Draft Sisitunwaŋ-Wahpetunwaŋ Standards

Grades K-12 Math

Taku waunspeiçiciyapi hena sdodyapi yaciŋ he?

Tribal Council Approval – August 2, 2017

Resolution No. SWO-17-067

Standards for Kindergarten Math

Taku waunspeiçiciyapi hena sdodyapi yaciŋ he?

Introduction

In Kindergarten, instructional time should focus on two critical areas: (1) representing and comparing whole numbers, initially with sets of objects; (2) describing shapes and space. More learning time in Kindergarten should be devoted to numbers than to other topics.

Throughout the year, students should solve real-world problems that involve connections to Dakotah symbols, culture or contemporary Dakotah issues. Examples are provided within the standards. In implementation of these standards, students should have an opportunity to develop as creative thinkers and global citizens, utilizing math to solve real problems in the community and their world.

The Dakotah language words, spelling, fonts, and pronunciations will be based on the SWO Dakotah Language Institute.

Throughout the standards, many sample problems are adapted from Illustrative Mathematics. Go to www.illustrativemathematics.org to find solutions and extended explanations for each standard.

Mathematical Practices

The standards for Mathematical Practice describe ways in which students develop mathematical proficiency throughout the elementary, middle and high school years. The core practices are the same for all grade levels and represent important habits for students to develop, but implementation looks different at each grade level to align with students' developmental levels. These standards should be included in lesson planning alongside content standards.

Practice 1: Make sense of problems and persevere in solving them. I can think about how to solve a problem and carry out my plan. If I get stuck, I try something else. (PBLO: Creative Thinkers)

- I know that doing math involves solving problems and talking about how I solved them. I can say in my own words, to myself and others, what a problem means and think about ways to solve it. I can use objects or pictures to help me understand and solve problems. I can check my thinking by asking myself, "Does this make sense?".

Practice 2: Reason abstractly and quantitatively. I can use numbers, words and reasoning to help me make sense of problems. (PBLO: Creative Thinkers)

- I can begin to see that a number shows a specific quantity and can connect it to a written symbol.

Practice 3: Construct viable arguments and critique the reasoning of others. I can justify my thinking and engage in meaningful mathematical discussions with others. I can support my argument with objects, drawings, diagrams and explanations. (PBLO: Effective Communicators)

- I can use objects, pictures, drawings, and actions to explain my thinking. I can talk about math and ask and answer questions like "How did you get that?", "What strategy did you use?", and "Why is that true?" I can explain my thinking to others and respond to others' thinking.

Practice 4: Model with mathematics. I can recognize when math will help me solve a problem in everyday life and can apply math I know to find a solution. (PBLOs: Creative Thinkers and Global Citizens)

- I can represent a math problem in multiple ways including numbers, words (mathematical language), drawing pictures, using objects, acting out, making a chart or list, creating equations, etc. and can use a variety of different representations. I can connect the different representations and explain the connections.

Practice 5: Use appropriate tools strategically. I can choose and use math tools to help me explore and deepen my math understanding. (PBLO: Creative Thinkers)

- I can think about math tools (including estimation) when solving a problem and decide when certain tools might be helpful. I can use linking cubes to represent two quantities and then compare the two representations side-by-side.

Practice 6: Attend to precision. I can be precise when calculating, solving problems, and communicating my ideas. (PBLO: Effective Communicators)

- I can use math accurately. I can try to use math vocabulary in my discussions with others and when I explain my own reasons.

Practice 7: Look for and make use of structure. I can see and understand how numbers and spaces are organized and put together as parts and wholes. (PBLO: Creative Thinkers)

- I can begin to see a pattern or structure. I can see the pattern that exists in the teen numbers; every teen number is written with a 1 (representing one ten) and ends with the digit that is said first.

Practice 8: Look for and express regularity in repeated reasoning. I can notice when there are patterns, when calculations are repeated, and can then find more general and efficient methods. (PBLO: Creative Thinkers)

- I can notice when I do repeating actions in counting and computation. I notice that the next number in the counting sequence is one more.

Priority Content Standards

Students should spend the large majority of their time on the **major work** of the grade. **Supporting work** and, where appropriate, **additional work** can engage students in the major work of the grade. Prioritized clusters are listed below and identified in the standards.

MAJOR, SUPPORTING, AND ADDITIONAL CLUSTERS FOR KINDERGARTEN

Emphases are given at the cluster level. Refer to the Common Core State Standards for Mathematics for the specific standards that fall within each cluster.

Key: ■ Major Clusters □ Supporting Clusters ○ Additional Clusters

K.CC.A	■	Know number names and the count sequence.
K.CC.B	■	Count to tell the number of objects.
K.CC.C	■	Compare numbers.
K.OA.A	■	Understand addition as putting together and adding to, and understand subtraction as taking apart and taking from.
K.NBT.A	■	Work with numbers 11–19 to gain foundations for place value.
K.MD.A	○	Describe and compare measureable attributes.
K.MD.B	□	Classify objects and count the number of objects in categories.
K.G.A	○	Identify and describe shapes.
K.G.B	□	Analyze, compare, create, and compose shapes.

Counting and Cardinality

Know number names and the count sequence. (Major Work)

K.CC.1: Count to 100 by ones and by tens.

- **K.CC.1a:** Identify numbers that are important to Dakotah culture, such as 7 and 4.

K.CC.2: Count forward beginning from a given number within the known sequence (instead of having to begin at 1).

K.CC.3: Write numbers from 0 to 20. Represent a number of objects with a written numeral 0-20 (with 0 representing a count of no objects).

Count to tell the number of objects. (Major Work)

K.CC.4: Understand the relationship between numbers and quantities; connect counting to cardinality.

- **K.CC.4a:** When counting objects in English and Dakotah, say the number names in the standard order, pairing each object with one and only one number name and each number name with one and only one object.
- **K.CC.4b:** Understand that the last number name said tells the number of objects counted. The number of objects is the same regardless of their arrangement or the order in which they were counted.
- **K.CC.4c:** Understand that each successive number name refers to a quantity that is one larger.

K.CC.5: In English and Dakotah, count to answer "how many?" questions about as many as 20 things arranged in a line, a rectangular array, or a circle, or as many as 10 things in a scattered configuration; given a number from 1-20, count out that many objects.

Compare numbers. (Major Work)

K.CC.6: Identify whether the number of objects in one group is greater than (isaŋpa) less than (aokpani), or the same as (iyececa) the number of objects in another group, by using matching and counting strategies, including groups with up to 10 objects.

K.CC.7: Compare two numbers between 1 and 10 presented as written numerals.

Operations and Algebraic Thinking

Understand addition as putting together and adding to, and understand subtraction as taking apart and taking from. (Major Work)

K.OA.1: Represent addition and subtraction with objects, fingers, mental images, drawings, sounds, acting out situations, verbal explanations, expressions, or equations.

K.OA.2: Solve addition and subtraction word problems, and add and subtract within 10, by using objects or drawings to represent the problem.

K.OA.3: Decompose numbers less than or equal to 10 into pairs in more than one way, by using objects or drawings, and record each decomposition by a drawing or equation.

K.OA.4: For any number from 1 to 9, find the number that makes 10 when added to the given number, by using objects or drawings, and record the answer with a drawing or equation.

K.OA.5: Fluently add and subtract within 5.

Number and Operations in Base Ten

Work with numbers 11-19 to gain foundations for place value. (Major Work)

K.NBT.1: Compose and decompose numbers from 11 to 19 into ten ones and some further ones, by using objects or drawings, and record each composition or decomposition by a drawing or equation (such as 18 = 10 + 8); understand that these numbers are composed of ten ones and one, two, three, four, five, six, seven, eight, or nine ones.

Measurement and Data

Describe and compare measurable attributes. (Additional Work)

K.MD.1: Describe measurable attributes of objects, such as length or weight. Describe several measurable attributes of a single object.

K.MD.2: Directly compare two objects with a measurable attribute in common, to see which object has "more of"/"less of" the attribute, and describe the difference.

Classify objects and count the number of objects in each category. (Supporting Work)

K.MD.3: Classify objects (including objects significant to Dakotah culture) into given categories; count the numbers of objects in each category (in English and Dakotah) and sort the categories by count, size, shape or color.

K.MD.4: Identify pennies, nickels, dimes and quarters by name and value.

Geometry

Identify and describe shapes. (Additional Work)

K.G.1: Describe objects in the environment using names of shapes, including squares, circles, triangles, hexagons, cubes, cones, cylinders and spheres.

- **K.G.1a:** Correctly name and identify basic shapes in Dakotah: circle (himyaya), square (obdetuŋ), rectangle (obdetuŋ haŋska), triangle (oise yamni), oval (witkamibe), star (wicaŋhpi).

K.G.2: Correctly name shapes regardless of their orientations or overall size.

- **K.G.2a:** Correctly describe the relative positions of shapes using Dakotah terms: above (iwaŋkam), below (ihukudya), beside (ịcahda).

K.G.3: Identify shapes as two-dimensional (lying in a plane, "flat") or three-dimensional ("solid").

Analyze, compare, create, and compose shapes. (Supporting Work)

K.G.4: Analyze and compare two- and three-dimensional shapes, in different sizes and orientations, using informal language to describe their similarities, differences, parts and other attributes.

K.G.5: Model shapes in the world by building shapes from components and drawing shapes.

K.G.6: Compose simple shapes to form larger shapes.

Standards for Toka heya (Grade 1) Math

Taku waunspeiçiciyapi hena sdodyapi yaciŋ he?

Introduction

In Toka heya (Grade 1), instructional time should focus on four critical areas: (1) developing understanding of addition, subtraction, and strategies for addition and subtraction within 20; (2) developing understanding of whole number relationships and place value, including grouping in tens and ones; (3) developing understanding of linear measurement and measuring lengths as iterating length units; and (4) reasoning about attributes of, and composing and decomposing geometric shapes.

Throughout the year, students should solve real-world problems that involve connections to Dakotah symbols, culture or contemporary Dakotah issues. Examples are provided within the standards. In implementation of these standards, students should have an opportunity to develop as creative thinkers and global citizens, utilizing math to solve real problems in the community and in their world.

The Dakotah language words, spelling, fonts, and pronunciations will be based on the SWO Dakotah Language Institute.

Throughout the standards, many sample problems are adapted from Illustrative Mathematics. Go to www.illustrativemathematics.org to find solutions and extended explanations for each standard.

Mathematical Practices

The standards for Mathematical Practice describe ways in which students develop mathematical proficiency throughout the elementary, middle and high school years. The core practices are the same for all grade levels and represent important habits for students to develop, but implementation looks different at each grade level to align with students' developmental levels. These standards should be included in lesson planning alongside content standards.

Practice 1: Make sense of problems and persevere in solving them. I can think about how to solve a problem and carry out my plan. If I get stuck, I try something else. (PBLO: Creative Thinkers)

- I know that doing mathematics involves solving problems and discussing how I solved them. I can explain to myself the meaning of a problem and look for ways to solve it. I can use concrete objects or pictures to help me understand and solve problems. I can check my thinking by asking myself "Does this make sense?" I can try different ways to solve the problem.

Practice 2: Reason abstractly and quantitatively. I can use numbers, words and reasoning habits to help me make sense of problems. (PBLO: Creative Thinkers)

- I know that a number represents a specific quantity. I can connect the quantity to written symbols. I can create a representation of a problem.

Practice 3: Construct viable arguments and critique the reasoning of others. I can justify my thinking and engage in meaningful mathematical discussions with others. I can support my argument with objects, drawings, diagrams and explanations. (PBLO: Effective Communicators)

- I can construct a math explanation using objects, pictures, drawings, and actions. I can talk about math and ask questions like “How did you get that?”, “Explain your thinking”, and “Why is that true?” I can explain my own thinking and listen to others’ explanations. I can decide if the explanations make sense and ask questions.

Practice 4: Model with mathematics. I can recognize when math will help me solve a problem in everyday life and can apply math I know to find a solution. (PBLOs: Creative Thinkers and Global Citizens)

- I can represent a math problem in multiple ways including numbers, words (mathematical language), drawing pictures, using objects, acting out, making a chart or list, creating equations, etc. and can use a variety of different representations. I can connect the different representations and explain the connections.

Practice 5: Use appropriate tools strategically. I can choose and use math tools to help me explore and deepen my math understanding. (PBLO: Creative Thinkers)

- I can think about math tools (including estimation) when solving a problem and decide when certain tools might be helpful.

Practice 6: Attend to precision. I can be precise when calculating, solving problems, and communicating my ideas. (PBLO: Effective Communicators)

- I can try to use math vocabulary in my discussions with others and when I explain my own reasons.

Practice 7: Look for and make use of structure. I can see and understand how numbers and spaces are organized and put together as parts and wholes. (PBLO: Creative Thinkers)

- I can begin to see a pattern or structure. (Commutative property of addition.)

Practice 8: Look for and express regularity in repeated reasoning. I can notice when calculations are repeated and can then find more general and efficient methods. (PBLO: Creative Thinkers)

- I can notice when I do repeating actions in counting and computation. When I add and subtract ten and multiples of ten, I notice the pattern and gain a better understanding of place value. I continually check my work by asking myself, “Does this make sense?”

Priority Content Standards

Students should spend the large majority of their time on the **major work** of the grade. **Supporting work** and, where appropriate, **additional work** can engage students in the major work of the grade. Prioritized clusters are listed below and identified in the standards.

MAJOR, SUPPORTING, AND ADDITIONAL CLUSTERS FOR GRADE 1

Emphases are given at the cluster level. Refer to the Common Core State Standards for Mathematics for the specific standards that fall within each cluster.

Key: ■ Major Clusters ☐ Supporting Clusters ○ Additional Clusters

1.OA.A	■	Represent and solve problems involving addition and subtraction.
1.OA.B	■	Understand and apply properties of operations and the relationship between addition and subtraction.
1.OA.C	■	Add and subtract within 20.
1.OA.D	■	Work with addition and subtraction equations.
1.NBT.A	■	Extending the counting sequence.
1.NBT.B	■	Understand place value.
1.NBT.C	■	Use place value understanding and properties of operations to add and subtract.
1.MD.A	■	Measure lengths indirectly and by iterating length units.
1.MD.B	○	Tell and write time.
1.MD.C	☐	Represent and interpret data.
1.G.A	○	Reason with shapes and their attributes.

Operations and Algebraic Thinking

Represent and solve problems involving addition and subtraction. (Major Work)

1.OA.1: Use addition and subtraction within 20 to solve word problems involving situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all positions, by using objects, drawings, and equations with a symbol for the unknown number to represent the problem.

1.OA.2: Solve word problems that call for addition of three whole numbers whose sum is less than or equal to 20.

Understand and apply properties of operations and the relationship between addition and subtraction. (Major Work)

1.OA.3: Apply properties of operations as strategies to add and subtract.

1.OA.4: Understand subtraction as an unknown-addend problem.

Add and subtract within 20. (Major Work)

1.OA.5: Relate counting to addition and subtraction.

1.OA.6: Add and subtract within 20, demonstrating fluency for addition and subtraction within 10. Use strategies such as counting on; making ten, decomposing a number leading to a ten, using the relationship between addition and subtraction and creating equivalent but easier or known sums.

Work with addition and subtraction equations. (Major Work)

1.OA.7: Understand the meaning of the equal sign, and determine if equations involving addition and subtraction are true or false.

1.OA.8: Determine the unknown whole number in an addition or subtraction equation relating three whole numbers.

Number and Operations in Base Ten

Extend the counting sequence. (Major Work)

1.NBT.1: Count to 120, in English and Dakotah, starting at any number less than 120. In this range, read and write numerals and represent a number of objects with a written numeral.

- **1.NBT.1a:** Count using ordinal numbers in order to twenty.

Understand place value. (Major Work)

1.NBT.2: Understand that the two digits of a two-digit number represent amounts of tens and ones.

1.NBT.3: Compare two two-digit numbers based on meanings of the tens and ones digits, recording the results of comparisons with the symbols >, =, and <.

Use place value understanding and properties of operations to add and subtract. (Major Work)

1.NBT.4: Add within 100, including adding a two-digit number and a one-digit number, and adding a two-digit number and a multiple of 10, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning used. Understand that in adding two-digit numbers, one adds tens and tens, ones and ones; and sometimes it is necessary to compose a ten.

