LARAMIE COUNTY
SCHOOL DISTRICT 2

Students First

Mathematics Curriculum

Approved by the Laramie County School District #2
Board of Trustees

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Mathematics Subject Area Committee (SAC):

Kindergarten	Nikki Poelma – AES
First Grade	Marjorie Gorman – PBES
Second Grade	Mary Beth Crips – BES
Third Grade	Amber Imel – CES
Fourth Grade	Natalie Freeburg – AES
Fifth Grade	Britt Bath – BES, Todd Thompson – PBES
Sixth Grade	Barbara Franzen – CES
Seventh-Twelfth Grade	Cindy Collins – BHS
	Nate Hellbaum – PBHS
	Cole Manlove – BHS
	Pat Walter – PBHS

Cole Manlove and Pat Walter – co-chairs of the Mathematics SAC

Margie Simmons – Curriculum Leadership Institute

Sue Stevens – LCSD2 Curriculum Coordinator

Leanne Person – PBES secretary, for making copies and processing documents

Introduction

The purpose of Laramie County School District #2's Mathematics Curriculum is to provide a clear, organized framework on which to build instruction in the classroom. The curriculum includes clear outcomes and components of these outcomes which further clarify the skills necessary to achieve each outcome. Each outcome also describes the depth of knowledge and level of rigor required for students to demonstrate their conceptual understanding of the mathematical knowledge and skills outlined in the curriculum.

All standards and outcomes are not created equal. The mathematics curriculum has been carefully aligned to include complete coverage of the Wyoming Mathematics Standards. However, it is important to note that all standards are not of equal importance. Some standards, commonly called priority standards, are essential for students to master in order to be prepared for the next grade level or course. Others, commonly referred to as supporting standards, are taught within the context of the priority standards, but do not receive the same degree of instruction and assessment as the priority standards. They act as a scaffold to help students understand and attain the priority standards.

LCSD2 has analyzed the content of each course and prioritized the concepts of greater importance. These are called **Essential Standards** and are noted in each course curriculum for grades 7-12. In grades K-6, essential standards are described in the **Proficiency Scales.** LCSD2 teachers may access the scales in the Curriculum Library. Parents may request copies from the building administrator. District assessments are created to assess student learning on these essential standards.

Each outcome has been assigned a code number consisting of symbols for content area, grade level or course, and outcome number. In the example shown below, MA stands for Math (content area) – K stands for kindergarten (grade) – 1 symbolizes that it is the first outcome in this grade level.

Example:

Outcome MA-K-1:

Students will count and write numbers 0-20 and count numbers 0-100 by 1's and 10's.

MA-K-1-1	Count to 100 by 1's. (K.CC.1)
MA-K-1-2	Count to 100 by 10's. (K.CC.1)
MA-K-1-3	Write numbers from 0-20. (K.CC.3)
MA-K-1-4	When given a number, count forward from that number. (K.CC.2)

Each component has also been given a code number consisting of symbols for the content area, grade level or course, outcome number, and component number. In the example shown above, MA stands for Math (content area) – K stands for kindergarten (grade) – 1 stands for the outcome number – and 4 symbolizes that it is the fourth component of the outcome.
At the end of each component, the code number in parentheses indicates the Wyoming Common Core State Standard to which it aligns and includes the grade level, domain, and

standard number. In the above example, the K stands for Kindergarten, CC stands for Counting and Cardinality, and 2 stands for standard 2 under Counting and Cardinality.

A link to the complete Wyoming Common Core State Standards document can be found here.

Mission

Successful math students in LCSD2 will fluently read, write, compute and communicate mathematically. Students will demonstrate conceptual understanding, critical thinking and reasoning skills by solving real world problems.

Course/Grade Level Purposes

Kindergarten
Students in kindergarten will demonstrate their understanding of number sense and shapes using critical thinking and reasoning skills by solving real world problems.

First Grade
Students in first grade will use addition and subtraction within 20 to solve real world problems and demonstrate fluency for addition and subtraction within 10.

Second Grade
Students in second grade will use place value and properties of operations to fluently add and subtract within 100 to solve real world problems.

Third Grade
Students in third grade will fluently compute multiplication and division problems within 100. Students will identify and compare fractions and apply measurement skills in real world problems.

Fourth Grade
Students in fourth grade will add, subtract, compare, and order fractions and use critical thinking and reasoning skills to solve real world multiplication and division problems.

