

## 7<sup>th</sup> Grade Math Curriculum/6<sup>th</sup> Grade Advanced

### ***Course Information:***

*Course:* Course 2 of Prentice Hall Common Core

*Length:* 1 period/day

*Description:* Mathematics at the 7<sup>th</sup> grade level will cover a variety of fundamental math skills, along with application of real-life scenarios. The course will also include the following concepts: ratios and proportional relationships, the number system, expressions and equations, geometry, statistics, and probability.

### **Essential Understanding:**

The seventh grade curriculum is designed to focus but not be limited to four critical areas using a variety of mathematical practices.

- (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.
- (4) Drawing inferences about populations based on samples.

### **Theme Samples:**

1. Integers and Rational Numbers
2. Equations
3. Inequalities
4. Ratios, Rates, and Proportions
5. Percents
6. Geometry and Area
7. Surface Area and Volume
8. Analyzing Data
9. Probability

### **Mathematical Practices:**

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

### **Course Expectations:**

1. Students will build on their knowledge of whole numbers, fractions, and decimals to compute with rational numbers.
2. Students evaluate and write algebraic expressions and write and solve both one-step and two-step equations.
3. Students write and solve one-step and two-step inequalities.
4. Students learn to find equivalent ratios and to see if ratios can form a proportion.
5. Students work with percents, including percents less than or greater than 100.
6. Students work with plane geometry concepts.
7. Students will build on their knowledge of the geometric concepts from the previous chapter to learn about the properties of three dimensional figures.
8. Students build on their knowledge of graphing and statistics as they investigate different ways of obtaining and displaying data.
9. Students work with both theoretical and experimental probability.

### **Student Objectives**

1. Students will be able to compare and order integers, perform all operations with integers, convert between fractions/decimals/rational numbers, and perform all operations with rational numbers.
2. Students will be able to evaluate and write algebraic expressions, simplify expressions, write one and two step equations from word problems, solve one and two step equations, and use the Distributive Property to solve equations.
3. Students will be able to graph and write inequalities and solve one and two step inequalities using inverse operations.
4. Students will be able to write ratios and use them to compare quantities, solve for unit rates and unit cost using proportional reasoning, identify and write proportions from word problems, solve proportions using the Multiplication Property of Equality, solve proportions using unit rates, mental math, and cross products, use proportions to find missing lengths in similar figures, use proportions to solve problems involving scale, and identify proportional relationships and find constants of proportionality.
5. Students will convert between fractions, decimals, and percent, will use proportions to solve problems involving percent, will find and estimate solutions to application problems involving percent, and will find and apply percent of increase and decrease including markup and discount.
6. Students will write and solve equations for unknown angle measures, identify types of angles, solve for perimeter and area of parallelograms, triangles, trapezoids, circles, apply area and perimeter formulas to solving for missing information, and know formulas for and solve for area and circumference of a circle.
7. Students will classify and draw three dimensional figures, find surface areas and volume of two and three dimensional of figures composed of triangles, quadrilaterals, polygons, cubes, and right prisms, and describe and identify cross sections of three dimensional figures.
8. Students will identify random samples and use to write survey questions, estimate population size, use data from random samples to draw inferences about populations, and compare data about two populations using measures of center and variability.
9. Students will find probability and complement of an event, find experimental probability, make and use sample spaces, find probability of independent and dependent events, and design and use simulations to estimate probability of compound events.