1.NBT.5: Given a two-digit number, mentally find 10 more or 10 less than the number, without having to count; explain the reasoning used.

1.NBT.6: Subtract multiples of 10 in the range 10-90 from multiples of 10 in the range 10-90 (positive or zero differences), using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning used.

Measurement and Data

Measure lengths indirectly and by iterating length units. (Major Work)

1.MD.1: Order three objects by length; compare the lengths of two objects indirectly by using a third object.

1.MD.2: Express the length of an object as a whole number of length units, by laying multiple copies of a shorter object (the length unit) end to end; understand that the length measurement of an object is the number of same-size length units that span it with no gaps or overlaps. Limit to contexts where the object being measured is spanned by a whole number of length units with no gaps or overlaps.

Tell and write time (Additional Work).

1.MD.3: Tell and write time in hours and half-hours using analog and digital clocks.

Represent and interpret data (Supporting Work).

1.MD.4: Organize, represent, and interpret data with up to three categories; ask and answer questions about the total number of data points, how many in each category, and how many more or less are in one category than in another.

1.MD.5: Count the value of multiple pennies, nickels, dimes and quarters in English and Dakotah.

Geometry

Reason with shapes and their attributes. (Additional Work)

1.G.1: Distinguish between defining attributes versus non-defining attributes. Build and draw shapes to possess defining attributes.

1.G.2: Compose two-dimensional shapes (rectangles, squares, trapezoids, triangles, half-circles, and quarter-circles) or three-dimensional shapes (cubes, right rectangular prisms, right circular cones, and right circular cylinders) to create a composite shape, and compose new shapes from the composite shape.

1.G.3: Partition circles and rectangles into two and four equal shares, describe the shares using the words halves, fourths, and quarters, and use the phrases half of, fourth of, and quarter of. Describe the whole as two of, or four of the shares. Understand for these examples that decomposing into more equal shares creates smaller shares.

Standards for Inunpa (Grade 2) Math

Taku waunspeiçiciyapi hena sdodyapi yaciŋ he?

Introduction

In Inunpa (Grade 2), instructional time should focus on four critical areas: (1) extending understanding of base-ten notation; (2) building fluency with addition and subtraction; (3) using standard units of measure; and (4) describing and analyzing shapes.

Throughout the year, students should solve real-world problems that involve connections to Dakotah symbols, culture or contemporary Dakotah issues. Examples are provided within the standards. In implementation of these standards, students should have an opportunity to develop as creative thinkers and global citizens, utilizing math to solve real problems in the community and in their world.

The Dakotah language words, spelling, fonts, and pronunciations will be based on the SWO Dakotah Language Institute.

Throughout the standards, many sample problems are adapted from Illustrative Mathematics. Go to www.illustrativemathematics.org to find solutions and extended explanations for each standard.

Mathematical Practices

The standards for Mathematical Practice describe ways in which students develop mathematical proficiency throughout the elementary, middle and high school years. The core practices are the same for all grade levels and represent important habits for students to develop, but implementation looks different at each grade level to align with students' developmental levels. These standards should be included in lesson planning alongside content standards.

Practice 1: Make sense of problems and persevere in solving them. I can think about how to solve a problem and carry out my plan. If I get stuck, I try something else. (PBLO: Creative Thinkers)

- I know that doing mathematics involves solving problems and discussing how I solved them. I can explain to myself the meaning of a problem and look for ways to solve it. I can use concrete objects or pictures to help me understand and solve problems. I can check my thinking by asking myself "Does this make sense?". I can make a guess about a solution and plan out how to solve the problem.

Practice 2: Reason abstractly and quantitatively. I can use numbers, words and reasoning habits to help me make sense of problems. (PBLO: Creative Thinkers)

- I know that a number represents a specific quantity. I can connect the quantity to written symbols. I can create a representation of a problem while also thinking about what the number means. I can use different properties of operations and relate addition and subtraction to length.

Practice 3: Construct viable arguments and critique the reasoning of others. I can justify my thinking and engage in meaningful mathematical discussions with others. I can support my argument with objects, drawings, diagrams and explanations. (PBLO: Effective Communicators)

- I can construct an argument using concrete objects, such as objects, pictures, drawings, and actions. I can participate in mathematical discussions involving questions like “How did you get that?”, “Explain your thinking” and “Why is that true?”. I can explain my own thinking, but listen to others’ explanations. I can decide if the explanations make sense and ask questions about the explanations.

Practice 4: Model with mathematics. I can recognize when math will help me solve a problem in everyday life and can apply math I know to find a solution. (PBLOs: Creative Thinkers and Global Citizens)

- I can experiment with representing problem situations in multiple ways including numbers, words (mathematical language), drawing pictures, using objects, acting out, making a chart or list, creating equations, etc. I can connect the different representations and explain the connections.

Practice 5: Use appropriate tools strategically. I can choose and use math tools to help me explore and deepen my math understanding. (PBLO: Creative Thinkers)

- I can think about the available tools (including estimation) when solving a mathematical problem and decide when certain tools might be better to use. I can solve a problem by drawing a picture rather than writing an equation.

Practice 6: Attend to precision. I can be precise when calculating, solving problems, and communicating my ideas. (PBLO: Effective Communicators)

- I can begin to use math vocabulary in my discussions with others and when I explain my reasons.

Practice 7: Look for and make use of structure. I can see and understand how numbers and spaces are organized and put together as parts and wholes. (PBLO: Creative Thinkers)

- I can look for patterns. I can use mental math strategies based on patterns (making ten, fact families, doubles).

Practice 8: Look for and express regularity in repeated reasoning. I can notice when calculations are repeated and can then find more general and efficient methods. (PBLO: Creative Thinkers)

- I can look for patterns in addition and subtraction to find shortcuts, such as rounding up and then adjusting the answer. I continually check my work by asking myself, “Does this make sense?”

Priority Content Standards

Students should spend the large majority of their time on the **major work** of the grade. **Supporting work** and, where appropriate, **additional work** can engage students in the major work of the grade. Prioritized clusters are listed below and identified in the standards.

MAJOR, SUPPORTING, AND ADDITIONAL CLUSTERS FOR GRADE 2

Emphases are given at the cluster level. Refer to the Common Core State Standards for Mathematics for the specific standards that fall within each cluster.

Key: ■ Major Clusters □ Supporting Clusters ○ Additional Clusters

2.OA.A	■	Represent and solve problems involving addition and subtraction.
2.OA.B	■	Add and subtract within 20.
2.OA.C	□	Work with equal groups of objects to gain foundations for multiplication.
2.NBT.A	■	Understand place value.
2.NBT.B	■	Use place value understanding and properties of operations to add and subtract.
2.MD.A	■	Measure and estimate lengths in standard units.
2.MD.B	■	Relate addition and subtraction to length.
2.MD.C	□	Work with time and money.
2.MD.D	□	Represent and interpret data.
2.G.A	○	Reason with shapes and their attributes.

Operations and Algebraic Thinking

Represent and solve problems involving addition and subtraction. (Major Work)

2.OA.1: Use addition and subtraction within 100 to solve one- and two-step word problems involving situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all positions.

Add and subtract within 20. (Major Work)

2.OA.2: Fluently add and subtract within 20 using mental strategies such as counting on; making ten, decomposing a number leading to a ten, using the relationship between addition and subtraction and creating equivalent but easier or known sums,. By end of Grade 2, know from memory all sums of two one-digit numbers.

Work with equal groups of objects to gain foundations for multiplication. (Supporting Work)

2.OA.3: Determine whether a group of objects (up to 20) has an odd or even number of members.

2.OA.4: Use addition to find the total number of objects arranged in rectangular arrays with up to 5 rows and up to 5 columns; write an equation to express the total as a sum of equal addends.

Number and Operations in Base Ten

Understand place value. (Major Work)

2.NBT.1: Understand that the three digits of a three-digit number represent amounts of hundreds, tens, and ones. Describe the digits in English and Dakotah.

- **2.NBT.1a:** 100 can be thought of as a bundle of ten tens - called a "hundred."
- **2.NBT.1b:** The numbers 100, 200, 300, 400, 500, 600, 700, 800, 900 refer to one, two, three, four, five, six, seven, eight, or nine hundreds (and 0 tens and 0 ones).

2.NBT.2: Count within 1000 and skip-count by 5s, 10s, and 100s.

2.NBT.3: Read and write numbers to 1000 using base-ten numerals, number names, and expanded form.

2.NBT.4: Compare two three-digit numbers based on meanings of the hundreds, tens, and ones digits, using >, =, and < symbols to record the results of comparisons.

Use place value understanding and properties of operations to add and subtract. (Major Work)

2.NBT.5: Fluently add and subtract within 100 using strategies based on place value, properties of operations, and/or the relationship between addition and subtraction.

2.NBT.6: Add up to four two-digit numbers using strategies based on place value and properties of operations.

2.NBT.7: Add and subtract within 1000, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method. Understand that in adding or subtracting three-digit numbers, one adds or subtracts hundreds and hundreds, tens and tens, ones and ones; and sometimes it is necessary to compose or decompose tens or hundreds.

2.NBT.8: Mentally add 10 or 100 to a given number 100-900, and mentally subtract 10 or 100 from a given number 100-900.

2.NBT.9: Explain why addition and subtraction strategies work, using place value and the properties of operations.

Measurement and Data

Measure and estimate lengths in standard units. (Major Work)

2.MDA.1: Measure the length of an object by selecting and using appropriate tools such as rulers, yardsticks, meter sticks, and measuring tapes.

2.MDA.2: Measure the length of an object twice, using length units of different lengths for the two measurements; describe how the two measurements relate to the size of the unit chosen.

2.MDA.3: Estimate lengths using units of inches, feet, centimeters, and meters.

2.MDA.4: Measure to determine how much longer one object is than another, expressing the length difference in terms of a standard length unit.

Relate addition and subtraction to length. (Major Work)

2.MD.5: Use addition and subtraction within 100 to solve word problems involving lengths that are given in the same units.

2.MD.6: Represent whole numbers as lengths from 0 on a number line diagram with equally spaced points corresponding to the numbers 0, 1, 2, ..., and represent whole-number sums and differences within 100 on a number line diagram.

Work with time and money. (Supporting Work)

2.MD.7: Tell and write time from analog and digital clocks to the nearest five minutes, using a.m. and p.m.

2.MD.8: Solve word problems involving dollar bills, quarters, dimes, nickels, and pennies, using $ and ¢ symbols appropriately.

Represent and interpret data. (Supporting Work)

2.MD.9: Generate measurement data by measuring lengths of several objects to the nearest whole unit, or by making repeated measurements of the same object. Show the measurements by making a line plot, where the horizontal scale is marked off in whole-number units.

2.MD.10: Draw a picture graph and a bar graph (with single-unit scale) to represent a data set with up to four categories. Solve simple put-together, take-apart, and compare problems using information presented in a bar graph.

Geometry

Reason with shapes and their attributes. (Additional Work)

2.G.1: Recognize and draw shapes having specified attributes, such as a given number of angles or a given number of equal faces. Identify triangles, quadrilaterals, pentagons, hexagons, and cubes.

2.G.2: Partition a rectangle into rows and columns of same-size squares and count to find the total number of them.

2.G.3: Partition circles and rectangles into two, three, or four equal shares, describe the shares using the words halves, thirds, half of, a third of, etc., and describe the whole as two halves, three thirds, four fourths. Recognize that equal shares of identical wholes need not have the same shape.

Standards for Iyamni (Grade 3) Math

Taku waunspeiçiciyapi hena sdodyapi yaciŋ he?

Introduction

In Iyamni (Grade 3), instructional time should focus on four critical areas: (1) developing understanding of multiplication and division and strategies for multiplication and division within 100; (2) developing understanding of fractions, especially unit fractions (fractions with numerator 1); (3) developing understanding of the structure of rectangular arrays and of area; and (4) describing and analyzing two-dimensional shapes.

Throughout the year, students should solve real-world problems that involve connections to Dakotah symbols, culture or contemporary Dakotah issues. Examples are provided within the standards. In implementation of these standards, students should have an opportunity to develop as creative thinkers and global citizens, utilizing math to solve real problems in the community and their world.

The Dakotah language words, spelling, fonts, and pronunciations will be based on the SWO Dakotah Language Institute.

Throughout the standards, many sample problems are adapted from Illustrative Mathematics. Go to www.illustrativemathematics.org to find solutions and extended explanations for each standard.

Mathematical Practices

The standards for Mathematical Practice describe ways in which students develop mathematical proficiency throughout the elementary, middle and high school years. The core practices are the same for all grade levels and represent important habits for students to develop, but implementation looks different at each grade level to align with students' developmental levels. These standards should be included in lesson planning alongside content standards.

Practice 1: Make sense of problems and persevere in solving them. I can think about how to solve a problem and carry out my plan. If I get stuck, I try something else. (PBLO: Creative Thinkers)

- I know that doing mathematics involves solving problems and discussing how they solved them. I can explain to myself the meaning of a problem and look for ways to solve it. I can use concrete objects or pictures to help me understand and solve problems. I can check my thinking by asking myself, "Does this make sense?" I can listen to the strategies of others and try different approaches. I can often use another method to check my answers.

Practice 2: Reason abstractly and quantitatively. I can use numbers, words and reasoning habits to help me make sense of problems. (PBLO: Creative Thinkers)

- I can recognize that a number represents a specific quantity. I can connect the quantity to written symbols and create a logical representation of the problem, thinking about the units and the meaning of quantities.

Practice 3: Construct viable arguments and critique the reasoning of others. I can justify my thinking and engage in meaningful mathematical discussions with others. I can support my argument with objects, drawings, diagrams and explanations. (PBLO: Effective Communicators)

- I can construct arguments using concrete items, such as objects, pictures, and drawings. I can participate in mathematical discussions involving questions like "How did you get that?" and "Why is that true?" I can explain my thinking to others and respond to others' thinking.

Practice 4: Model with mathematics. I can recognize when math will help me solve a problem in everyday life and can apply math I know to find a solution. (PBLOs: Creative Thinkers and Global Citizens)

- I can experiment with representing 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 can use them as needed. I can evaluate my results in the situation and think about whether the results make sense.

Practice 5: Use appropriate tools strategically. I can choose and use math tools to help me explore and deepen my math understanding. (PBLO: Creative Thinkers)

- I can consider the available tools, including estimation, when solving a mathematical problem and decide when certain tools might be helpful. I can use graph paper to find all the possible rectangles that have a given perimeter. I can compile the possibilities into an organized list or a table, and determine whether I have all the possible rectangles.

Practice 6: Attend to precision. I can be precise when calculating, solving problems, and communicating my ideas. (PBLO: Effective Communicators)

- I can use clear and precise language in my discussions with others and in my own reasoning. I can be careful about specifying units of measure and state the meaning of the symbols I choose. When figuring out the area of a rectangle I can record my answers in square units.

Practice 7: Look for and make use of structure. I can see and understand how numbers and spaces are organized and put together as parts and wholes. (PBLO: Creative Thinkers)

- I can look closely to discover a pattern or structure. I can use properties of operations as strategies to multiply and divide (commutative and distributive properties).

Practice 8: Look for and express regularity in repeated reasoning. I can identify when calculations are repeated and can then find more general and efficient methods. (PBLO: Creative Thinkers)

- I can notice when I repeat actions in computation and can look for more shortcut methods. I can use the distributive property as a strategy for using products I know to solve products that I don't know. I can continually evaluate my work by asking myself, "Does this make sense?"

Priority Content Standards

Students should spend the large majority of their time on the **major work** of the grade. **Supporting work** and, where appropriate, **additional work** can engage students in the major work of the grade. Prioritized clusters are listed below and identified in the standards.

MAJOR, SUPPORTING, AND ADDITIONAL CLUSTERS FOR GRADE 3

Emphases are given at the cluster level. Refer to the Common Core State Standards for Mathematics for the specific standards that fall within each cluster.