Fifth Grade
Students in fifth grade will fluently add and subtract fractions and decimals. Students will also apply their knowledge of fractions and decimals to multiply and divide. Students will measure volume using appropriate units by applying addition and multiplication principles to solve real world problems.

Sixth Grade
Students in sixth grade will write and evaluate expressions and equations involving variables to represent an unknown. Students will apply the operations of integers to solve real world problems.

Seventh Grade
Students in seventh grade will analyze proportional relationships and apply operations with rational numbers to generate and solve equations. Equations will include angles, area, and volume from real world problems. In addition, students will develop, use, and evaluate problems involving probability and make inferences about populations.

Eighth Grade
Students in eighth grade will define, evaluate, and model functions and compare linear equations. Students will explain congruence or similarity through transformations. In addition, they will use the Pythagorean Theorem, volume formulas, and system of equations to solve real world problems.

Pre-Algebra
Students in Pre-Algebra will identify, simplify, and evaluate algebraic expressions. Students will identify, write, and solve linear functions using a variety of methods. Students will calculate simple and compound probability. They will also collect and interpret statistical data and make predictions based on calculations and data. Students will apply the Pythagorean Theorem to solve real world problems.

Algebra I
Students in Algebra I will simplify algebraic expressions using properties of exponents. Students will identify and classify polynomials. They will construct and compare linear, quadratic, and exponential models to solve real world problems and create, graph, and solve linear inequalities in systems.

Algebra II
Students in Algebra II will solve quadratics resulting in complex number solutions. Students will analyze and solve problems involving exponential, logarithmic, rational, and radical functions. Students will define trigonometric ratios and solve real world problems involving right triangles.

Geometry
Students in Geometry will prove geometric theorems by applying concepts of similar and congruent triangles or circles. Students will derive trigonometric ratios by comparing similar right triangles. Students will express geometric properties with equations to solve real world problems from a coordinate plane and in measurements from two and three dimensional objects.

Advanced Mathematics
Students in Advanced Mathematics will apply trigonometric laws and identities to solve real world problems, including problems involving vectors. Students will identify, derive, and graph higher order functions. They will collect, summarize, display, and interpret data. Students will calculate simple and compound probabilities, make predictions based on probability models and calculate expected value.

Applied Mathematics

Students in Applied Mathematics will collect, summarize, display and interpret data. Students will calculate simple and compound probabilities, make predictions based on probability models, and calculate expected values. Students will evaluate and apply mathematical concepts as they appear in real-world situations such as personal finance, taxes and insurance.

Standards for Mathematical Practice

(excerpt from the 2012 Wyoming State Mathematics Standards)

What are the Standards for Mathematical Practice?

The Standards for Mathematical Practice bring the complexities of the world into focus and give schema for grappling with authentic and meaningful problems. The Practices define experiences that build understanding of mathematics and ways of thinking through which students develop, apply, and assess their knowledge:

- Develop Mathematical Practices
  - ✔ Students make sense of quantities and their relationships in situations by sifting through available information to construct an approach for solving the problem.
  - ✔ Students persevere in the development of a variety of approaches.

- Apply Mathematical Practices
  - ✔ Students take complex scenarios and distill important quantities and their relationships by looking for patterns and making use of structure. They then apply appropriate models and use appropriate tools to derive a solution.
  - ✔ Students maintain oversight of the process, while attending to the details as they work to solve a problem.

- Assess Mathematical Practices
  - ✔ Students are critical consumers of the practices and processes they adapt from other sources and are able to consider the efficiency and effectiveness of a variety of methods.
  - ✔ Students apply precision in communicating processes and solutions. They explain why and how various methods succeed or fail.

The Standards for Mathematical Practice establish habits of mind and empower students to become mathematically literate and informed citizens.

Why are the Standards of Mathematical Practice important?

Algorithmic knowledge is no longer sufficient when preparing our students to become globally competitive. The knowledge of good practitioners goes beyond algorithmic learning and allows them to picture the problem and the many roads that may lead to absolution. They realize that mathematics is applicable outside of the classroom and are confident in their ability to apply mathematical concepts to all aspects of life. The symbiotic nature of the Standards of Mathematical Practice allows students to deepen their understandings of mathematical concepts and cultivates their autonomy as mathematically literate and informed citizens. Employing mathematics as a means of synthesizing complex concepts and making informed decisions is paramount to success in all post-secondary endeavors.

