. Understand the concepts of volume and find the volume of pyramids, cones and spheres.

Learning Goal

Students will be able to solve real-world and mathematical problems involving volume of cylinders, cones, and spheres.

Proficiency Scale

- 4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal.
- 3: Student demonstrates mastery with the learning goal as evidenced by calculating the volumes of cones, cylinders, and spheres in direct and familiar mathematical and real-world problems.
- 2: Student demonstrates he/she is nearing proficiency by:
- Recognizing and recalling specific vocabulary, such as: radius, circumference, diameter, height, perpendicular, area, volume, Base, cone, cylinder, sphere, coordinate system.
 - Performing processes such as:
 - Identifying the appropriate formula for the volumes of a cone, a cylinder, and a sphere.
 - Connecting the key dimensions to the appropriate variables in the formula.
- 1: Student demonstrates a limited understanding or skill with the learning goal by identifying the key dimensions (i.e., radius, height, circumference, and diameter) of cones, cylinders, and spheres.

Learning Targets

- Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.

Learning Design

WGSD Curriculum – Math 8th Grade

Data Analysis, Statistics and Probability

High Priority Standards

- 8.DSP.A.1 Construct and interpret scatter plots of bivariate measurement data to investigate patterns of association between two quantities.
- 8.DSP.A.2 Generate and use a trend line for bivariate data, and informally assess the fit of the line.
- 8.DSP.A.3 Interpret the parameters of a linear model of bivariate measurement data to solve problems.
- 8.DSP.A.4 Understand the patterns of association in bivariate categorical data displayed in a two-way table. a. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. b. Use relative frequencies calculated for rows or columns to describe possible association between the two variables.

Learning Goal

Students will investigate patterns of association in bivariate data.

Proficiency Scale

- 4: In addition to score 3.0 performance, the student demonstrates an in-depth inference or advanced application, or innovates with the learning goal.
- 3: Student demonstrates mastery with the learning goal as evidenced by:
- Writing an equation for the trend line or line of best fit for a given scatter plot with a linear association.
 - Interpreting and using relative frequencies from a two-way table to describe possible association between two variables.
- 2: Student demonstrates he/she is nearing proficiency by:
- Recognizing and recalling specific vocabulary, such as: positive association, negative association, linear association, nonlinear association, cluster, scatter plot, independent variable, dependent variable, outlier, bivariate, frequency, relative frequency, trend line (line of best fit).
 - Performing processes such as:
 - Investigating a scatter plot for patterns such as outliers and nonlinear association.
 - Informally fitting a line to data (sketching) for a given scatter plot that suggests a linear association.
 - Calculating frequencies from categorical data in a two-way frequency table.
- 1: Student demonstrates a limited understanding or skill with the learning goal by:
- Investigating a scatter plot for positive, negative, and linear association.
 - Investigating a scatter plot for clustering between two quantities.
 - Constructing a scatter plot from given data.
 - Constructing a two-way frequency table of given categorical data.

Learning Targets

WGSD Curriculum – Math 8th Grade

- Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association
- Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line
- Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept
 - *For example, in a linear model for a biology experiment, interpret a slope of 1.5 cm/hr as meaning that an additional hour of sunlight each day is associated with an additional 1.5 cm in mature plant height*
- Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to describe possible association between the two variables
 - *For example, collect data from students in your class on whether or not they have a curfew on school nights and whether or not they have assigned chores at home. Is there evidence that those who have a curfew also tend to have chores?*

Learning Design

WGSD Curriculum – Math 8th Grade

Sources:

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