Key: ■ Major Clusters ☐ Supporting Clusters ○ Additional Clusters

3.OA.A	■	Represent and solve problems involving multiplication and division.
3.OA.B	■	Understand properties of multiplication and the relationship between multiplication and division.
3.OA.C	■	Multiply and divide within 100.
3.OA.D	■	Solve problems involving the four operations, and identify and explain patterns in arithmetic.
3.NBT.A	○	Use place value understanding and properties of operations to perform multi-digit arithmetic.
3.NF.A	■	Develop understanding of fractions as numbers.
3.MD.A	■	Solve problems involving measurement and estimation of intervals of time, liquid volumes, and masses of objects.
3.MD.B	☐	Represent and interpret data.
3.MD.C	■	Geometric measurement: understand concepts of area and relate area to multiplication and to addition.
3.MD.D	○	Geometric measurement: recognize perimeter as an attribute of plane figures and distinguish between linear and area measures.
3.G.A	☐	Reason with shapes and their attributes.

Operations and Algebraic Thinking

Represent and solve problems involving multiplication and division. (Major Work)

3.OA.1: Interpret products of whole numbers.

3.AO.2: Interpret whole-number quotients of whole numbers.

3.OA.3: Use multiplication and division within 100 to solve word problems in situations involving equal groups, arrays, and measurement quantities.

3.OA.4: Determine the unknown whole number in a multiplication or division equation relating three whole numbers.

Understand properties of multiplication and the relationship between multiplication and division. (Major Work)

3.OA.5: Apply properties of operations as strategies to multiply and divide.

3.OA.6: Understand division as an unknown-factor problem.

Multiply and divide within 100. (Major Work)

3.OA.7: Fluently multiply and divide within 100, using strategies such as the relationship between multiplication and division or properties of operations from memory.

Solve problems involving the four operations, and identify and explain patterns in arithmetic. (Major Work)

3.OA.8: Solve two-step word problems using the four operations. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding.

3.OA.9: Identify arithmetic patterns (including patterns in the addition table or multiplication table), and explain them using properties of operations.

Use place value understanding and properties of operations to perform multi-digit arithmetic, using a range of algorithms. (Additional Work)

3.NBT.1: Use place value understanding to round whole numbers to the nearest 10 or 100.

3.NBT.2: Fluently add and subtract within 1000 using strategies and algorithms based on place value, properties of operations, and/or the relationship between addition and subtraction.

3.NBT.3: Multiply one-digit whole numbers by multiples of 10 in the range 10-90 using strategies based on place value and properties of operations.

Number and Operations – Fractions

Grade 3 expectations in this domain are limited to fractions with denominators 2, 3, 4, 6, and 8.

Develop understanding of fractions as numbers. (Major Work)

3.NF.1: Understand a fraction $\frac{1}{b}$ as the quantity formed by 1 part when a whole is partitioned into b equal parts; understand a fraction $\frac{a}{b}$ as the quantity formed by a parts of size $\frac{1}{b}$.

3.NF.2: Understand a fraction as a number on the number line; represent fractions on a number line diagram.

- **3.NF.2a:** Represent a fraction $\frac{1}{b}$ on a number line diagram by defining the interval from 0 to 1 as the whole and partitioning it into b equal parts. Recognize that each part has size $\frac{1}{b}$ and that the endpoint of the part based at 0 locates the number $\frac{1}{b}$ on the number line.
- **3.NF.2b:** Represent a fraction $\frac{a}{b}$ on a number line diagram by marking off a lengths $\frac{1}{b}$ from 0. Recognize that the resulting interval has size $\frac{a}{b}$ and that its endpoint locates the number $\frac{a}{b}$ on the number line.

3.NF.3: Explain equivalence of fractions in special cases, and compare fractions by reasoning about their size.

- **3.NF.3a:** Understand two fractions as equivalent (equal) if they are the same size, or the same point on a number line.
- **3.NF.3b:** Recognize and generate simple equivalent fractions, e.g., $\frac{1}{2} = \frac{2}{4}$, $\frac{4}{6} = \frac{2}{3}$. Explain why the fractions are equivalent, by using a visual fraction model.

- **3.NF.3c:** Express whole numbers as fractions, and recognize fractions that are equivalent to whole numbers.
- **3.NF.3d:** Compare two fractions with the same numerator or the same denominator by reasoning about their size. Recognize that comparisons are valid only when the two fractions refer to the same whole. Record the results of comparisons with the symbols >, =, or <, and Dakotah language terms: less than (isaŋpa), equal (iyececa), greater than (aokpani). Justify the conclusions, by using a visual fraction model.

Measurement and Data

Solve problems involving measurement and estimation. (Major Work)

3.MD.1: Tell and write time to the nearest minute and measure time intervals in minutes. Solve word problems involving addition and subtraction of time intervals in minutes, by representing the problem on a number line diagram.

3.MD.2: Measure and estimate liquid volumes and masses of objects using standard units of grams (g), kilograms (kg), and liters (l). Add, subtract, multiply, or divide to solve one-step word problems involving masses or volumes that are given in the same units, by using drawings to represent the problem.

Represent and interpret data. (Supporting Work)

3.MD.3: Draw a scaled picture graph and a scaled bar graph to represent a data set with several categories. Solve one- and two-step "how many more" and "how many less" problems using information presented in scaled bar graphs.

3.MD.4: Generate measurement data by measuring lengths using rulers marked with halves and fourths of an inch. Show the data by making a line plot, where the horizontal scale is marked off in appropriate units - whole numbers, halves, or quarters.

Geometric measurement: understand concepts of area and relate area to multiplication and to addition. (Major Work)

3.MD.5: Recognize area as an attribute of plane figures and understand concepts of area measurement.

- **3.MD.5a:** A square with side length 1 unit, called "a unit square," is said to have "one square unit" of area, and can be used to measure area.

3.MD.6: Measure areas by counting unit squares (square cm, square m, square in, square ft, and improvised units).

3.MD.7: Relate area to the operations of multiplication and addition.

- **3.MD.7a:** Find the area of a rectangle with whole-number side lengths by tiling it, and show that the area is the same as would be found by multiplying the side lengths.
- **3.MD.7b:** Multiply side lengths to find areas of rectangles with whole-number side lengths in the context of solving real world and mathematical problems, and represent whole-number products as rectangular areas in mathematical reasoning.

- **3.MD.7c:** Use tiling to show in a concrete case that the area of a rectangle with whole-number side lengths a and b + c is the sum of a × b and a × c. Use area models to represent the distributive property in mathematical reasoning.
- **3.MD.7d:** Recognize area as additive. Find areas of rectilinear figures by decomposing them into non-overlapping rectangles and adding the areas of the non-overlapping parts, applying this technique to solve real world problems.

Geometric measurement: recognize perimeter. (Major Work)

3.MD.8: Solve real world and mathematical problems involving perimeters of polygons, including finding the perimeter given the side lengths, finding an unknown side length, and exhibiting rectangles with the same perimeter and different areas or with the same area and different perimeters.

Geometry

Reason with shapes and their attributes. (Supporting Work)

3.G.1: Understand that shapes in different categories may share attributes and that the shared attributes can define a larger category. Recognize rhombuses, rectangles, and squares as examples of quadrilaterals, and draw examples of quadrilaterals that do not belong to any of these subcategories.

3.G.2: Partition shapes into parts with equal areas. Express the area of each part as a unit fraction of the whole.

Standards for Itopa (Grade 4) Math

Taku waunspeiçiciyapi hena sdodyapi yaciŋ he?

Introduction

In Itopa (Grade 4), instructional time should focus on three critical areas: (1) developing understanding and fluency with multi-digit multiplication, and developing understanding of dividing to find quotients involving multi-digit dividends; (2) developing an understanding of fraction equivalence, addition and subtraction of fractions with like denominators, and multiplication of fractions by whole numbers; (3) understanding that geometric figures can be analyzed and classified based on their properties, such as having parallel sides, perpendicular sides, particular angle measures, and symmetry.

Throughout the year, students should solve real-world problems that involve connections to Dakotah symbols, culture or contemporary Dakotah issues. Examples are provided within the standards. In implementation of these standards, students should have an opportunity to develop as creative thinkers and global citizens, utilizing math to solve real problems in the community and their world.

The Dakotah language words, spelling, fonts, and pronunciations will be based on the SWO Dakotah Language Institute.

Throughout the standards, many sample problems are adapted from Illustrative Mathematics. Go to www.illustrativemathematics.org to find solutions and extended explanations for each standard.

Mathematical Practices

The standards for Mathematical Practice describe ways in which students develop mathematical proficiency throughout the elementary, middle and high school years. The core practices are the same for all grade levels and represent important habits for students to develop, but implementation looks different at each grade level to align with students' developmental levels. These standards should be included in lesson planning alongside content standards.

Practice 1: Make sense of problems and persevere in solving them. I can think about how to solve a problem and carry out my plan. If I get stuck, I try something else. (PBLO: Creative Thinkers)

- I know that doing mathematics involves solving problems and discussing how I solved them. I can explain to myself the meaning of a problem and look for ways to solve it. I can use concrete objects or pictures to help me understand and solve problems. I can check my thinking by asking myself, "Does this make sense?". I can listen to the strategies of others and can try different approaches. I can use another method to check my answers.

Practice 2: Reason abstractly and quantitatively. I can use numbers, words and reasoning habits to help me make sense of problems. (PBLO: Creative Thinkers)

- I can recognize that a number represents a specific quantity. I can connect the quantity to written symbols and create a logical representation of the problem at hand, considering the appropriate units involved and the meaning of quantities. I can extend this understanding from whole numbers to my work with fractions and decimals. I can write simple expressions, record calculations with numbers, and represent or round numbers using place value concepts.

Practice 3: Construct viable arguments and critique the reasoning of others. I can justify my thinking and engage in meaningful mathematical discussions with others. I can support my argument with objects, drawings, diagrams and explanations. (PBLO: Effective Communicators)

- I can construct arguments using concrete items, such as objects, pictures, and drawings. I can explain my thinking and make connections between models and equations. I can refine my mathematical communication skills and participate in mathematical discussions involving questions like "How did you get that?" and "Why is that true?" I can explain my thinking to others and respond to others' thinking.

Practice 4: Model with mathematics. I can recognize when math will help me solve a problem in everyday life and can apply math I know to find a solution. (PBLOs: Creative Thinkers and Global Citizens)

- I can experiment with representing problem situations in multiple ways including numbers, words (mathematical language), drawing pictures, using objects, making a chart, list, or graph, creating equations, etc. I can connect the different representations and explain the connections. I can use all of these representations as needed. I can evaluate my results in the context of the problem and think about whether the results make sense.

Practice 5: Use appropriate tools strategically. I can choose and use math tools to help me explore and deepen my math understanding. (PBLO: Creative Thinkers)

- I can consider the available tools (including estimation) when solving a mathematical problem and decide when certain tools might be helpful. I can use graph paper or a number line to represent and compare decimals and protractors to measure angles. I can use other measurement tools to understand the relative size of units within a system and express measurements given in larger units in terms of smaller units.

Practice 6: Attend to precision. I can be precise when calculating, solving problems, and communicating my ideas. (PBLO: Effective Communicators)

- I can try to use clear and precise language in my discussions with others and in my own reasoning. I can specify units of measure and state the meaning of the symbols I choose. I can use appropriate labels when creating a line plot.

Practice 7: Look for and make use of structure. I can see and understand how numbers and spaces are organized and put together as parts and wholes. (PBLO: Creative Thinkers)

- I can look closely to discover a pattern or structure. I can use properties of operations to explain calculations (partial products model). I can relate representations of counting problems such as tree diagrams and arrays to the multiplication principal of counting. I can generate number or shape patterns that follow a given rule.

Practice 8: Look for and express regularity in repeated reasoning. I can notice when calculations are repeated and can then find more general and efficient methods. (PBLO: Creative Thinkers)

- I can notice when I repeat actions in computation and make generalizations from these actions. I can use models to explain calculations and understand how algorithms work. I can use models to examine patterns and generate my own algorithms. I can use visual fraction models to write equivalent fractions.

Priority Content Standards

Students should spend the large majority of their time on the **major work** of the grade. **Supporting work** and, where appropriate, **additional work** can engage students in the major work of the grade. Prioritized clusters are listed below and identified in the standards.

MAJOR, SUPPORTING, AND ADDITIONAL CLUSTERS FOR GRADE 4

Emphases are given at the cluster level. Refer to the Common Core State Standards for Mathematics for the specific standards that fall within each cluster.

Key: ■ Major Clusters □ Supporting Clusters ○ Additional Clusters

4.OA.A	■	Use the four operations with whole numbers to solve problems.
4.OA.B	□	Gain familiarity with factors and multiples.
4.OA.C	○	Generate and analyze patterns.
4.NBT.A	■	Generalize place value understanding for multi-digit whole numbers.
4.NBT.B	■	Use place value understanding and properties of operations to perform multi-digit arithmetic.
4.NF.A	■	Extend understanding of fraction equivalence and ordering.
4.NF.B	■	Build fractions from unit fractions by applying and extending previous understandings of operations on whole numbers.
4.NF.C	■	Understand decimal notation for fractions, and compare decimal fractions.
4.MD.A	□	Solve problems involving measurement and conversion of measurements from a larger unit to a smaller unit.
4.MD.B	□	Represent and interpret data.
4.MD.C	○	Geometric measurement: understand concepts of angle and measure angles.
4.G.A	○	Draw and identify lines and angles, and classify shapes by properties of their lines and angles.

Operations and Algebraic Thinking

Use the four operations with whole numbers to solve problems. (Major Work)

4.OA.1: Interpret a multiplication equation as a comparison, such as interpreting 35 = 5 × 7 as a statement that 35 is 5 times as many as 7 and 7 times as many as 5. Represent verbal statements of multiplicative comparisons as multiplication equations.

4.AO.2: Multiply or divide to solve word problems involving multiplicative comparison, by using drawings and equations with a symbol for the unknown number to represent the problem, distinguishing multiplicative comparison from additive comparison.

4.OA.3: Solve multistep word problems posed with whole numbers and having whole-number answers using the four operations, including problems in which remainders must be interpreted. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding.

Gain familiarity with factors and multiples. (Supporting Work)

4.OA.4: Find all factor pairs for a whole number in the range 1-100. Recognize that a whole number is a multiple of each of its factors. Determine whether a given whole number in the range 1-100 is a multiple of a given one-digit number.

- **4.OA.4a:** Determine whether a given whole number in the range 1-100 is prime or composite.

Generate and analyze patterns. (Additional Work)

4.OA.5: Generate a number or shape pattern that follows a given rule. Identify apparent features of the pattern that were not explicit in the rule itself.

Number and Operations in Base Ten

Grade 4 expectations in this domain are limited to whole numbers less than or equal to 1,000,000.

Generalize place value understanding for multi-digit whole numbers. (Major Work)

4.NBT.1: Recognize that in a multi-digit whole number, a digit in one place represents ten times what it represents in the place to its right.

4.NBT.2: Read and write multi-digit whole numbers using base-ten numerals, number names, and expanded form. Compare two multi-digit numbers based on meanings of the digits in each place, using >, =, and < symbols and Dakotah language terms to record the results of comparisons: less than (isaŋpa), equal (iyececa), greater than (aokpani).

4.NBT.3: Use place value understanding to round multi-digit whole numbers to any place.

Use place value understanding and properties of operations to perform multi-digit arithmetic. (Major Work)

4.NBT.4: Fluently add and subtract multi-digit whole numbers using the standard algorithm.

4.NBT.5: Multiply a whole number of up to four digits by a one-digit whole number, and multiply two two-digit numbers, using strategies based on place value and the properties of operations. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.

4.NBT.6: Find whole-number quotients and remainders with up to four-digit dividends and one-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.

Number and Operations – Fractions

Grade 4 expectations in this domain are limited to fractions with denominators 2, 3, 4, 5, 6, 8, 10, 12, and 100.

Extend understanding of fraction equivalence and ordering. (Major Work)

4.NF.1: Explain why a fraction $\frac{a}{b}$ is equivalent to a fraction $\frac{(n \times a)}{(n \times b)}$ by using visual fraction models, with attention to how the number and size of the parts differ even though the two fractions themselves are the same size. Use this principle to recognize and generate equivalent fractions.

4.NF.2: Compare two fractions with different numerators and different denominators, by creating common denominators or numerators, or by comparing to a benchmark fraction such as $\frac{1}{2}$. Recognize that comparisons are valid only when the two fractions refer to the same whole. Record the results of comparisons with symbols >, =, or <, and Dakotah language terms: less than (isaŋpa), equal (iyececa), greater than (aokpani). Justify the conclusions, by using a visual fraction model.