Mathematics | Standards for Mathematical Practice

The Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students. These practices rest on important "processes and proficiencies" with longstanding importance in mathematics education. The first of these are the NCTM process standards of problem solving, reasoning and proof, communication, representation, and connections. The second are the strands of mathematical proficiency specified in the National Research Council's report *Adding It Up*: adaptive reasoning, strategic competence, conceptual understanding (comprehension of mathematical concepts, operations and relations), procedural fluency (skill in carrying out procedures flexibly, accurately, efficiently and appropriately), and productive disposition (habitual inclination to see mathematics as sensible, useful, and worthwhile, coupled with a belief in diligence and one's own efficacy).

1 Make sense of problems and persevere in solving them.

Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students 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. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, "Does this make sense?" They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.

2 Reason abstractly and quantitatively.

Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to *decontextualize*—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to *contextualize*, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.

3 Construct viable arguments and critique the reasoning of others.
Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to 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. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

4 Model with mathematics.
Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their 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.

5 Use appropriate tools strategically.
Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation

and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.

6 Attend to precision.
Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.

7 Look for and make use of structure.
Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see 7×8 equals the well remembered $7 \times 5 + 7 \times 3$, in preparation for learning about the distributive property. In the expression $x2 + 9x + 14$, older students can see the 14 as 2×7 and the 9 as $2 + 7$. They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see $5 – 3(x – y)2$ as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers x and y.

8 Look for and express regularity in repeated reasoning.
Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through (1, 2) with slope 3, middle school students might abstract the equation $(y – 2)/(x – 1) = 3$. Noticing the regularity in the way terms cancel when expanding $(x – 1)(x + 1)$, $(x – 1)(x2 + x + 1)$, and $(x – 1)(x3 + x2 + x + 1)$ might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.

Kindergarten

Kindergarten Mathematical Terms and Definitions

above – positioned in a higher place

add, addition – to combine parts to make a whole

after – following in time or place, next

angle – the figure formed by two lines extending from the same point

before – ahead of

behind – positioned after

below – positioned under

beside – positioned next to

categorize – group objects

circle – a line segment that is curved so that its ends meet and every point on the line is equally far away from a single point inside

classify – arrange or assign

combine – put parts together

compare – determine similarities and differences

compose – put together

cone – a solid figure that slopes evenly to a point from a circular base

corner/point – the point or place where edges or sides meet

count – add one by one to find how many, name next number(s)

count back – start at a given number and say the next lowest number(s)

count on, count forward – start at a given number and say the next highest number(s)

cube – solid body having six equal square sides

curve – rounded edge

cylinder – a geometric shape composed of two parallel faces of identical size and shape (as circles) and a curved surface that completely connects their borders

decompose – take apart

different – how things are not alike

edge – the line where an object or surface begins or ends

equal sign (=) – mathematical symbol used to represent the total

equal, equal to – the same amount

equation – a number sentence

expression – numbers and symbols grouped together to show the value of something (example: 2+3)

face – any of the flat surfaces that form the boundary of a solid in geometry

fewer – less than

forward – Move ahead

greater – more than

greater than – a larger amount, more

greatest – the most, largest amount

heavy – greater than usual weight

hexagon – a polygon of six angles and six sides

how many, in all, total, all together – whole amount

in front of – positioned before

join – put together

larger – bigger than usual size

least – smallest amount

left – how many are still there

less – smaller than usual size

less than – the least, smallest amount

light – less than usual weight

long, length – measurement from end to end

longer – covers further distance than usual

longest – comparison of something of greater measurement from end to end

match – the same, equal to

measure, measurement – determine specific unit of size

minus (–) – symbol used to represent subtraction

model – to show

more – amounting to a larger number

most – largest amount

next to – positioned beside

number – word or symbol to tell how many

number sentence, addition sentence, subtraction sentence – equation that includes numbers and operation symbols (example: 3+4=7 or 9-5=4)

number words (0-20) – Zero (0), One (1), Two (2)…Twenty (20)

number words (multiples of 10) – Ten (10), Twenty (20), Thirty (30)…One Hundred (100)

ones – a single unit, used for numbers 0-9

orientation – placement of an object

over – positioned above
place value – where a digit is in a larger number

plus (+) – symbol used to represent addition

quantity – total, how many

rectangle – a four-sided polygon that has four right angles and each pair of opposite sides parallel and of the same length