**Pacing****Montana Common Core Standard****Quarter 1**

Integers and Rational Numbers  
Equations

7.NS.1; 7.NS.2; 7.NS.3  
7.EE.1; 7.EE.3; 7.EE.4

**Quarter 2**

Inequalities  
Ratios, Rates, and Proportions

7.EE.4  
7.RP.1; 7.RP.2; 7.G.1

**Quarter 3**

Percents  
Geometry and Area

7.EE.2; 7.EE.3; 7.RP.3  
7.G.2; 7.G.4; 7.G.5; 7.G.6

**Quarter 4**

Surface Area and Volume  
Analyzing Data  
Probability

7.G.3; 7.G.6  
7.SP.1; 7.SP.2; 7.SP.3; 7.SP.4  
7.SP.5; 7.SP.6; 7.SP.7; 7.SP.8

**Timeline****Approximate length to teach unit**

Fundamental Skills Review	15- 20 days
Chapter 1- Integers and Rational Numbers	25 days
Chapter 2- Equations	24 days
Chapter 3- Inequalities	14 days
Chapter 4- Ratios, Rates, and Proportions	24 days
Chapter 5- Percents	18 days
Chapter 6- Geometry and Area	14 days
Chapter 7- Surface Area and Volume	8-10 days
Chapter 8- Analyzing Data	8-10 days
Chapter 9- Probability	14 days

**Content**

## Quarter 1

Fundamentals Skills Review

A. Adding, Subtracting, Multiplying, and Dividing with Decimals

B. Adding, Subtracting, Multiplying, and Dividing Operations with Fractions and Mixed Numbers

Integers and Rational Numbers

- A. Comparing and Ordering Integers
- B. Adding and Subtracting Integers
- C. Multiplying and Dividing Integers
- D. Fractions and Decimals
- E. Rational Numbers
- F. Adding and Subtracting Rational Numbers
- G. Multiplying Rational Numbers
- H. Dividing Rational Numbers

Quarter 2

Equations

- A. Evaluating and Writing Algebraic Expressions
- B. Simplifying Expressions
- C. Solving One Step Equations
- D. Exploring Two Step Equations
- E. Solving Two Step Equations
- F. Solving Equations Involving the Distributive Property Inequalities

Inequalities

- A. Graphing and Writing Inequalities
- B. Solving Inequalities by Adding or Subtracting
- C. Solving Inequalities by Multiplying or Dividing
- D. Solving Two- Step Inequalities

Quarter 3

Ratios, Rates, and Proportions

- A. Ratios
- B. Unit Rates and Proportional Reasoning
- C. Proportions
- D. Solving Proportions
- E. Similar Figures
- F. Maps and Scale Drawings
- G. Proportional Relationships

Percents

- A. Percents, Fractions, and Decimals
- B. Solving Percent Problems Using Proportions
- C. Solving Percent Problems Using Equations
- D. Applications of Percents
- E. Simple Interest
- F. Finding Percent of Change

Quarter 4

Geometry and Area

- A. Angle Measures
- B. Area of a Parallelogram
- C. Area of a Triangle

- D. Area of Other Figures
- E. Circumference and Area of a Circle

#### Surface Area and Volume

- A. Three Dimensional Figures
- B. Surface Area of Prisms and Cylinders
- C. Volumes of Prisms and Cylinders
- D. Cross Sections

#### Analyzing Data

- A. Random Samples
- B. Estimating Population Size
- C. Inferences
- D. Data Variability

#### Probability

- A. Probability
- B. Experimental Probability
- C. Sample Spaces
- D. Compound Events
- E. Simulating Compound Events

## Montana Mathematics Grade 7 Content Standards

In Grade 7, instructional time should 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.

1. Students extend their understanding of ratios and develop understanding of proportionality to solve single- and multi-step problems. Students use their understanding of ratios and proportionality to solve a wide variety of percent problems, including those involving discounts, interest, taxes, tips, and percent increase or decrease. Students solve problems about scale drawings by relating corresponding lengths between the objects or by using the fact that relationships of lengths within an object are preserved in similar objects. Students graph proportional relationships and understand the unit rate informally as a measure of the steepness of the related line, called the slope. They distinguish proportional relationships from other relationships.
2. Students develop a unified understanding of number, recognizing fractions, decimals (that have a finite or a repeating decimal representation), and percents as different representations of rational numbers. Students extend addition, subtraction, multiplication, and division to all rational numbers, maintaining the properties of operations and the relationships between addition and subtraction, and multiplication and division. By applying these properties, and by viewing negative numbers in terms of everyday contexts (e.g., amounts owed or temperatures below zero), students explain and interpret the rules for adding, subtracting, multiplying, and dividing with negative numbers. They use the arithmetic of rational numbers as they formulate expressions and equations in one variable and use these equations to solve problems.
3. Students continue their work with area from Grade 6, solving problems involving the area and circumference of a circle and surface area of three-dimensional objects. In preparation for work on congruence and similarity in Grade 8 they reason about relationships among two-dimensional figures using scale drawings and informal geometric constructions, and they gain familiarity with the relationships between angles formed by intersecting lines. Students work with three-dimensional figures, relating them to two-dimensional figures by examining cross-sections. They solve real-world and mathematical problems involving area, surface area, and volume of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes and right prisms.
4. Students build on their previous work with single data distributions to compare two data distributions and address questions about differences between populations. They begin informal work with random sampling to generate data sets and learn about the importance of representative samples for drawing inferences.