Build fractions from unit fractions. (Major Work)

4.NF.3: Grade 4 expectations in this domain are limited to fractions with denominators 2, 3, 4, 5, 6, 8, 10, 12, and 100.

- **4.NF.3a:** Understand addition and subtraction of fractions as joining and separating parts referring to the same whole.
- **4.NF.3b:** Decompose a fraction into a sum of fractions with the same denominator in more than one way, recording each decomposition by an equation. Justify decompositions, by using a visual fraction model.
- **4.NF.3c/d:** Add and subtract mixed numbers with like denominators, by replacing each mixed number with an equivalent fraction, and/or by using properties of operations and the relationship between addition and subtraction. Solve word problems involving addition and subtraction of fractions referring to the same whole and having like denominators, by using visual fraction models and equations to represent the problem.

4.NF.4: Apply and extend previous understandings of multiplication to multiply a fraction by a whole number.

- **4.NF.4a:** Understand a fraction $\frac{a}{b}$ as a multiple of $\frac{1}{b}$.
- **4.NF.4b:** Understand a multiple of $\frac{a}{b}$ as a multiple of $\frac{1}{b}$, and use this understanding to multiply a fraction by a whole number.
- **4.NF.4c:** Solve word problems involving multiplication of a fraction by a whole number, by using visual fraction models and equations to represent the problem.

Understand decimal notation for fractions, and compare decimal fractions. (Major Work)

4.NF.5: Express a fraction with denominator 10 as an equivalent fraction with denominator 100, and use this technique to add two fractions with respective denominators 10 and 100. Students who can generate equivalent fractions can develop strategies for adding fractions with unlike denominators in general. (Addition and subtraction with unlike denominators in general is not a requirement at this grade.)

4.NF.6: Use decimal notation for fractions with denominators 10 or 100.

4.NF.7: Compare two decimals to hundredths by reasoning about their size. Recognize that comparisons are valid only when the two decimals refer to the same whole. Record the results of comparisons with the symbols >, =, or <, and Dakotah language terms: less than (isaŋpa), equal (iyececa), greater than (aokpani). Justify the conclusions, by using a visual model.

Measurement and Data

Solve problems involving measurement and conversion of measurements. (Supporting Work)

4.MD.1: Know relative sizes of measurement units within one system of units including km, m, cm; kg, g; lb, oz.; l, ml; hr, min, sec. Within a single system of measurement, express measurements in a larger unit in terms of a smaller unit. Record measurement equivalents in a two-column table.

4.MD.2: Use the four operations to solve word problems involving distances, intervals of time, liquid volumes, masses of objects, and money, including problems involving simple fractions or decimals, and problems that require expressing measurements given in a larger unit in terms of a smaller unit. Represent measurement quantities using diagrams such as number line diagrams that feature a measurement scale.

4.MD.3: Apply the area and perimeter formulas for rectangles in real world and mathematical problems.

Represent and interpret data. (Supporting Work)

4.MD.4: Make a line plot to display a data set of measurements in fractions of a unit ($\frac{1}{2}, \frac{1}{4}, \frac{1}{8}$). Solve problems involving addition and subtraction of fractions by using information presented in line plots.

Geometric measurement: understand concepts of angle and measure angles. (Additional Work)

4.MD.5: Recognize angles as geometric shapes that are formed wherever two rays share a common endpoint, and understand concepts of angle measurement.

- **4.MD.5a:** An angle is measured with reference to a circle with its center at the common endpoint of the rays, by considering the fraction of the circular arc between the points where the two rays intersect the circle. An angle that turns through 1/360 of a circle is called a "one-degree angle," and can be used to measure angles.

4.MD.6: Measure angles in whole-number degrees using a protractor. Sketch angles of specified measure.

4.MD.7: Recognize angle measure as additive. When an angle is decomposed into non-overlapping parts, the angle measure of the whole is the sum of the angle measures of the parts. Solve addition and subtraction problems to find unknown angles on a diagram in real world and mathematical problems, by using an equation with a symbol for the unknown angle measure.

Geometry

Draw and identify lines and angles, and classify shapes by properties of their lines and angles. (Additional Work)

4.G.1: Draw points, lines, line segments, rays, angles (right, acute, obtuse), and perpendicular and parallel lines. Identify these in two-dimensional figures.

4.G.2: Classify two-dimensional figures based on the presence or absence of parallel or perpendicular lines, or the presence or absence of angles of a specified size. Recognize right triangles as a category, and identify right triangles.

4.G.3: Recognize a line of symmetry for a two-dimensional figure as a line across the figure such that the figure can be folded along the line into matching parts. Identify line-symmetric figures and draw lines of symmetry.

Standards for Izaptan (Grade 5) Math

Taku waunspeiçiciyapi hena sdodyapi yaciŋ he?

Introduction

In Izaptan (Grade 5), instructional time should focus on three critical areas: (1) developing fluency with addition and subtraction of fractions, and developing understanding of the multiplication of fractions and of division of fractions in limited cases (unit fractions divided by whole numbers and whole numbers divided by unit fractions); (2) extending division to 2-digit divisors, integrating decimal fractions into the place value system and developing understanding of operations with decimals to hundredths, and developing fluency with whole number and decimal operations; and (3) developing understanding of volume.

Throughout the year, students should solve real-world problems that involve connections to Dakotah symbols, culture or contemporary Dakotah issues. Examples are provided within the standards. In implementation of these standards, students should have an opportunity to develop as creative thinkers and global citizens, utilizing math to solve real problems in the community and their world.

The Dakotah language words, spelling, fonts, and pronunciations will be based on the SWO Dakotah Language Institute.

Throughout the standards, many sample problems are adapted from Illustrative Mathematics. Go to www.illustrativemathematics.org to find solutions and extended explanations for each standard.

Mathematical Practices

The standards for Mathematical Practice describe ways in which students develop mathematical proficiency throughout the elementary, middle and high school years. The core practices are the same for all grade levels, but implementation looks different at each grade level.

Practice 1: Make sense of problems and persevere in solving them. I can think about how to solve a problem and carry out my plan. If I get stuck, I try something else. (PBLO: Creative Thinkers)

- I can solve problems by applying my understanding of operations with whole numbers, decimals, and fractions including mixed numbers. I can solve problems related to volume and measurement conversions. I can seek the meaning of a problem and look for efficient ways to represent and solve it. I can check my thinking by asking myself, “What is the most efficient way to solve the problem?”, “Does this make sense?”, and “Can I solve the problem in a different way?”.

Practice 2: Reason abstractly and quantitatively. I can use numbers, words and reasoning habits to help me make sense of problems. (PBLO: Creative Thinkers)

- I can recognize that a number represents a specific quantity. I extend my understanding from whole numbers to my work with fractions and decimals. This involves two processes: decontextualizing and contextualizing. I can decontextualize by taking a real-world problem and writing and solving equations based on the word problem. I can decontextualize the problem by writing the equation $4\frac{1}{6} - 2\frac{2}{3}$ = ___ and then solving it. Further, I can contextualize the problem after I find the answer, by reasoning that $1\frac{3}{6}$ or $1\frac{1}{2}$ yards of rope is the amount needed. I can write simple expressions that record calculations with numbers and represent or round numbers using place value concepts.

Practice 3: Construct viable arguments and critique the reasoning of others. I can justify my thinking and engage in meaningful mathematical discussions with others. I can support my argument with objects, drawings, diagrams and explanations. (PBLO: Effective Communicators)

- I can construct arguments using representations, such as objects, pictures, and drawings. I can explain calculations based upon models and properties of operations and rules that generate patterns. I can demonstrate and explain the relationship between volume and multiplication. I can refine my mathematical communication skills as I participate in mathematical discussions involving questions like "How did you get that?" and "Why is that true?" I can explain my thinking to others and respond to others' thinking through both discussions or written responses.

Practice 4: Model with mathematics. I can recognize when math will help me solve a problem in everyday life and can apply math I know to find a solution. (PBLOs: Creative Thinkers and Global Citizens)

- I can experiment with representing problem situations in multiple ways including numbers, words (mathematical language), drawing pictures, using objects, making a chart, list, or graph, creating equations, etc. I can connect the different representations and explain the connections. I can use all of these representations as needed. I can evaluate my results in the context of the situation and whether the results make sense. I can evaluate the utility of models to determine which models are most useful and efficient to solve problems.

Practice 5: Use appropriate tools strategically. I can choose and use math tools to help me explore and deepen my math understanding. (PBLO: Creative Thinkers)

- I can consider the available tools, including estimation, when solving a mathematical problem and decide when certain tools might be helpful. For instance, I may use unit cubes to fill a rectangular prism and then use a ruler to measure the dimensions. I can use graph paper to accurately create graphs and solve problems or make predictions from real world data.

Practice 6: Attend to precision. I can be precise when calculating, solving problems, and communicating my ideas. (PBLO: Effective Communicators)

- I can continue to refine my mathematical communication skills by using clear and precise language in my discussions with others and in my own reasoning. I can use appropriate vocabulary when referring to expressions, fractions, geometric figures, and coordinate grids. I am careful about specifying units of measure and state the meaning of the symbols I choose. For instance, when figuring out the volume of a rectangular prism I can record my answers in cubic units. My calculations are accurate and precise.

Practice 7: Look for and make use of structure. I can see and understand how numbers and spaces are organized and put together as parts and wholes. (PBLO: Creative Thinkers)

- I can look closely to discover a pattern or structure. For instance, I can use properties of operations as strategies to add, subtract, multiply and divide with whole numbers, fractions, and decimals. I can examine numerical patterns and relate them to a rule or a graphical representation.

Practice 8: Look for and express regularity in repeated reasoning. I can notice when calculations are repeated and can then find more general and efficient methods. (PBLO: Creative Thinkers)

- I can use repeated reasoning to understand algorithms and make generalizations about patterns. I can connect place value and my prior work with operations to understand algorithms to fluently multiply multi-digit numbers and perform all operations with decimals to hundredths. I can explore operations with fractions with visual models and begin to formulate generalizations.

Priority Content Standards

Students should spend the large majority of their time on the **major work** of the grade. **Supporting work** and, where appropriate, **additional work** can engage students in the major work of the grade. Prioritized clusters are listed below and identified in the standards.

MAJOR, SUPPORTING, AND ADDITIONAL CLUSTERS FOR GRADE 5

Emphases are given at the cluster level. Refer to the Common Core State Standards for Mathematics for the specific standards that fall within each cluster.

Key: ■ Major Clusters □ Supporting Clusters ○ Additional Clusters

5.OA.A	○	Write and interpret numerical expressions.
5.OA.B	○	Analyze patterns and relationships.
5.NBT.A	■	Understand the place value system.
5.NBT.B	■	Perform operations with multi-digit whole numbers and with decimals to hundredths.
5.NF.A	■	Use equivalent fractions as a strategy to add and subtract fractions.
5.NF.B	■	Apply and extend previous understandings of multiplication and division to multiply and divide fractions.
5.MD.A	□	Convert like measurement units within a given measurement system.
5.MD.B	□	Represent and interpret data.
5.MD.C	■	Geometric measurement: understand concepts of volume and relate volume to multiplication and to addition.
5.G.A	○	Graph points on the coordinate plane to solve real-world and mathematical problems.
5.G.B	○	Classify two-dimensional figures into categories based on their properties.

Operations and Algebraic Thinking

Write and interpret numerical expressions. (Additional Work)

5.OA.1: Use parentheses ( ), brackets[ ], or braces { } in numerical expressions, and evaluate expressions with these symbols.

5.OA.2: Write simple expressions that record calculations with numbers, and interpret numerical expressions without evaluating them.

Analyze patterns and relationships (Additional Work).

5.OA.3: Generate two numerical patterns using two given rules. Identify apparent relationships between corresponding terms. Form ordered pairs consisting of corresponding terms from the two patterns, and graph the ordered pairs on a coordinate plane.

Number and Operations in Base Ten

Understand the place value system. (Major Work)

5.NBT.1: Recognize that in a multi-digit number, a digit in one place represents 10 times as much as it represents in the place to its right and $\frac{1}{10}$ of what it represents in the place to its left. Use Dakotah words when counting and saying numbers.

5.NBT.2: Explain patterns in the number of zeros of the product when multiplying a number by powers of 10, and explain patterns in the placement of the decimal point when a decimal is multiplied or divided by a power of 10. Use whole-number exponents to denote powers of 10.

5.NBT.3: Read, write, and compare decimals to thousandths in English and Dakotah.

- **5.NBT.3a:** Read and write decimals to the thousandth place using base-ten numerals, names of numbers, and the expanded form in English and Dakotah. The expanded form looks like this: $347.392 = 3 \times 100 + 4 \times 10 + 7 \times 1 + 3 \times (1/10) + 9 \times (1/100) + 2 \times (1/1000)$.
- **5.NBT.3b:** Compare two decimals to thousandths based on meanings of the digits in each place, using >, =, and < symbols to record the results of comparisons in English and Dakotah. Dakotah terms: less than (isaŋpa), equal (iyececa), greater than (aokpani).

5.NBT.4: Use place value understanding to round decimals to any place.

Perform operations with multi-digit whole numbers and with decimals to hundredths. (Major Work)

5.NBT.5: Fluently multiply multi-digit whole numbers using the standard algorithm.

5.NBT.6: Find whole-number quotients of whole numbers with up to four-digit dividends and two-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.

5.NBT.7: Add, subtract, multiply, and divide decimals to hundredths, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning used.

Number and Operations – Fractions

Use equivalent fractions as a strategy to add and subtract fractions. (Major Work)

5.NF.1: Add and subtract fractions with unlike denominators (including mixed numbers) by replacing given fractions with equivalent fractions in such a way as to produce an equivalent sum or difference of fractions with like denominators.

5.NF.2: Solve word problems involving addition and subtraction of fractions referring to the same whole, including cases of unlike denominators, by using visual fraction models or equations to represent the problem. Use benchmark fractions and number sense of fractions to estimate mentally and assess the reasonableness of answers.

Apply and extend previous understandings of multiplication and division. (Major Work)

5.NF.3: Interpret a fraction as division of the numerator by the denominator ($\frac{a}{b} = a \div b$). Solve word problems involving division of whole numbers leading to answers in the form of fractions or mixed numbers, by using visual fraction models or equations to represent the problem.

5.NF.4: Apply and extend previous understandings of multiplication to multiply a fraction or whole number by a fraction.

- **5.NF.4a:** Interpret the product $(\frac{a}{b}) \times q$ as *a* parts of a partition of q into b equal parts; equivalently, as the result of a sequence of operations $a \times q \div b$.
- **5.NF.4b:** Find the area of a rectangle with fractional side lengths by tiling it with unit squares of the appropriate unit fraction side lengths, and show that the area is the same as would be found by multiplying the side lengths. Multiply fractional side lengths to find areas of rectangles, and represent fraction products as rectangular areas.

5.NF.5: Interpret multiplication as scaling (resizing) by:

- **5.NF.5a:** Comparing the size of a product to the size of one factor on the basis of the size of the other factor, without performing the indicated multiplication.
- **5.NF.5b:** Explaining why multiplying a given number by a fraction greater than 1 results in a product greater than the given number (recognizing multiplication by whole numbers greater than 1 as a familiar case); explaining why multiplying a given number by a fraction less than 1 results in a product smaller than the given number; and relating the principle of fraction equivalence $\frac{a}{b} = (n \times a)/(n \times b)$ to the effect of multiplying $\frac{a}{b}$ by 1.

5.NF.6: Solve real world problems involving multiplication of fractions and mixed numbers, by using visual fraction models or equations to represent the problem. I can solve real-world problems that require me to multiply fractions and mixed numbers. I can solve them using strategies like visual fraction models or equations to represent the problem.

5.NF.7: Apply and extend previous understandings of division to divide unit fractions by whole numbers and whole numbers by unit fractions. (Students are not required to divide a fraction by a fraction at this grade).

- **5.NF.7a:** Interpret division of a unit fraction by a non-zero whole number, and compute such quotients.
- **5.NF.7b:** Interpret division of a whole number by a unit fraction, and compute such quotients.
- **5.NF.7c:** Solve real world problems involving division of unit fractions by non-zero whole numbers and division of whole numbers by unit fractions, by using visual fraction models and equations to represent the problem.