remove – take away

same – alike

separate – divide

sequence – to put in order

set – a group with a like attribute

shape – specific form of an object

short – less than usual length

shorter – comparison of something of smaller measurement from end to end

side, sides – a straight-line segment forming part of the boundary of a geometric figure

similar – ways things are the same

size – measurement of an object

smaller – less than usual size

solve – find the answer

sort – group with a common attribute

sphere – a solid shape whose surface is made up of all the points that are an equal distance from the point that is the shape's center

square – shape with four equal sides and angles

straight – free from curves, bends, angles, or unevenness

subtract, subtraction – take away, determine what is left

sum, total – whole amount, all together, in all

tall – height measurement

taller – higher than usual height measurement

ten frame – mathematical tool used to organize units

tens – ten units

three-dimensional, solid – an object that has height, width, and depth

triangle – three sides, three angles

two-dimensional, flat – a shape that only has two dimensions (example: width and height) and no thickness

under – position beneath something

unit – a single thing, a group of objects making up a whole

vertices/corners – point where edges or sides meet

volume – the amount that something holds

weight – measurement of mass

word problem – math story to be solved

zero – none

ESSENTIAL STANDARDS: Please see the complete Social Studies Proficiency Scales in the Curriculum Library.

Outcome MA-K-1:
Students will count and write numbers 0-20 and count numbers 0-100 by 1's and 10's.

MA-K-1-1	Count to 100 by 1's. (K.CC.1)
MA-K-1-2	Count to 100 by 10's. (K.CC.1)
MA-K-1-3	Write numbers from 0-20. (K.CC.3)
MA-K-1-4	When given a number, count forward from that number. (K.CC.2)

Outcome MA-K-2:
Students will make connections between numbers and quantities by reading, writing, and saying number names to represent quantities 0-20.

MA-K-2-1	Say number names 0-20 in standard order, connecting each number name to one object. (K.CC.4.A)
MA-K-2-2	Write the number of objects in a group of 0-20 objects after counting them, restating the last number said when counting. (K.CC.4.B)
MA-K-2-3	Represent an amount of 0-20 objects with a written number. (K.CC.3)
MA-K-2-4	Justify why changing the arrangement or order of objects does not change the total amount. (K.CC.5)
MA-K-2-5	When given any number 0-20, model and say the number representing one more. (K.CC.4.C)
MA-K-2-6	When given any number 0-20 orally or in writing, represent that number with objects. (K.CC.5)
MA-K-2-7	When given specified quantities (0-20) of objects and corresponding number cards, design a project that shows quantities in order from least to greatest, label each with the appropriate corresponding number, and tell which number corresponds with each quantity. (K.CC.3, K.CC.4, K.CC.5).

Outcome MA-K-3:
Students will classify real-world objects into categories (such as color, shape, size, etc.), count how many objects are in each category, and sort the categories.

MA-K-3-1	Classify real-world objects into given categories. (K.MD.3)
MA-K-3-2	Count how many objects are in each sorted category. (K.MD.3)
MA-K-3-3	Sort categories by the number of objects in each category. (K.MD.3)
MA-K-3-4	Given up to 20 real-life objects, classify and sort by attribute (e.g., color, shape, size), count, and record their results. (K.MD.3)

Outcome MA-K-4:
Students will compare numbers 1-10 using the terms *greater than, less than,* and *equal to*.

MA-K-4-1	Define *greater than, less than,* and *equal to.* (K.CC.6)
MA-K-4-2	When given two groups of objects containing 1-10 objects each, compare the groups using the terms greater than, less than, or equal to. (K.CC.6)
MA-K-4-3	When given two written numbers 1-10, compare the two numbers using the terms greater than, less than, or equal to. (K.CC.6 & K.CC.7)

Outcome MA-K-5:
Students will add to 10 by manipulating objects and writing equations and students will fluently add to 5.