### Mathematical Practices

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

### Grade 7 Overview

#### Ratios and Proportional Relationships

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

#### The Number System

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

#### Expressions and Equations

- Use properties of operations to generate equivalent expressions.
- Solve real-life and mathematical problems using numerical and algebraic expressions and equations.

#### Geometry

- Draw, construct and describe geometrical figures and describe the relationships between them.
- Solve real-life and mathematical problems involving angle measure, area, surface area, and volume.

#### Statistics and Probability

- Use random sampling to draw inferences about a population.
- Draw informal comparative inferences about two populations.
- Investigate chance processes and develop, use, and evaluate probability models.

## Ratios and Proportional Relationships

7.RP

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

1. 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  $1/2$  mile in each  $1/4$  hour, compute the unit rate as the complex fraction  $^{1/2}/_{1/4}$  miles per hour, equivalently 2 miles per hour.*
2. Recognize and represent proportional relationships between quantities including those represented in Montana American Indian cultural contexts.
  - a. Decide whether two quantities are in a proportional relationship, e.g., by testing for equivalent ratios in a table or graphing on a coordinate plane and observing whether the graph is a straight line through the origin.
  - b. Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.
  - c. Represent proportional relationships by equations. *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  $t = pn$ . A contemporary American Indian example, analyze cost of beading materials; cost of cooking ingredients for family gatherings, community celebrations, etc.*
  - d. Explain what a point  $(x, y)$  on the graph of a proportional relationship means in terms of the situation, with special attention to the points  $(0, 0)$  and  $(1, r)$  where  $r$  is the unit rate.
3. Use proportional relationships to solve multistep ratio and percent problems within cultural contexts, including those of Montana American Indians (e.g., percent of increase and decrease of tribal land). *Examples: simple interest, tax, markups and markdowns, gratuities and commissions, fees, percent increase and decrease, percent error.*

## The Number System

7.NS

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

1. Apply and extend previous understandings of addition and subtraction to add and subtract rational numbers; represent addition and subtraction on a horizontal or vertical number line diagram.
  - a. 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.*
  - b. Understand  $p + q$  as the number located a distance  $|q|$  from  $p$ , in the positive or negative direction depending on whether  $q$  is positive or negative. Show that a number and its opposite have a sum of 0 (are additive inverses). Interpret sums of rational numbers by describing real-world contexts.
  - c. Understand subtraction of rational numbers as adding the additive inverse,  $p - q = p + (-q)$ . Show that the distance between two rational numbers on the number line is the absolute value of their difference, and apply this principle in real-world contexts.
  - d. Apply properties of operations as strategies to add and subtract rational numbers.
2. Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers.
  - a. Understand that multiplication is extended from fractions to rational numbers by requiring that operations continue to satisfy the properties of operations, particularly the distributive property, leading to products such as  $(-1)(-1) = 1$  and the rules for multiplying signed numbers. Interpret products of rational numbers by describing real-world contexts.
  - b. Understand that integers can be divided, provided that the divisor is not zero, and every quotient of integers (with non-zero divisor) is a rational number. If  $p$  and  $q$  are integers, then  $-(p/q) = (-p)/q = p/(-q)$ . Interpret quotients of rational numbers by describing real-world contexts.
  - c. Apply properties of operations as strategies to multiply and divide rational numbers.
  - d. Convert a rational number to a decimal using long division; know that the decimal form of a rational number terminates in 0s or eventually repeats.
3. Solve real-world and mathematical problems from a variety of cultural contexts, including those of Montana American Indians, involving the four operations with rational numbers.<sup>1</sup>