Measurement and Data

Convert like measurement units within a given measurement system. (Supporting Work)

5.MD.1: Convert among different-sized standard measurement units within a given measurement system and use these conversions in solving multi-step, real world problems.

Represent and interpret data. (Supporting Work)

5.MD.2: Make a line plot to display a data set of measurements in fractions of a unit ($\frac{1}{2}, \frac{1}{4}, \frac{1}{8}$). Use operations on fractions for this grade to solve problems involving information presented in line plots.

Geometric measurement: understand concepts of volume. (Major Work)

5.MD.3: Recognize volume as an attribute of solid figures and understand concepts of volume measurement.

- **5.MD.3a:** A cube with side length 1 unit, called a "unit cube," is said to have "one cubic unit" of volume, and can be used to measure volume.
- **5.MD.3b:** A solid figure which can be packed without gaps or overlaps using n unit cubes is said to have a volume of n cubic units.

5.MD.4: Measure volumes by counting unit cubes, using cubic cm, cubic in, cubic ft, and improvised units.

5.MD.5: Relate volume to the operations of multiplication and addition and solve real world and mathematical problems involving volume.

- **5.MD.5a:** Find the volume of a right rectangular prism with whole-number side lengths by packing it with unit cubes, and show that the volume is the same as would be found by multiplying the edge lengths, equivalently by multiplying the height by the area of the base. Represent threefold whole-number products as volumes, to represent the associative property of multiplication.
- **5.MD.5b:** Apply the formulas $V = l \times w \times h$ and $V = b \times h$ for rectangular prisms to find volumes of right rectangular prisms with whole-number edge lengths in the context of solving real world and mathematical problems.
- **5.MD.5c:** Recognize volume as additive. Find volumes of solid figures composed of two non-overlapping right rectangular prisms by adding the volumes of the non-overlapping parts, applying this technique to solve real world problems.

Geometry

Graph points on the coordinate plane to solve real-world and mathematical problems. (Additional Work)

5.G.1: Use a pair of perpendicular number lines, called axes, to define a coordinate system, with the intersection of the lines (the origin) arranged to coincide with the 0 on each line and a given point in the plane located by using an ordered pair of numbers, called its coordinates. Understand that the first number indicates how far to travel from the origin in the direction of one axis, and the second number indicates how far to travel in the direction of the second axis, with the convention that the names of the two axes and the coordinates correspond (e.g., x-axis and x-coordinate, y-axis and y-coordinate).

5.G.2: Represent real world and mathematical problems by graphing points in the first quadrant of the coordinate plane, and interpret coordinate values of points in the context of the situation.

Classify two-dimensional figures into categories based on their properties. (Additional Work)

5.G.3: Understand that attributes belonging to a category of two-dimensional figures also belong to all subcategories of that category.

5.G.4: Classify two-dimensional figures in a hierarchy based on properties.

Standards for Isakpe (Grade 6) Math

Taku waunspeiċiciyapi hena sdodyapi yaciŋ he?

Introduction

In Isakpe (Grade 6), instructional time should 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.

Throughout the year, students should solve real-world problems that involve connections to Dakotah symbols, culture or contemporary Dakotah issues. Examples are provided within the standards. In implementation of these standards, students should have an opportunity to develop as creative thinkers and global citizens, utilizing math to solve real problems in the community and their world.

The Dakotah language words, spelling, fonts, and pronunciations will be based on the SWO Dakotah Language Institute.

Throughout the standards, many sample problems are adapted from Illustrative Mathematics. Go to www.illustrativemathematics.org to find solutions and extended explanations for each standard.

Mathematical Practices

The Standards for Mathematical Practice describe ways in which students develop mathematical proficiency throughout the elementary, middle and high school years. The core practices are the same for all grade levels and represent important habits for students to develop, but implementation looks different at each grade level to align with students' developmental levels. These standards should be included in lesson planning alongside content standards.

Practice 1: Make sense of problems and persevere in solving them. I can think about how to solve a problem and carry out my plan. If I get stuck, I try something else. (PBLO: Creative Thinkers)

- I can solve problems involving ratios and rates and discuss how I solved them. I can solve real world problems through the application of algebraic and geometric concepts. I can seek the meaning of a problem and look for efficient ways to represent and solve it. I can check my thinking by asking myself "What is the most efficient way to solve the problem?" "Does this make sense?" and "Can I solve the problem in a different way?"

Practice 2: Reason abstractly and quantitatively. I can use numbers, words and reasoning habits to help me make sense of problems. (PBLO: Creative Thinkers)

- I can represent a wide variety of real world contexts through the use of real numbers and variables in mathematical expressions, equations, and inequalities. I can contextualize to understand the meaning of the number or variable as related to the problem and decontextualize to manipulate symbolic representations by applying properties of operations.

Practice 3: Construct viable arguments and critique the reasoning of others. I can justify my thinking and engage in meaningful mathematical discussions with others. I can support my argument with objects, drawings, diagrams and explanations. (PBLO: Effective Communicators)

- I can construct arguments using verbal or written explanations accompanied by expressions, equations, inequalities, models, and graphs, tables, and other data displays (i.e. box plots, dot plots, histograms, etc.). I can refine my mathematical communication skills through mathematical discussions in which I critically evaluate my own thinking and the thinking of other students. I can pose questions like “How did you get that?”, “Why is that true?”, “Does that always work?” I can explain my thinking to others and respond to others’ thinking.

Practice 4: Model with mathematics. I can recognize when math will help me solve a problem in everyday life and can apply math I know to find a solution. (PBLOs: Creative Thinkers and Global Citizens)

- I can model problem situations symbolically, graphically, tabularly, and contextually. I can form expressions, equations, or inequalities from real world contexts and connect symbolic and graphical representations. I can begin to explore covariance and represent two quantities simultaneously. I can use number lines to compare numbers and represent inequalities. I can use measures of center and variability and data displays (i.e. box plots and histograms) to draw inferences about and make comparisons between data sets. I can connect and explain the connections between the different representations.

Practice 5: Use appropriate tools strategically. I can choose and use math tools to help me explore and deepen my math understanding. (PBLO: Creative Thinkers)

- I can consider available tools, including estimation and technology, when solving a mathematical problem and decide when certain tools might be helpful. I can select the most appropriate way to represent similar data sets. I can use dot plots with the same scale to visually compare the center and variability of the data. Alternatively, I may use physical objects or apps to construct nets to calculate the surface area of three-dimensional figures.

Practice 6: Attend to precision. I can be precise when calculating, solving problems, and communicating my ideas. (PBLO: Effective Communicators)

- I can use clear and precise language in my discussions with others and in my own reasoning. I can use appropriate terminology when referring to rates, ratios, geometric figures, data displays, and components of expressions, equations or inequalities. My calculations are accurate and precise.

Practice 7: Look for and make use of structure. I can see and understand how numbers and spaces are organized and put together as parts and wholes. (PBLO: Creative Thinkers)

- I can seek patterns or structures to model and solve problems. I can recognize patterns that exist in ratio tables recognizing both the additive and multiplicative properties. I can apply properties to generate equivalent expressions and solve equations. I can compose and decompose two- and three-dimensional figures to solve real world problems involving area and volume.

Practice 8: Look for and express regularity in repeated reasoning. I can notice when calculations are repeated and can then find more general and efficient methods to calculate. (PBLO: Creative Thinkers)

- I can use repeated reasoning to understand algorithms and make generalizations about patterns. During multiple opportunities to solve and model problems, I can notice that a/b ÷ c/d = ad/bc and construct other examples and models that confirm my generalization. I can connect place value and my prior work with operations to understand algorithms to fluently divide multi-digit numbers and perform all operations with multi-digit decimals. I can informally begin to make connections between covariance, rates, and representations showing the relationships between quantities.

Priority Standards

Students should spend the large majority of their time on the **major work** of the grade. **Supporting work** and, where appropriate, **additional work** can engage students in the major work of the grade. Prioritized clusters are listed below and identified in the standards.

MAJOR, SUPPORTING, AND ADDITIONAL CLUSTERS FOR GRADE 6

Emphases are given at the cluster level. Refer to the Common Core State Standards for Mathematics for the specific standards that fall within each cluster.

Key: ■ Major Clusters ◻ Supporting Clusters ○ Additional Clusters

6.RP.A	■	Understand ratio concepts and use ratio reasoning to solve problems.
6.NS.A	■	Apply and extend previous understandings of multiplication and division to divide fractions by fractions.
6.NS.B	○	Compute fluently with multi-digit numbers and find common factors and multiples.
6.NS.C	■	Apply and extend previous understandings of numbers to the system of rational numbers.
6.EE.A	■	Apply and extend previous understandings of arithmetic to algebraic expressions.
6.EE.B	■	Reason about and solve one-variable equations and inequalities.
6.EE.C	■	Represent and analyze quantitative relationships between dependent and independent variables.
6.G.A	◻	Solve real-world and mathematical problems involving area, surface area, and volume.
6.SP.A	○	Develop understanding of statistical variability.
6.SP.B	○	Summarize and describe distributions.

Ratios and Proportional Reasoning

Understand ratio concepts and use ratio reasoning to solve problems.

6.RP.1: Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities.

6.RP.2: Understand the concept of a unit rate $\frac{a}{b}$ associated with a ratio a:b with $b \neq 0$, and use rate language in the context of a ratio relationship. (Expectations for unit rates in this grade are limited to non-complex fractions.)

6.RP.3: Use ratio and rate reasoning to solve real-world and mathematical problems, by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations.

- **6.RP.3a:** 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.
- **6.RP.3b:** Solve unit rate problems including those involving unit pricing and constant speed.
- **6.RP.3c:** Find a percent of a quantity as a rate per 100 and solve problems involving finding the whole, given a part and the percent.
- **6.RP.3d:** Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities.

The Number System

Apply and extend previous understandings of multiplication and division to divide fractions by fractions.

6.NS.1: Interpret and compute quotients of fractions, and solve word problems involving division of fractions by fractions, by using visual fraction models and equations to represent the problem.

Compute fluently with multi-digit numbers and find common factors and multiples.

6.NS.2: Fluently divide multi-digit numbers using the standard algorithm.

6.NS.3: Fluently add, subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation.

6.NS.4: Find the greatest common factor of two whole numbers less than or equal to 100 and 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 as a multiple of a sum of two whole numbers with no common factor.

Apply and extend previous understandings of numbers to the system of rational numbers.

6.NS.5: Understand that positive and negative numbers are used together to describe quantities having opposite directions or values and use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation.

6.NS.6: 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.

- **6.NS.6a:** 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, and that 0 is its own opposite.
- **6.NS.6b:** 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.
- **6.NS.6c:** 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.

6.NS.7: Understand ordering and absolute value of rational numbers.

- **6.NS.7a:** Interpret statements of inequality as statements about the relative position of two numbers on a number line diagram.
- **6.NS.7b:** Write, interpret, and explain statements of order for rational numbers in real-world contexts.
- **6.NS.7c:** 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.
- **6.NS.7d:** Distinguish comparisons of absolute value from statements about order.

6.NS.8: 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.

Expressions and Equations

Apply and extend previous understandings of arithmetic to algebraic expressions.

6.EE.1: Write and evaluate numerical expressions involving whole-number exponents.

6.EE.2: Write, read, and evaluate expressions in which letters stand for numbers.

- **6.EE.2a:** Write expressions that record operations with numbers and with letters standing for numbers.
- **6.EE.2b:** 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.
- **6.EE.2c:** 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).

6.EE.3: Apply the properties of operations to generate equivalent expressions.

6.EE.4: Identify when two expressions are equivalent (iyececa) (i.e., when the two expressions name the same number regardless of which value is substituted into them).

Reason about and solve one-variable equations and inequalities.

6.EE.5: 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 true (hecetu)? Use substitution to determine whether a given number in a specified set makes an equation or inequality true.

6.EE.6: 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.

6.EE.7: 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.

6.EE.8: 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.

Represent and analyze quantitative relationships between dependent and independent variables.

6.EE.9: 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.

Geometry

Solve real-world and mathematical problems involving area, surface area, and volume. (Supporting Work)

6.G.1: 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.

6.G.2: 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.

6.G.3: 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.

6.G.4: 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.

Statistics and Probability

Develop understanding of statistical variability. (Additional Work)

6.SP.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.SP.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.SP.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 with a single number.

Summarize and describe distributions. (Additional Work)

6.SP.4: Display numerical data in plots on a number line, including dot plots, histograms, and box plots.

6.SP.5: Summarize numerical data sets in relation to their context, such as by:

- **6.SP.5a:** Reporting the number of observations.
- **6.SP.5b:** Describing the nature of the attribute under investigation, including how it was measured and its units of measurement.
- **6.SP.5c:** 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.
- **6.SP.5d:** 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.

Standards for Isakowiŋ (Grade 7) Math

Taku waunspeiçiciyapi hena sdodyapi yaciŋ he?

Introduction

In Isakowiŋ (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.

Throughout the year, students should solve real-world problems that involve connections to Dakotah symbols, culture or contemporary Dakotah issues. Examples are provided within the standards. In implementation of these standards, students should have an opportunity to develop as creative thinkers and global citizens, utilizing math to solve real problems in the community and their world.

The Dakotah language words, spelling, fonts, and pronunciations will be based on the SWO Dakotah Language Institute.

Throughout the standards, many sample problems are adapted from Illustrative Mathematics. Go to www.illustrativemathematics.org to find solutions and extended explanations for each standard.

Mathematical Practices

The standards for Mathematical Practice describe ways in which students develop mathematical proficiency throughout the elementary, middle and high school years. The core practices are the same for all grade levels and represent important habits for students to develop, but implementation looks different at each grade level to align with students' developmental levels. These standards should be included in lesson planning alongside content standards.

Practice 1: Make sense of problems and persevere in solving them. I can think about how to solve a problem and carry out my plan. If I get stuck, I try something else. (PBLO: Creative Thinkers)

- I can solve problems involving ratios and rates and discuss how I solved them. I can solve real world problems through the application of algebraic and geometric concepts. I can look for the meaning of a problem and look for efficient ways to represent and solve it. I can check my thinking by asking myself, "What is the most efficient way to solve the problem?", "Does this make sense?", and "Can I solve the problem in a different way?".

Practice 2: Reason abstractly and quantitatively. I can use numbers, words and reasoning habits to help me make sense of problems. (PBLO: Creative Thinkers)

- I can represent a wide variety of real world contexts through the use of real numbers and variables in mathematical expressions, equations, and inequalities. I can contextualize to understand the meaning of the number or variable as related to the problem and decontextualize to manipulate symbolic representations by applying properties of operations.

Practice 3: Construct viable arguments and critique the reasoning of others. I can justify my thinking and engage in meaningful mathematical discussions with others. I can support my argument with objects, drawings, diagrams and explanations. (PBLO: Effective Communicators)

- I can construct arguments using verbal or written explanations accompanied by expressions, equations, inequalities, models, and graphs, tables, and other data displays (i.e. box plots, dot plots, histograms, etc.). I can participate in mathematical discussions in which I critically evaluate my own thinking and the thinking of other students. I can pose questions like “How did you get that?”, “Why is that true?” and “Does that always work?”. I can explain my thinking to others and respond to others’ thinking.

Practice 4: Model with mathematics. I can recognize when math will help me solve a problem in everyday life and can apply math I know to find a solution. (PBLOs: Creative Thinkers and Global Citizens)

- I can model problem situations symbolically, graphically, tabularly, and contextually. I can form expressions, equations, or inequalities from real world contexts and connect symbolic and graphical representations. I can explore covariance and represent two quantities simultaneously. I can use measures of center and variability and data displays (i.e. box plots and histograms) to draw inferences, make comparisons and formulate predictions. I can use experiments or simulations to generate data sets and create probability models. I can connect and explain the connections between the different representations.

Practice 5: Use appropriate tools strategically. I can choose and use math tools to help me explore and deepen my math understanding. (PBLO: Creative Thinkers)

- I can consider available tools, including estimation and technology, when solving a mathematical problem and decide when certain tools might be helpful. I can represent similar data sets using dot plots with the same scale to visually compare the center and variability of the data. I can use physical objects or apps to generate probability data and use graphing calculators or spreadsheets to manage and represent data in different forms.