MA-K-5-1	Define *addition* and identify the symbols needed for writing addition problems. (K.OA.1, K.OA.2, K.OA.3, K.OA.4, K.OA.5)
MA-K-5-2	Represent addition with concrete objects or actions. (K.OA.1)
MA-K-5-3	Explain how to solve addition problems. (K.OA.1, K.OA.2, K.OA.3, K.OA.4, K.OA.5)
MA-K-5-4	Write addition sentences that correspond to a given problem. (K.OA.1, K.OA.2, K.OA.3, K.OA.4)
MA-K-5-5	Fluently add numbers with sums ranging from 0 to 5. (K.OA.5)
MA-K-5-6	Solve real-world addition problems with numbers 0-10 using drawings or objects to represent the problem. (K.OA.1, K.OA.2)
MA-K-5-7	Decompose numbers 1-10 into pairs in two or more ways as represented by using manipulatives or drawings and representing their work with equations or drawings. (K.OA.3)
MA-K-5-8	Find the number that, when added to any given number 0-10, equals 10, and write the answer with a picture or equation. (K.OA.4)
MA-K-5-9	Choose an appropriate tool (manipulatives, pictures, sounds, etc.) to create, represent, write a number sentence for, solve, and explain their own addition problems using the numbers 0-10. (K.OA.1, K.OA.2, K.OA.3, K.OA.4, K.OA.5)

Outcome MA-K-6:
Students will subtract numbers through 10 by manipulating objects and writing equations and students will fluently subtract to 5.

MA-K-6-1	Define *subtraction* and identify the symbols needed for writing subtraction problems. (K.OA.1, K.OA.2, K.OA.3, K.OA.4, K.OA.5)
MA-K-6-2	Represent subtraction with concrete objects or actions. (K.OA.1)
MA-K-6-3	Explain how to solve subtraction problems. (K.OA.1, K.OA.2, K.OA.3, K.OA.4, K.OA.5)
MA-K-6-4	Write subtraction sentences that correspond to a given problem. (K.OA.1, K.OA.2, K.OA.3, K.OA.4)

MA-K-6-5	Using the digits 0 to 5, fluently subtract numbers. (K.OA.5)
MA-K-6-6	Solve real-world subtraction problems with numbers 0-10 using drawings or objects to represent the problem. (K.OA.1, K.OA.2)
MA-K-6-7	Choose an appropriate tool (e.g., manipulatives, pictures, sounds) to create, represent, write a number sentence for, solve, and explain their own subtraction problems using the numbers 0-10. (K.OA.1, K.OA.2, K.OA.3, K.OA.4, K.OA.5)

Outcome MA-K-7:
Students will compose and decompose numbers 11-19 into tens and ones.

MA-K-7-1	Compose numbers from 11-19 into one group of ten and some additional ones. (K.NBT.1)
MA-K-7-2	Decompose numbers from 11-19 into one group of ten and some additional ones. (K.NBT.1)
MA-K-7-3	Record compositions of numbers 11-19 using a drawing or equation. (K.NBT.1)
MA-K-7-4	Record decompositions of numbers 11-19 using a drawing or equation. (K.NBT.1)
MA-K-7-5	Show and explain that numbers 11-19 are composed of one group of ten and some additional ones. (K.NBT.1)

Outcome MA-K-8:
Students will identify shapes in the world using their names, determine if they are two-dimensional or three-dimensional, describe their relative positions, and analyze, compare, build, draw, and compose shapes.

MA-K-8-1	Identify *squares, circles, triangles, rectangles, hexagons, cubes, cones, cylinders,* and *spheres* in the environment, regardless of their orientation or size. (K.G.1, K.G.2)
MA-K-8-2	Explain the differences between two-dimensional and three-dimensional shapes and sort real-world objects using these categories. (K.G.3)

MA-K-8-3	Describe the relative positions of shapes in their world using the terms *above, below, beside, in front of, behind,* and *next to*. (K.G.1)
MA-K-8-4	Analyze two-dimensional and three-dimensional shapes regardless of their size or orientation using the terms *faces/sides* and *vertices/corners*. (K.G.4)
MA-K-8-5	Compare two-dimensional and three-dimensional shapes regardless of their size or orientation by describing their similarities and differences using the terms *faces/sides*, *vertices/corners*, and other attributes. (K.G.4)
MA-K-8-6	Build two- and three-dimensional shapes. (K.G.5)
MA-K-8-7	Draw triangles, rectangles, squares, and circles. (K.G.6)
MA-K-8-8	Compose larger shapes using triangles, rectangles, and squares. (K.G.6)
MA-K-8-9	Design a project that combines shapes and describe, compare, and analyze it using positional words and the terms *two-dimensional* and *three-dimensional*. (K.G.1, K.G.2, K.G.3, K.G.4, K.G.5, and K.G.6)

Outcome MA-K-9:
Students will describe three or more measurable attributes of a real-world object and compare that object's measurements to those of another real-world object.