**Use properties of operations to generate equivalent expressions.**

1. Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.
2. 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.”*

**Solve real-life and mathematical problems using numerical and algebraic expressions and equations.**

3. Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies. *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.*
4. Use variables to represent quantities in a real-world or mathematical problem, including those represented in Montana American Indian cultural contexts, and construct simple equations and inequalities to solve problems by reasoning about the quantities.
  - a. Solve word problems leading to equations of the form  $px + q = r$  and  $p(x + q) = r$ , where  $p$ ,  $q$ , and  $r$  are specific rational numbers. Solve equations of these forms fluently. Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach. *For example, the perimeter of a rectangle is 54 cm. Its length is 6 cm. What is its width?*
  - b. Solve word problems leading to inequalities of the form  $px + q > r$  or  $px + q < r$ , where  $p$ ,  $q$ , and  $r$  are specific rational numbers. Graph the solution set of the inequality and interpret it in the context of the problem. *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.*

**Draw, construct, and describe geometrical figures and describe the relationships between them.**

1. Solve problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale.
2. Draw (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.
3. Describe the two-dimensional figures that result from slicing three-dimensional figures, as in plane sections of right rectangular prisms and right rectangular pyramids.

**Solve real-life and mathematical problems involving angle measure, area, surface area, and volume.**

4. Know the formulas for the area and circumference of a circle and use them to solve problems from a variety of cultural contexts, including those of Montana American Indians; give an informal derivation of the relationship between the circumference and area of a circle.
5. Use facts about supplementary, complementary, vertical, and adjacent angles in a multi-step problem to write and solve simple equations for an unknown angle in a figure.
6. Solve real-world and mathematical problems from a variety of cultural contexts, including those of Montana American Indians, involving area, volume and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms.

**Use random sampling to draw inferences about a population.**

1. 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.
2. Use data, including Montana American Indian demographic 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, predict how many text messages your classmates receive in a day. Gauge how far off the estimate or prediction might be.*

**Draw informal comparative inferences about two populations.**

3. 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.*
4. 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.*

**Investigate chance processes and develop, use, and evaluate probability models.**

5. Understand that the probability of a chance event is a number between 0 and 1 that expresses the likelihood of the event occurring. Larger numbers indicate greater likelihood. A probability near 0 indicates an unlikely event, a probability around 1/2 indicates an event that is neither unlikely nor likely, and a probability near 1 indicates a likely event.
6. 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. For example, when playing Montana American Indian Hand/Stick games, you can predict the approximate number of accurate guesses.*
7. Develop a probability model and use it to find probabilities of events. Compare probabilities from a model to observed frequencies; if the agreement is not good, explain possible sources of the discrepancy.
  - a. Develop a uniform probability model by assigning equal probability to all outcomes, and use the model to determine probabilities of events. *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.*
  - b. 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?*
8. Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation.
  - a. Understand that, just as with simple events, the probability of a compound event is the fraction of outcomes in the sample space for which the compound event occurs.
  - b. Represent sample spaces for compound events using methods such as organized lists, tables and tree diagrams. For an event described in everyday language (e.g., “rolling double sixes”), identify the outcomes in the sample space which compose the event.
  - c. Design and use a simulation to generate frequencies for compound events. *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?*

Resources:

*Prentice Hall Course 2 Mathematics Common Core 2013 Edition*

*Prentice Hall Course 2 Mathematics 2010 Edition*

Montana Common Core Standards for Mathematical Practice & Content from Office of Public Instruction WEBPAGE; Denise Juneau, Superintendent, Montana Office of Public Instruction, [www.opi.mt.gov](http://www.opi.mt.gov)