Practice 6: Attend to precision. I can be precise when calculating, solving problems, and communicating my ideas. (PBLO: Effective Communicators)

- I can communicate mathematically using clear and precise language in my discussions with others and in my own reasoning. I can define variables, specify units of measure, and label axes accurately. I can use appropriate terminology when referring to rates, ratios, probability models, geometric figures, data displays, and components of expressions, equations or inequalities. My calculations are accurate and precise.

Practice 7: Look for and make use of structure. I can see and understand how numbers and spaces are organized and put together as parts and wholes. (PBLO: Creative Thinkers)

- I can seek patterns or structures to model and solve problems. I can recognize patterns that exist in ratio tables making connections between the constant of proportionality in a table with the slope of a graph. I can apply properties to generate equivalent expressions (i.e. 6 + 2x = 2 (3 + x) by distributive property) and solve equations (i.e. 2c + 3 = 15, 2c = 12 by subtraction property of equality; c=6 by division property of equality). I can compose and decompose two- and three-dimensional figures to solve real world problems involving scale drawings, surface area, and volume. I can examine tree diagrams or systematic lists to determine the sample space for compound events and verify that I have listed all possibilities.

Practice 8: Look for and express regularity in repeated reasoning. I can notice when calculations are repeated and can then find more general and efficient methods. (PBLO: Creative Thinkers)

- I can use repeated reasoning to understand algorithms and make generalizations about patterns. I can begin to make connections between covariance, rates, and representations showing the relationships between quantities. I can create, explain, evaluate, and modify probability models to describe simple and compound events.

Priority Content Standards

Students should spend the large majority of their time on the **major work** of the grade. **Supporting work** and, where appropriate, **additional work** can engage students in the major work of the grade. Prioritized clusters are listed below and identified in the standards.

MAJOR, SUPPORTING, AND ADDITIONAL CLUSTERS FOR GRADE 7

Emphases are given at the cluster level. Refer to the Common Core State Standards for Mathematics for the specific standards that fall within each cluster.

Key: ■ Major Clusters □ Supporting Clusters ○ Additional Clusters

7.RP.A	■	Analyze proportional relationships and use them to solve real-world and mathematical problems.
7.NS.A	■	Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers.
7.EE.A	■	Use properties of operations to generate equivalent expressions.
7.EE.B	■	Solve real-life and mathematical problems using numerical and algebraic expressions and equations.
7.G.A	○	Draw, construct and describe geometrical figures and describe the relationships between them.
7.G.B	○	Solve real-life and mathematical problems involving angle measure, area, surface area, and volume.
7.SP.A	□	Use random sampling to draw inferences about a population.
7.SP.B	○	Draw informal comparative inferences about two populations.
7.SP.C	□	Investigate chance processes and develop, use, and evaluate probability models.

Ratios and Proportional Relationships

Analyze proportional relationships and use them to solve real-world and mathematical problems. (Major Work)

7.RP.1: Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units.

7.RP.2: Recognize and represent proportional relationships between quantities.

- **7.RP.2a:** Decide whether two quantities are in a proportional relationship, 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.
- **7.RP.2b:** Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.
- **7.RP.2c:** Represent proportional relationships by equations.
- **7.RP.2d:** 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.

7.RP.3: Use proportional relationships to solve multistep ratio and percent problems such as simple interest, tax, markups and markdowns, gratuities and commissions, fees, percent increase and decrease, percent error.

The Number System

Apply and extend previous understandings of operations with fractions. (Major Work)

7.NS.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.

- **7.NS.1a:** Describe situations in which opposite quantities combine to make 0.
- **7.NS.1b:** 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.
- **7.NS.1c:** 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.
- **7.NS.1d:** Apply properties of operations as strategies to add and subtract rational numbers.

7.NS.2: Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers.

- **7.NS.2a:** 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.
- **7.NS.2b:** 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.
- **7.NS.2c:** Apply properties of operations as strategies to multiply and divide rational numbers.
- **7.NS.2d:** 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.

7.NS.3: Solve real-world and mathematical problems involving the four operations with rational numbers. Computations with rational numbers extend the rules for manipulating fractions to complex fractions.

Expressions and Equations

Use properties of operations to generate equivalent expressions. (Major Work)

7.EE.1: Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.

7.EE.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.

Solve real-life and mathematical problems using numerical and algebraic expressions and equations. (Major Work)

7.EE.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.

7.EE.4: Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities.

- **7.EE.4a:** 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.
- **7.EE.4b:** 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.

Geometry

Draw construct, and describe geometrical figures and describe the relationships between them. (Additional Work)

7.G.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.

7.G.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.

7.G.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. (Additional Work)

7.G.4: 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.

7.G.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.

7.G.6: Solve real-world and mathematical problems involving area, volume and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms.

Statistics and Probability

Use random sampling to draw inferences about a population. (Supporting Work)

7.SP.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.

7.SP.2: 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.

Draw informal comparative inferences about two populations. (Additional Work)

7.SP.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.

7.SP.4: Use measures of center and measures of variability for numerical data from random samples to draw informal comparative inferences about two populations.

Investigate chance processes and develop, use, and evaluate probability models. (Supporting Work)

7.SP.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.

7.SP.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.

7.SP.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.

- **7.SP.7a:** Develop a uniform probability model by assigning equal probability to all outcomes, and use the model to determine probabilities of events.
- **7.SP.7b:** Develop a probability model (which may not be uniform) by observing frequencies in data generated from a chance process.

7.SP.8: Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation.

- **7.SP.8a:** 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.
- **7.SP.8b:** 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.
- **7.SP.8c:** Design and use a simulation to generate frequencies for compound events.

Standards for Isahdogaŋ (Grade 8) Math

Taku waunspeiçiciyapi hena sdodyapi yaciŋ he?

Introduction

In Isahdogaŋ (Grade 8), instructional time should 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; (3) analyzing two- and three-dimensional space and figures using distance, angle, similarity, and congruence, and understanding and applying the Pythagorean Theorem.

Throughout the year, students should solve real-world problems that involve connections to Dakotah symbols, culture or contemporary Dakotah issues. Examples are provided within the standards. In implementation of these standards, students should have an opportunity to develop as creative thinkers and global citizens, utilizing math to solve real problems in the community and throughout the world.

The Dakotah language words, spelling, fonts, and pronunciations will be based on the SWO Dakotah Language Institute.

Throughout the standards, many sample problems are adapted from Illustrative Mathematics. Go to www.illustrativemathematics.org to find solutions and extended explanations for each standard.

Mathematical Practices

The standards for Mathematical Practice describe ways in which students develop mathematical proficiency throughout the elementary, middle and high school years. The core practices are the same for all grade levels and represent important habits for students to develop, but implementation looks different at each grade level to align with students' developmental levels. These standards should be included in lesson planning alongside content standards.

Practice 1: Make sense of problems and persevere in solving them. I can think about how to solve a problem and carry out my plan. If I get stuck, I try something else. (PBLO: Creative Thinkers)

- I can solve real world problems through the application of algebraic and geometric concepts. I can seek the meaning of a problem and look for efficient ways to represent and solve it. I can check my thinking by asking myself, "What is the most efficient way to solve the problem?", "Does this make sense?" and "Can I solve the problem in a different way?"

Practice 2: Reason abstractly and quantitatively. I can use numbers, words and reasoning habits to help me make sense of problems. (PBLO: Creative Thinkers)

- I can represent a wide variety of real world contexts through the use of real numbers and variables in mathematical expressions, equations, and inequalities. I can examine patterns in data and assess the degree of linearity of functions. I can contextualize to understand the meaning of the number or variable as related to the problem and decontextualize to manipulate symbolic representations by applying properties of operations.

Practice 3: Construct viable arguments and critique the reasoning of others. I can justify my thinking and engage in meaningful mathematical discussions with others. I can support my argument with objects, drawings, diagrams and explanations. (PBLO: Effective Communicators)

- I can construct arguments using verbal or written explanations accompanied by expressions, equations, inequalities, models, and graphs, tables, and other data displays. I can communicate mathematically through discussions in which I critically evaluate my own thinking and the thinking of other students. I can pose questions like "How did you get that?", "Why is that true?" and "Does that always work?". I can explain my thinking to others and respond to others' thinking.

Practice 4: Model with mathematics. I can recognize when math will help me solve a problem in everyday life and can apply math I know to find a solution. (PBLOs: Creative Thinkers and Global Citizens)

- I can model problem situations symbolically, graphically, tabularly, and contextually. I can form expressions, equations, or inequalities from real world contexts and connect symbolic and graphical representations. I can solve systems of linear equations and compare properties of functions provided in different forms. I can use scatterplots to represent data and describe associations between variables. I can connect and explain the connections between the different representations. I can use a variety of representations as appropriate to a problem context.

Practice 5: Use appropriate tools strategically. I can choose and use math tools to help me explore and deepen my math understanding. (PBLO: Creative Thinkers)

- I can consider the available tools, including estimation, when solving a mathematical problem and decide when certain tools might be helpful. I can use graph paper to accurately create graphs and solve problems or make predictions from real world data. I can effectively use a graphing calculator or an app.

Practice 6: Attend to precision. I can be precise when calculating, solving problems, and communicating my ideas. (PBLO: Effective Communicators)

- I can communicate mathematically by using clear and precise language in my discussions with others and in their own reasoning. I can use appropriate terminology when referring to the number system, functions, geometric figures, and data displays. My calculations are accurate and precise.

Practice 7: Look for and make use of structure. I can see and understand how numbers and spaces are organized and put together as parts and wholes. (PBLO: Creative Thinkers)

- I can seek patterns or structures to model and solve problems. I can apply properties to generate equivalent expressions and solve equations. I can examine patterns in tables and graphs to generate equations and describe relationships. I can experimentally verify the effects of transformations and describe them in terms of congruence and similarity.

Practice 8: Look for and express regularity in repeated reasoning. I can notice when calculations are repeated and can then find more general and efficient methods. (PBLO: Creative Thinkers)

- I can use repeated reasoning to understand algorithms and make generalizations about patterns. I can use iterative processes to determine more precise rational approximations for irrational numbers. During multiple opportunities to solve and model problems, I can notice that the slope of a line and rate of change are the same value. I can flexibly make connections between covariance, rates, and representations showing the relationships between quantities.

Priority Content Standards

Students should spend the large majority of their time on the **major work** of the grade. **Supporting work** and, where appropriate, **additional work** can engage students in the major work of the grade. Prioritized clusters are listed below and identified in the standards.

MAJOR, SUPPORTING, AND ADDITIONAL CLUSTERS FOR GRADE 8

Emphases are given at the cluster level. Refer to the Common Core State Standards for Mathematics for the specific standards that fall within each cluster.

Key: ■ Major Clusters □ Supporting Clusters ○ Additional Clusters

8.NS.A	□	Know that there are numbers that are not rational, and approximate them by rational numbers.
8.EE.A	■	Work with radicals and integer exponents.
8.EE.B	■	Understand the connections between proportional relationships, lines, and linear equations.
8.EE.C	■	Analyze and solve linear equations and pairs of simultaneous linear equations.
8.F.A	■	Define, evaluate, and compare functions.
8.F.B	■	Use functions to model relationships between quantities.
8.G.A	■	Understand congruence and similarity using physical models, transparencies, or geometry software.
8.G.B	■	Understand and apply the Pythagorean Theorem.
8.G.C	○	Solve real-world and mathematical problems involving volume of cylinders, cones and spheres.
8.SP.A	□	Investigate patterns of association in bivariate data.

The Number System

Know that there are numbers that are not rational, and approximate them by rational numbers. (Supporting Work)

8.NS.1: 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.

8.NS.2: 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).

Expressions and Equations

Expressions and Equations Work with radicals and integer exponents. (Major Work)

8.EE.1: Know and apply the properties of integer exponents to generate equivalent numerical expressions.

8.EE.2: 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.

8.EE.3: 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.

8.EE.4: Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notations are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities. Interpret scientific notation that has been generated by technology.

Understand the connections between proportional relationships, lines, and linear equations. (Major Work)

8.EE.5: Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. Compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.

8.EE.6: 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.

Analyze and solve linear equations and pairs of simultaneous linear equations. (Major Work)

8.EE.7: Solve linear equations in one variable.

- **8.EE.7a:** 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).
- **8.EE.7b:** Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.

8.EE.8: Analyze and solve pairs of simultaneous linear equations.

- **8.EE.8a:** 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.
- **8.EE.8b:** Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations. Solve simple cases by inspection.
- **8.EE.8c:** Solve real-world and mathematical problems leading to two linear equations in two variables.

Functions

Define, evaluate, and compare functions. (Major Work)

8.F.1: 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. Function notation is not required for Grade 8.

8.F.2: Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).

8.F.3: 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.

Use functions to model relationships between quantities. (Major Work)

8.F.4: 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.

8.F.5: Describe qualitatively the functional relationship between two quantities by analyzing a graph. Sketch a graph that exhibits the qualitative features of a function that has been described verbally.

Geometry

Understand congruence and similarity using physical models, transparencies, or geometry software. (Major Work)

8.G.1: Verify experimentally the properties of rotations, reflections, and translations.

- **8.G.1a:** Lines are taken to lines, and line segments to line segments of the same length.
- **8.G.1b:** Angles are taken to angles of the same measure.
- **8.G.1c:** Parallel lines are taken to parallel lines.

8.G.2: 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.

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

8.G.4: 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.

8.G.5: 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.

Understand and apply the Pythagorean Theorem. (Major Work)

8.G.6: Explain a proof of the Pythagorean Theorem and its converse.

8.G.7: Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.

8.G.8: Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.

Solve real-world and mathematical problems involving volume of cylinders, cones, and spheres. (Additional Work)

8.G.9: Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.

Statistics and Probability

Investigate patterns of association in bivariate data. (Supporting Work)

8.SP.1: 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.

8.SP.2: 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.

8.SP.3: Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept.

8.SP.4: 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.

Standards for Woyawapi iciŋnapciŋwaŋka – Wowawapi ake nuŋpa (Grades 9-12) Algebra I

Taku waunspeiçiciyapi hena sdodyapi yaciŋ he?

Introduction

Throughout the year, students should solve real-world problems that involve connections to Dakotah symbols, culture or contemporary Dakotah issues. Examples are provided within the standards. In implementation of these standards, students should have an opportunity to develop as creative thinkers and global citizens, utilizing math to solve real problems in the community and their world.

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Mathematical Practices

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Practice 1: Make sense of problems and persevere in solving them. I can think about how to solve a problem and carry out my plan. If I get stuck, I try something else. (PBLO: Creative Thinkers)

- I can examine problems by explaining to myself the meaning of a problem and looking for entry points to its solution. I can analyze givens, constraints, relationships, and goals. I can make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. I can consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. I can monitor and evaluate my progress and change course if necessary. I can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. I can check my answers to problems using different methods and continually ask myself "Does this make sense?" I can understand the approaches of others to solving complex problems and identify correspondences between different approaches.

Practice 2: Reason abstractly and quantitatively. I can use numbers, words and reasoning habits to help me make sense of problems. (PBLO: Creative Thinkers)

- I can make sense of quantities and their relationships in problem situations. I can abstract a given situation and represent it symbolically, manipulate the representing symbols, and pause as needed during the manipulation process in order to probe into the referents for the symbols involved. I can use quantitative reasoning to create coherent representations of the problem at hand; consider the units involved; attend to the meaning of quantities, not just how to compute them; and know and flexibly use different properties of operations and objects.

Practice 3: Construct viable arguments and critique the reasoning of others. I can justify my thinking and engage in meaningful mathematical discussions with others. I can support my argument with objects, drawings, diagrams and explanations. (PBLO: Effective Communicators)

- I can understand and use stated assumptions, definitions, and previously established results in constructing arguments. I can make conjectures and build a logical progression of statements to explore the truth of my conjectures. I can analyze situations by breaking them into cases, and can recognize and use counterexamples. I can justify my conclusions, communicate them to others, and respond to the arguments of others. I can reason inductively about data, making plausible arguments that take into account the context from which the data arose. I can compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and - if there is a flaw in an argument - explain what it is. I can determine domains to which an argument applies, listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

Practice 4: Model with mathematics. I can recognize when math will help me solve a problem in everyday life and can apply math I know to find a solution. (PBLOs: Creative Thinkers and Global Citizens)

- I can apply the mathematics I know to solve problems arising in everyday life, society, and the workplace. I can make assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. I can identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. I can analyze those relationships mathematically to draw conclusions. I can interpret my mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

Practice 5: Use appropriate tools strategically. I can choose and use math tools to help me explore and deepen my math understanding. (PBLO: Creative Thinkers)

- I can consider the available tools when solving a mathematical problem, including pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. I can make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. I can detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, I know that technology can enable me to visualize the results of varying assumptions, explore consequences, and compare predictions with data. I can identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. I can use technological tools to explore and deepen my understanding of concepts.