MA-K-9-1	Define *length*. (K.MD.1)
MA-K-9-2	Define *weight*. (K.MD.1)
MA-K-9-3	Define *volume.*
MA-K-9-4	Describe three or more measurable attributes (e.g., tall, short, long, wide, thin) of a real-world object. (K.MD.1)
MA-K-9-5	Compare two real-world objects using opposites relating to measurement (e.g., more of/less of, taller/shorter, longer/shorter, wide/thin). (K.MD.2)
MA-K-9-6	Compare two real-world objects with several common, measurable attributes, explaining which has *more than* and which has *less than* of those attributes and describe the similarities and differences between them. (K.MD.1 and K.MD.2)

First Grade

1st Grade Mathematical Terms and Definitions

Associative Property of addition- states that the sum of a set of numbers is the same, no matter how they are grouped – ex. (2+3)+7=2+(7+3)

analog clock – a clock or watch is called "analog" when it has moving hands and hours marked 1 to 12 to show time

attribute – a characteristic of an object

bar graph- a graph that uses bars to stand for data

Commutative Property- changing the order of addends does not change the sum –ex. (3+4+6 = 4+6+3)

count backward- to count in a negative direction

difference- answer to a subtraction problem

digital clock – a type of clock that displays the time digitally – in numbers or other symbols

doubles- an addition fact that includes two of the same number

fact family- a group of facts made up of two addition facts with the same addends and two subtraction facts in which the addends are now the subtrahends

fourth of – one fourth of a whole

half of – one half of a whole

half-hour- a period of time equal to 30 minutes

hour- a period of time equal to 60 minutes

hour hand- the shorter hand on a clock that tells what hour of the day it is

minute- a period of time equal to 60 seconds

minute hand- the longer hand on a clock that tells how many minutes

number line- a line marked with a sequence of numbers at regularly spaced points along its length

picture graph- graph that uses pictures

one-half- ½- one of two equal parts that make up a whole

one – fourth ¼- one of four equal parts that make up a whole

one – third 1/3- one of three equal parts that make up a whole

quarter of – one fourth of a whole

rectangular prism- a rectangular solid figure such as a brick

right circular cone – a right cone with a base that is a circle (similar to a regular pyramid except that its base is a circle)

right circular cylinder – a three dimensional object with two congruent circles as parallel bases and a lateral surface consisting of a rectangle

tally table- a table in which objects are counted and recorded by using tallies

trapezoid – a quadrilateral with only one pair of parallel sides

ESSENTIAL STANDARDS: Please see the complete Social Studies Proficiency Scales in the Curriculum Library.

Outcome MA-1-1:
Students will fluently compute addition and subtraction problems within 20, demonstrating fluency within 10, using strategies such as counting on, making ten, using the relationship between addition and subtraction and creating equivalent, but easier or known sums.

MA-1-1-1	Demonstrate the doubles and double plus one strategies to find sums to 20. (1.0A.6)
MA-1-1-2	*Count on* to add and *count backwards* to subtract using a number line to compute addition and subtraction problems to 20. (1.0A.6, 1.NBT.I, 1.0A.5)
MA-1-1-3	Apply addition strategies to add 3 numbers with sums up to 20. (1.0A.2)
MA-1-1-4	Find sums and differences to 20 using fact families. (1.0A.6)

Outcome MA-1-2:
Students will add and subtract within 20 to solve real world problems. Students will compute problems by adding to, taking from, and comparing with unknowns in all positions.

MA-1-2-1	Solve real world problems that call for addition of three whole numbers whose sum is less than or equal to 20 using manipulatives, drawings, and equations to explain their reasoning. (1.0A.2)
MA-1-2-2	Write a number sentence, solve, illustrate, and explain real world story problems with 10 plus another number less than 10. (1.NBT.4)
MA-1-2-3	Construct a question that can be answered by adding or subtracting using data from a table, write a number sentence that represents the problem, solve, and explain the solution. (1.0A.7)

Outcome MA-1-3:
Students will apply properties of operations as strategies to add and subtract. (Commutative property of addition and associative property of addition) (OA3)

MA-1-3-1	Name the unknown whole number in an addition or subtraction equation and explain why that number makes the equation true (e.g., 9+_=11, 2=__-9, etc.). (1.0A.8, 1.NBT.3, 1.OA4, 1.0A.6)
MA-1-3-2	Identify the meaning of the equal sign, and determine if equations involving addition and subtraction are true or false. (1.0A.7)

Outcome MA-1-4:
Students will identify that the two digits of a two digit number represent amount of tens and ones.