Practice 6: Attend to precision. I can be precise when calculating, solving problems, and communicating my ideas. (PBLO: Effective Communicators)

- I can communicate precisely to others by using clear definitions in discussion with others and in my own reasoning. I can state the meaning of the symbols I choose, specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. I can calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. I can examine claims and make explicit use of definitions. My calculations are accurate and precise.

Practice 7: Look for and make use of structure. I can see and understand how numbers and spaces are organized and put together as parts and wholes. (PBLO: Creative Thinkers)

- I can look closely to discern a pattern or structure. I can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. I can use patterns to create equivalent expressions, factor and solve equations, compose functions and transform figures.

Practice 8: Look for and express regularity in repeated reasoning. I can notice when calculations are repeated and can then find more general and efficient methods. (PBLO: Creative Thinkers)

- I can recognize when calculations are repeated, and look both for general methods and for shortcuts. As I work to solve a problem, derive formulas or make generalizations, I can maintain oversight of the process, while attending to the details. I continually evaluate the reasonableness of my intermediate results.

Priority Content Standards

Students should spend the large majority of their time on the widely applicable prerequisites for college and career success. **Prioritized clusters** are identified in the standards.

The Real Number System

Extend the properties of exponents to rational exponents. (Priority)

HSA1.RN.1: Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents.

HSA1.RN.2: Rewrite expressions involving radicals and rational exponents using the properties of exponents.

Use properties of rational and irrational numbers. (Priority)

HSA1.RN.3: Explain why the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational.

Quantities

Reason quantitatively and use units to solve problems. (Priority)
Algebra I Focus: Foundation of work with expressions, equations and functions.

HSA1.Q.1: Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.

HSA1.Q.2: Define appropriate quantities for the purpose of descriptive modeling.

HSA1.Q.3: Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

Seeing Structure in Expressions

Interpret the structure of expressions. (Highest Priority)
Algebra I Focus: Linear, exponential, quadratic

HSA1.SSE.1: Interpret expressions that represent a quantity in terms of its context.

- **HSA1.SSE.1a:** Interpret parts of an expression, such as terms, factors, and coefficients.
- **HSA1.SSE.1b:** Interpret complicated expressions by viewing one or more of their parts as a single entity.

HSA1.SSE.2: Use the structure of an expression to identify ways to rewrite it.

Write expressions in equivalent forms to solve problems. (Highest Priority)
Algebra I Focus: Quadratic and exponential

HSA1.SSE.3: Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.

- **HSA1.SSE.3a:** Factor a quadratic expression to reveal the zeros of the function it defines.
- **HSA1.SSE.3b:** Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.
- **HSA1.SSE.3c:** Use the properties of exponents to transform expressions for exponential functions.

Arithmetic with Polynomials and Rational Expressions

Perform arithmetic operations on polynomials. (Priority)
Algebra I Focus: Linear and quadratic

HSA1.APR.1: Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.

Creating Equations

Create equations that describe numbers or relationships. (Priority)
Algebra I Focus: Linear, quadratic, and exponential (integer inputs only); for CED.3, us linear only

HSA1.CED.1: Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions.

HSA1.CED.2: Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.

HSA1.CED.3: Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context.

HSA1.CED.4: Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.

Reasoning with Equations and Inequalities

Understand solving equations as a process of reasoning and explain the reasoning. (Priority)
Algebra I Focus: Master linear; learn as general principle.

HSA1.REI.1: Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.

Solve equations and inequalities in on variable. (Priority)
Algebra I Focus: Linear inequalities; literal that are linear in the variables being solved for; quadratics with real solutions.

HSA1.REI.3: Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.

HSA1.REI.4: Solve quadratic equations in one variable.

- **HSA1.REI.4a**: Use the method of completing the square to transform any quadratic equation in x into an equation of the form (x – p)^2 = q that has the same solutions. Derive the quadratic formula from this form.
- **HSA1.REI.4b:** Solve quadratic equations by inspection (e.g., for x^2 = 49), taking square

roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as a ± bi for real numbers a and b.

Solve systems of equations. (Priority)
Algebra I Focus: Linear-linear and linear-quadratic

HSA1.REI.5: Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions.

HSA1.REI.6: Solve systems of linear equations exactly and approximately with graphs, focusing on pairs of linear equations in two variables.

HSA1.REI.7: Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically.

Represent and solve equations and inequalities graphically. (Priority)
Algebra I Focus: Linear and exponential; learn as general principle

HSA1.REI.10: Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).

HSA.1.REI.11: Explain why the x-coordinates of the points where the graphs of the equations $y = f(x)$ and $y = g(x)$ intersect are the solutions of the equation $f(x) = g(x)$; find the solutions approximately, using technology to graph the functions, make tables of values, or find successive approximations. Include cases where $f(x)$ and/or $g(x)$ are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.

HSA1.REI.12: Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.

Interpreting Functions

Understand the concept of a function and use function notation. (Priority)
Algebra I Focus: Learn as general principle; focus on linear and exponential and on arithmetic and geometric sequences

HSA1.IF.1: Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If f is a function and x is an element of its domain, then $f(x)$ denotes the output of f corresponding to the input x. The graph of f is the graph of the equation $y = f(x)$.

HSA1.IF.2: Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.

HSA1.IF.3: Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers.

Interpret functions that arise in applications in terms of a context. (Priority)
Algebra I Focus: Linear, exponential and quadratic

HSA1.IF.4: Sketch a graph. Correctly label a graph's intercepts and intervals. Identify where the function is increasing, decreasing, positive, or negative. Identify relative maximums and minimums. Identify various symmetries, end behaviors, and periodicity.

HSA1.IF.5: Relate the domain of a function to its graph. Determine the appropriate domain for a real-world situation. Relate the domain of a function to the relationship it describes.

HSA1.IF.6: Find the slope of a function which is also known as the rate of change, over a specified interval. Use the graph to interpret the rate of change of the function. Calculate the rate of change given a table of values over a specified interval. Define the slope of a line in terms of rate of change.

Analyze functions using different representations. (Priority)
Algebra I Focus: Linear, exponential, quadratic, absolute value, step, piecewise defined

HSA1.IF.7: Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.

- **HSA1.IF.7a**: Graph linear and quadratic functions and show intercepts, maxima, and minima.
- **HSA1.IF.7b:** Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.
- **HSA1.IF.7c:** Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.

HSA1.IF.8: Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.

- **HSA1.IF.8a**: Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.
- **HSA1.IF.8b**: Use the properties of exponents to interpret expressions for exponential functions.

HSA1.IF.9: Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions.

Building Functions

Build a function that models a relationship between two quantities. (Priority)
Algebra I Focus: Linear, exponential and quadratic

HSA1.BF.1: Write a function that describes a relationship between two quantities.

- **HSA1.BF.1a:** Determine an explicit expression, a recursive process, or steps for calculation from a context.
- **HSA1.BF.1b:** Combine standard function types using arithmetic operations.

HSA1.BF.2: Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.

Build new functions from existing functions.
Algebra I Focus: Linear, exponential, quadratic, and absolute value; for F.BF.4a, linear only

HSA1.BF.3: Identify the effect on the graph of replacing f(x) by f(x) + k, k f(x), f(kx), and f(x + k) for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them. Algebra I - Linear, exponential, quadratic, and absolute value.

HSA1.BF.4: Find inverse functions. Algebra I - linear only.

- **HSA1.BF.4a:** Solve an equation of the form f(x) = c for a simple function f that has an inverse and write an expression for the inverse.

Linear, Quadratic and Exponential Models

Construct and compare linear, quadratic, and exponential models and solve problems. (Priority)

HSA1.LE.1: Distinguish between situations that can be modeled with linear functions and with exponential functions.

- **HSA1.LE.1a**: Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals.
- **HSA1.LE.1b:** Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.
- **HSA1.LE.1c:** Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.

HSA1.LE.2: Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input - output pairs (include reading these from a table).

HSA1.LE.3: Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.

Interpret expressions for functions in terms of the situation they model.
Algebra I Focus: Linear and exponential functions of form f(x)=b x +k

HSA1.LE.5: Interpret the parameters in a linear or exponential function in terms of a context.

Interpreting Categorical and Quantitative Data

Summarize, represent, and interpret data on a single count or measurement variable.

HSA1.ID.1: Represent data with plots on the real number line (dot plots, histograms, and box plots).

HSA1.ID.2 (Priority): Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.

HSA1.ID.3: Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).

Summarize, represent, and interpret data on two categorical and quantitative variables.
Algebra I Focus: Linear focus, discuss general principle

HSA1.ID.5: Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data.

HSA1.ID.6: Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.

- **HSA1.ID.6a:** Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear and exponential models.
- **HSA1.ID.6b:** Informally assess the fit of a function by plotting and analyzing residuals.
- **HSA1.ID.6c:** Fit a linear function for a scatter plot that suggests a linear association.

Interpret linear models. (Priority)

HSA.ID.7: Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.

HSA.ID.8: Compute (using technology) and interpret the correlation coefficient of a linear fit.

HSA.ID.9: Distinguish between correlation and causation.

Standards for Woyawapi iciŋnapciŋwaŋka – Wowawapi ake nuŋpa (Grades 9-12) Algebra II

Taku waunspeiçiciyapi hena sdodyapi yaciŋ he?

Introduction

Throughout the year, students should solve real-world problems that involve connections to Dakotah symbols, culture or contemporary Dakotah issues. Examples are provided within the standards. In implementation of these standards, students should have an opportunity to develop as creative thinkers and global citizens, utilizing math to solve real problems in the community and their world.

The Dakotah language words, spelling, fonts, and pronunciations will be based on the SWO Dakotah Language Institute.

Throughout the standards, many sample problems are adapted from Illustrative Mathematics. Go to www.illustrativemathematics.org to find solutions and extended explanations for each standard.

Mathematical Practices

The standards for Mathematical Practice describe ways in which students develop mathematical proficiency throughout the elementary, middle and high school years. The core practices are the same for all grade levels and represent important habits for students to develop, but implementation looks different at each grade level to align with students' developmental levels. These standards should be included in lesson planning alongside content standards.

Practice 1: Make sense of problems and persevere in solving them. I can think about how to solve a problem and carry out my plan. If I get stuck, I try something else. (PBLO: Creative Thinkers)

- I can examine problems by explaining to myself the meaning of a problem and looking for entry points to its solution. I can analyze givens, constraints, relationships, and goals. I can make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. I can consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. I can monitor and evaluate my progress and change course if necessary. I can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. I can check my answers to problems using different methods and continually ask myself "Does this make sense?" I can understand the approaches of others to solving complex problems and identify correspondences between different approaches.

Practice 2: Reason abstractly and quantitatively. I can use numbers, words and reasoning habits to help me make sense of problems. (PBLO: Creative Thinkers)

- I can make sense of quantities and their relationships in problem situations. I can abstract a given situation and represent it symbolically, manipulate the representing symbols, and pause as needed during the manipulation process in order to probe into the referents for the symbols involved. I can use quantitative reasoning to create coherent representations of the problem at hand; consider the units involved; attend to the meaning of quantities, not just how to compute them; and know and flexibly use different properties of operations and objects.

Practice 3: Construct viable arguments and critique the reasoning of others. I can justify my thinking and engage in meaningful mathematical discussions with others. I can support my argument with objects, drawings, diagrams and explanations. (PBLO: Effective Communicators)

- I can understand and use stated assumptions, definitions, and previously established results in constructing arguments. I can make conjectures and build a logical progression of statements to explore the truth of their conjectures. I can analyze situations by breaking them into cases, and can recognize and use counterexamples. I can justify my conclusions, communicate them to others, and respond to the arguments of others. I can reason inductively about data, making plausible arguments that take into account the context from which the data arose. I can compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and - if there is a flaw in an argument - explain what it is. I can determine domains to which an argument applies, listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

Practice 4: Model with mathematics. I can recognize when math will help me solve a problem in everyday life and can apply math I know to find a solution. (PBLOs: Creative Thinkers and Global Citizens)

- I can apply the mathematics I know to solve problems arising in everyday life, society, and the workplace. I can make assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. I can identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. I can analyze those relationships mathematically to draw conclusions. I can interpret my mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

Practice 5: Use appropriate tools strategically. I can choose and use math tools to help me explore and deepen my math understanding. (PBLO: Creative Thinkers)

- I can consider the available tools when solving a mathematical problem, including pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. I can make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. I can detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, I know that technology can enable me to visualize the results of varying assumptions, explore consequences, and compare predictions with data. I can identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. I can use technological tools to explore and deepen my understanding of concepts.

Practice 6: Attend to precision. I can be precise when calculating, solving problems, and communicating my ideas. (PBLO: Effective Communicators)

- I can communicate precisely to others by using clear definitions in discussion with others and in my own reasoning. I can state the meaning of the symbols I choose, specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. I can calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. I can examine claims and make explicit use of definitions.

Practice 7: Look for and make use of structure. I can see and understand how numbers and spaces are organized and put together as parts and wholes. (PBLO: Creative Thinkers)

- I can look closely to discern a pattern or structure. I can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. I can use patterns to create equivalent expressions, factor and solve equations, compose functions and transform figures.

Practice 8: Look for and express regularity in repeated reasoning. I can notice when calculations are repeated and can then find more general and efficient methods. (PBLO: Creative Thinkers)

- I can recognize when calculations are repeated, and look both for general methods and for shortcuts. As I work to solve a problem, derive formulas or make generalizations, I can maintain oversight of the process, while attending to the details. I continually evaluate the reasonableness of my intermediate results.

Priority Content Standards

Students should spend the large majority of their time on the Widely Applicable Prerequisites for college and career. Prioritized clusters are identified in the standards as **priority standards**.

The Complex Number System

Perform arithmetic operations with complex numbers.

HSA2.CN.1: Know there is a complex number i such that $i^2 = -1$, and every complex number has the form $a + bi$ with a and b real.

HSA2.CN.2: Use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.

Use complex numbers in polynomial identities and equations.
Algebra II Focus: Polynomials with real coefficients

HSA2.CN.7: Solve quadratic equations with real coefficients that have complex solutions.

HSA2.CN.8: Extend polynomial identities to the complex numbers. For example, rewrite $x^2 + 4$ as $(x + 2i)(x – 2i)$.

HSA2.CN.9: Use complex numbers in polynomial identities and equations. Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials.

Seeing Structure in Expressions

Interpret the structure of expressions. (Priority) Algebra II Focus: Polynomial and rational

HSA2.SSE.1: Interpret expressions that represent a quantity in terms of its context. (Begins in Algebra I)

- **HSA2.SSE.1a:** Interpret parts of an expression, such as terms, factors, and coefficients.
- **HSA2.SSE.1b:** Interpret complicated expressions by viewing one or more of their parts as a single entity. For example, interpret P(1+r)^n as the product of P and a factor not depending on P.

HSA2.SSE.2: Use the structure of an expression to identify ways to rewrite it. (Begins in Algebra I)

Write expressions in equivalent forms to solve problems. (Priority)

HSA2.SSE.4: Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems.

Arithmetic with Polynomials and Rational Expressions

Perform arithmetic operations on polynomials. Algebra II Focus: Beyond quadratic

HSA2.APR.1: Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials. (Begins in Algebra I)

Understand the relationship between zeros and factors of polynomials.

HSA2.APR.2: Know and apply the Remainder Theorem: For a polynomial $p(x)$ and a number a, the remainder on division by $x - a$ is $p(a)$, so $p(a) = 0$ if and only if $(x - a)$ is a factor of $p(x)$.

HSA2.APR.3: Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.

Use polynomial identities to solve problems.

HSA2.APR.4: Prove polynomial identities and use them to describe numerical relationships.

HSA2.APR.5: Know and apply the Binomial Theorem for the expansion of $(x + y)^n$ in powers of x and y for a positive integer n, where x and y are any numbers, with coefficients determined for example by Pascal's Triangle.[1]

[1]*The Binomial Theorem can be proved by mathematical induction or by a combinatorial argument.*

Rewrite rational expressions. Algebra II Focus: Linear and quadratic denominators

HSA2.APR.6: Rewrite simple rational expressions in different forms; write $a(x)/b(x)$ in the form $q(x) + r(x)/b(x)$, where $a(x)$, $b(x)$, $q(x)$, and $r(x)$ are polynomials with the degree of $r(x)$ less than the degree of $b(x)$, using inspection, long division, or, for the more complicated examples, a computer algebra system.

HSA2.APR.7: Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract, multiply, and divide rational expressions.

Creating Equations

Create equations that describe numbers or relationships. Algebra II Focus: Equations using all available types of expressions, including simple root functions

HSA2.CED.1: Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions. (Begins in Algebra I)

HSA2.CED.2: Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. (Begins in Algebra I)

HSA2.CED.3: Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. (Begins in Algebra I)

HSA2.CED.4: Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. (Begins in Algebra I)

Reasoning with Equations and Inequalities

Understand solving equations as a process of reasoning and explain that reasoning. Algebra II Focus: Simple radical and rational

HSA2.REI.2: Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.

Represent and solve equations and inequalities graphically. Algebra II Focus: Combine polynomial, rational, radical, absolute value, and exponential

HSA2.REI.11: Explain why the x-coordinates of the points where the graphs of the equations $y = f(x)$ and $y = g(x)$ intersect are the solutions of the equation $f(x) = g(x)$; find the solutions approximately, using technology to graph the functions, make tables of values, or find successive approximations. Include cases where $f(x)$ and/or $g(x)$ are linear, polynomial, rational, absolute value, exponential, and logarithmic functions. (Begins in Algebra I)

Interpreting Functions

Interpret functions that arise in applications in terms of a context. (Priority) Algebra II Focus: Emphasize selection of appropriate models

HSA2.IF.4: For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. (Begins in Algebra I)

HSA2.IF.5: Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. (Begins in Algebra I)

HSA2.IF.6: Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph. (Begins in Algebra I)

Analyze functions using different representations (Priority). Algebra II Focus: Focus on using key features to guide selections of appropriate type of model

HSA2.IF.7: Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.

- **HSA2.IF.7b:** Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions. (Begins in Algebra I)
- **HAS 2.IF.7c:** Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.
- **HSA2.IF.7e:** Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude. (Begins in Algebra I)

HSA2.IF.8: Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.

HSA2.IF.9: Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context. (Begins in Algebra I)

Building Functions

Build a function that models a relationship between two quantities. (Priority) Algebra II Focus: Include all types of functions studied

HSA2.BF.1: Write a function that describes a relationship between two quantities.

- **HSA2.BF.1b:** Combine standard function types using arithmetic operations. (Begins in Algebra I)

Build new functions from existing functions. Algebra II Focus: Include simple radical, rational, and exponential functions; emphasize common effect of each transformation across function types

HSA2.BF.3: Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $k\,f(x)$, $f(kx)$, and $f(x + k)$ for specific values of k (both positive and negative); find the value of k given the graphs.

Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them. (Begins in Algebra I)

HSA2.BF.4: Find inverse functions.

- **HSA2.BF.4a:** Solve an equation of the form f(x) = c for a simple function f that has an inverse and write an expression for the inverse. (Begins in Algebra I)

Linear, Quadratic and Exponential Models

Construct and compare linear, quadratic, and exponential models and solve problems.
Algebra II Focus: Logarithms as solutions for exponentials

HSA2.LE.4: For exponential models, express as a logarithm the solution to $ab^{ct} = d$ where *a*, *c*, and *d* are numbers and the base *b* is 2, 10, or *e*; evaluate the logarithm using technology.

Trigonometric Functions

Extend the domain of trigonometric functions using the unit circle.

HSA2.TF.1: Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.

HSA2.TF.2: Explain how the unit circle in the coordinate plane enables the extension of trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle.

Model periodic phenomena with trigonometric functions.

HSA2.TF.5: Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.

Prove and apply trigonometric identities.

HSA2.TF.8: Prove the Pythagorean identity $\sin^2(\theta) + \cos^2(\theta) = 1$ and use it to find sin(θ), cos(θ), or tan(θ) given sin(θ), cos(θ), or tan(θ) and the quadrant of the angle.

Interpreting Categorical and Quantitative Data

Summarize, represent, and interpret data on a single count or measurement variable.

HSA2.ID.4: Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve.

Making Inferences and Drawing Conclusions

Understand and evaluate random processes underlying statistical experiments.

HSA2.IC.1: Understand statistics as a process for making inferences about population parameters based on a random sample from that population. **(Priority)**

HSA2.IC.2: Decide if a specified model is consistent with results from a given data-generating process, using simulation.

Make inferences and justify conclusions from sample surveys, experiments and observational studies.

HSA2.IC.3: Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.

HSA2.IC.4: Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling.

HSA2.IC.5: Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.

HSA2.IC.6: Evaluate reports based on data.

Using Probability to Make Decisions

Use probability to evaluate outcomes of decisions.

HSA2.MD.6: Use probabilities to make fair decisions.

HSA2.MD.7: Analyze decisions and strategies using probability concepts.

Standards for Woyawapi iciŋnapciŋwaŋka – Wowawapi ake nuŋpa (Grades 9-12) Geometry

Taku waunspeiċiciyapi hena sdodyapi yaciŋ he?

Introduction

Throughout the year, students should solve real-world problems that involve connections to Dakotah symbols, culture or contemporary Dakotah issues. Examples are provided within the standards. In implementation of these standards, students should have an opportunity to develop as creative thinkers and global citizens, utilizing math to solve real problems in the community and their world.

The Dakotah language words, spelling, fonts, and pronunciations will be based on the SWO Dakotah Language Institute.

Throughout the standards, many sample problems are adapted from Illustrative Mathematics. Go to www.illustrativemathematics.org to find solutions and extended explanations for each standard.

Mathematical Practices

The standards for Mathematical Practice describe ways in which students develop mathematical proficiency throughout the elementary, middle and high school years. The core practices are the same for all grade levels and represent important habits for students to develop, but implementation looks different at each grade level to align with students' developmental levels. These standards should be included in lesson planning alongside content standards.

Practice 1: Make sense of problems and persevere in solving them. I can think about how to solve a problem and carry out my plan. If I get stuck, I try something else. (PBLO: Creative Thinkers)

- I can examine problems by explaining to myself the meaning of a problem and looking for entry points to its solution. I can analyze givens, constraints, relationships, and goals. I can make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. I can consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. I can monitor and evaluate my progress and change course if necessary. I can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. I can check my answers to problems using different methods and continually ask myself "Does this make sense?" I can understand the approaches of others to solving complex problems and identify correspondences between different approaches.

Practice 2: Reason abstractly and quantitatively. I can use numbers, words and reasoning habits to help me make sense of problems. (PBLO: Creative Thinkers)

- I can make sense of quantities and their relationships in problem situations. I can abstract a given situation and represent it symbolically, manipulate the representing symbols, and pause as needed during the manipulation process in order to probe into the referents for the symbols involved. I can use quantitative reasoning to create coherent representations of the problem at hand; consider the units involved; attend to the meaning of quantities, not just how to compute them; and know and flexibly use different properties of operations and objects.

Practice 3: Construct viable arguments and critique the reasoning of others. I can justify my thinking and engage in meaningful mathematical discussions with others. I can support my argument with objects, drawings, diagrams and explanations. (PBLO: Effective Communicators)

- I can understand and use stated assumptions, definitions, and previously established results in constructing arguments. I can make conjectures and build a logical progression of statements to explore the truth of their conjectures. I can analyze situations by breaking them into cases, and can recognize and use counterexamples. I can justify my conclusions, communicate them to others, and respond to the arguments of others. I can reason inductively about data, making plausible arguments that take into account the context from which the data arose. I can compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and - if there is a flaw in an argument - explain what it is. I can determine domains to which an argument applies, listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

Practice 4: Model with mathematics. I can recognize when math will help me solve a problem in everyday life and can apply math I know to find a solution. (PBLOs: Creative Thinkers and Global Citizens)

- I can apply the mathematics I know to solve problems arising in everyday life, society, and the workplace. I can make assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. I can identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. I can analyze those relationships mathematically to draw conclusions. I can interpret my mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

Practice 5: Use appropriate tools strategically. I can choose and use math tools to help me explore and deepen my math understanding. (PBLO: Creative Thinkers)

- I can consider the available tools when solving a mathematical problem, including pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. I can make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. I can detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, I know that technology can enable me to visualize the results of varying assumptions, explore consequences, and compare predictions with data. I can identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. I can use technological tools to explore and deepen my understanding of concepts.

Practice 6: Attend to precision. I can be precise when calculating, solving problems, and communicating my ideas. (PBLO: Effective Communicators)

- I can communicate precisely to others by using clear definitions in discussion with others and in my own reasoning. I can state the meaning of the symbols I choose, specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. I can calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. I can examine claims and make explicit use of definitions.

Practice 7: Look for and make use of structure. I can see and understand how numbers and spaces are organized and put together as parts and wholes. (PBLO: Creative Thinkers)

- I can look closely to discern a pattern or structure. I can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. I can use patterns to create equivalent expressions, factor and solve equations, compose functions and transform figures.

Practice 8: Look for and express regularity in repeated reasoning. I can notice when calculations are repeated and can then find more general and efficient methods. (PBLO: Creative Thinkers)

- I can recognize when calculations are repeated, and look both for general methods and for shortcuts. As I work to solve a problem, derive formulas or make generalizations, I can maintain oversight of the process, while attending to the details. I continually evaluate the reasonableness of my intermediate results.

Priority Content Standards

Students should spend the large majority of their time on the Widely Applicable Prerequisites for college and career. Prioritized clusters are identified in the standards as **priority standards**.

Congruence

Experiment with transformations in the plane.

HSG.CO.1: Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc.

HSG.CO.2: Represent transformations in the plane using transparencies and geometry software; describe transformations as functions that take points in the plane as inputs and give other points as outputs. Compare transformations that preserve distance and angle to those that do not.

HSG.CO.3: Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.

HSG.CO.4: Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.

HSG.CO.5: Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another.

Understand congruence in terms of rigid motions.
Geometry Focus: Build on rigid motions as a familiar starting point for development of concept of geometric proof

HSG.CO.6: Use geometric descriptions of rigid motions to transform figures and to predict the effect of a given rigid motion on a given figure; given two figures, use the definition of congruence in terms of rigid motions to decide if they are congruent.

HSG.CO.7: Use the definition of congruence in terms of rigid motions to show that two triangles are congruent if and only if corresponding pairs of sides and corresponding pairs of angles are congruent.

HSG.CO.8: Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions.

Prove geometric theorems.
Geometry Focus: Focus on validity of underlying reasoning while using variety of ways of writing proofs

HSG.CO.9: Prove theorems about lines and angles. *Theorems include: vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent and corresponding angles are congruent; points on a perpendicular bisector of a line segment are exactly those equidistant from the segment's endpoints.*

HSG.CO.10: Prove theorems about triangles. *Theorems include: measures of interior angles of a triangle sum to 180°; base angles of isosceles triangles are congruent; the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; the medians of a triangle meet at a point.*

HSG.CO.11: Prove theorems about parallelograms. *Theorems include: opposite sides are congruent, opposite angles are congruent, the diagonals of a parallelogram bisect each other, and conversely, rectangles are parallelograms with congruent diagonals.*

Make geometric constructions.
Geometry Focus: Formalize and explain processes

HSG.CO.12: Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.). *Copying a segment; copying an angle; bisecting a segment; bisecting an angle;*

constructing perpendicular lines, including the perpendicular bisector of a line segment; and constructing a line parallel to a given line through a point not on the line.

HSG.CO.13: Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle.

Similarity, Right Triangles and Trigonometry

Understand similarity in terms of similarity transformations.

HSG.SRT.1: Verify experimentally the properties of dilations given by a center and a scale factor.

HSG.SRT.2: Given two figures, use the definition of similarity in terms of similarity transformations to decide if they are similar; explain using similarity transformations the meaning of similarity for triangles as the equality of all corresponding pairs of angles and the proportionality of all corresponding pairs of sides.

HSG.SRT.3: Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.

Prove theorems involving similarity.

HSG.SRT.4: Prove theorems about triangles.

HSG.SRT.5: Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.

Define trigonometric ratios and solve problems involving right triangles.

HSG.SRT.6: Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles.

HSG.SRT.7: Explain and use the relationship between the sine and cosine of complementary angles.

HSG.SRT.8: Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.

HSG.SRT.9: Derive the formula $A = 1/2\ ab\ \mathrm{Sin}(C)$ for the area of a triangle by drawing an auxiliary line from a vertex perpendicular to the opposite side.

HSG.SRT.10: Prove the Laws of Sines and Cosines and use them to solve problems.

HSG.SRT.11: Understand and apply the Law of Sines and the Law of Cosines to find unknown measurements in right and non-right triangles (e.g., surveying problems, resultant forces).

Circles

Understand and apply theorems about circles.

HSG.C.1: Prove that all circles are similar.

HSG.C.2: Identify and describe relationships among inscribed angles, radii, and chords. *Include the relationship between central, inscribed, and circumscribed angles; inscribed angles on a* *diameter are right angles; the radius of a circle is perpendicular to the tangent where the radius intersects the circle.*

HSG.C.3: Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a circle.

Find arc lengths and areas of sectors of circles.
Geometry Focus: Radian introduced only as unit of measure

HSG.C.4: Construct a tangent line from a point outside a given circle to the circle.

HSG.C.5: Derive using similarity the fact that the length of the arc intercepted by an angle is proportional to the radius, and define the radian measure of the angle as the constant of proportionality; derive the formula for the area of a sector.

Expressing Geometric Properties with Equations

Translate between the geometric description and the equation for a conic section.

HSG.GPE.1: Derive the equation of a circle of given center and radius using the Pythagorean Theorem; complete the square to find the center and radius of a circle given by an equation.

HSG.GPE.2: Derive the equation of a parabola given a focus and directrix.

Use coordinates to prove simple geometric theorems algebraically.
Geometry Focus: Include distance formula; relate to Pythagorean theorem

HSG.GPE.4: Use coordinates to prove simple geometric theorems algebraically.

HSG.GPE.5: Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems.

HSG.GPE.6: Find the point on a directed line segment between two given points that partitions the segment in a given ratio.

HSG.GPE.7: Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, using the distance formula.

Geometric Measurement and Dimensions

Explain volume formulas and use them to solve problems.

HSG.GMD.1: Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone. *Use dissection arguments, Cavalieri's principle, and informal limit arguments*.

HSG.GMD.3: Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.

Visualize the relation between two-dimensional and three-dimensional object.

HSG.GMD.4: Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.

Modeling with Geometry

Apply geometric concepts in modeling situations.

HSG.MG.1: Use geometric shapes, their measures, and their properties to describe objects.

HSG.MG.2: Apply concepts of density based on area and volume in modeling situations.

HSG.MG.3: Apply geometric methods to solve design problems.

Conditional Probability and the Rules of Probability

Understand independence and conditional probability and use them to interpret data.

HSG.CP.1: Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events ("or," "and," "not").

HSG.CP.2: Understand that two events *A* and *B* are independent if the probability of *A* and *B* occurring together is the product of their probabilities, and use this characterization to determine if they are independent.

HSG.CP.3: Understand the conditional probability of *A* given *B* as *P*(*A* and *B*)/*P*(*B*), and interpret independence of *A* and *B* as saying that the conditional probability of *A* given *B* is the same as the probability of *A*, and the conditional probability of *B* given *A* is the same as the probability of *B*.

HSG.CP.4: Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities.

HSG.CP.5: Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations.

Use the rules of probability to compute probabilities of compound events in a uniform probability model.

HSG.CP.6: Find the conditional probability of *A* given *B* as the fraction of *B*'s outcomes that also belong to *A*, and interpret the answer in terms of the model.

HSG.CP.7: Apply the general Multiplication Rule in a uniform probability model, $P(A \text{ and } B) = P(A)P(B|A) = P(B)P(A|B)$, and interpret the answer in terms of the model.

HSG.CP.8: Use the rules of probability to compute probabilities of compound events in a uniform probability model. Apply the Addition Rule, $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$, and interpret the answer in terms of the model.

HSG.CP.9: Use the rules of probability to compute probabilities of compound events in a uniform probability model. Use permutations and combinations to compute probabilities of compound events and solve problems.