MA-1-4-1	Count to 120 starting at any number less than 120 and read and write numerals within this range. (1. NBT.I)
MA-1-4-2	Compare two digit numbers based on meanings of the digits in the tens and ones places, recording the results of comparison with the symbols greater than (>), less than (<), and equal to (=). (1.NBT.I, 1.NBT.3)
MA-1-4-3	Add a two-digit number and a one-digit number with sums up to 100, using concrete models, drawings, and strategies based on place value (e.g., ones are added to ones, tens are added to tens, and sometimes it's necessary to compose a ten). (1.NBT.2)
MA-1-4-4	Add a two-digit number and a multiple of ten with sums up to 100, using concrete models, drawings, and strategies based on place value (e.g., ones are added to ones, tens are added to tens, and sometimes it's necessary to compose a ten). (1.NBT.2)
MA-1-4-5	Identify ten more or ten less than the two-digit number given, having students count, and explain their reasoning. (1.NBT.2)
MA-1-4-6	Subtract multiples of ten from multiples of ten within the range of 10-90, using models or drawings and addition and subtraction strategies. (1.NBT.2)
MA-1-4-7	Skip count by 2s, 5s, and 10s using a hundreds chart. (1.NBT.5)

Outcome MA-1-5:
Students will collect, organize, represent, and interpret data with up to three categories.

MA-1-5-1	Sort and classify several objects into three categories. (1.MD.4)
MA-1-5-2	Use tally marks to count objects in each category and then design a bar or picture graph using data gathered from tally marks. (1.MD.4)
MA-1-5-3	Interpret bar and picture graphs, answering questions about how many in each category, and comparing how many more or less in each category. (1.MD.4)

Outcome MA-1-6:
Students will use attributes of two- and three- dimensional shapes to reason and compose new shapes.

MA-1-6-1	Compose two-dimensional shapes (rectangles, squares, trapezoids, triangles, half-circles, and quarter-circles) and three-dimensional shapes (cubes, right rectangular prisms, right circular cones and right circular cylinders). (1.G.2)
MA-1-6-2	Compare two objects to see which object has more of or less of an attribute and describe the difference. (1.MD.4)
MA-1-6-3	Predict the results of putting together and taking apart two- and three-dimensional shapes. (1.G.2)

MA-1-6-4 Compose composite shapes using two- or three-dimensional shapes (see MA-1-6-1). Then compose a new shape from the composite shape. (1.G.2)

MA-1-6-5 Compare and classify geometric shapes using defining attributes (e.g., shape, number of sides, number of angles, open, closed) and distinguish from non-defining attributes (e.g., color, size, orientation). (1.G.1)

MA-1-6-6 Partition circles and rectangles into two and four equal parts, describe the parts using the words *halves, fourths,* and *quarters* and using the words *half of, fourth of,* and *quarter of*. Describe the whole as *two of,* or *four of* the parts. (1.G.3)

Outcome MA-1-7:
Students will measure lengths of an object using non-standard units (e.g., paperclips, counters, cubes, etc.) by laying multiple copies of a shorter object end to end with no gaps and will write the length as a whole number of length units. Students will tell time to the nearest half hour.

MA-1-7-1 Order three objects by length, then compare the lengths of two objects indirectly by using a third object. (1.MD.1, 1.MD.2)

MA-1-7-2 Measure given objects using non-standard units and write the length as a whole number of units. (1.MD.2)

MA-1-7-3 Choose a non-standard unit and an object to measure and record the length of that object as a whole number of length units. (1.MD.2)

MA-1-7-4 Identify the parts of both digital and analog clocks, including minute hand, hour hand, and digits before and after the colon. (1.MD.3)

MA-1-7-5 Tell and write time in hours and half-hours using analog and digital clocks. (1.MD.3)

Outcome MA-1-8:
Students will measure and estimate liquid volume and use addition and subtraction to solve one-step word problems involving liquid volume expressed with the same units.

MA-1-8-1 Define *volume* and identify the tools used to measure mass. (3.MD.2)

MA-1-8-2 Define the differences between *gallons* and *cups* and identify and use their abbreviations. (3.MD.2)

MA-1-8-3 Measure liquid volume using gallons and cups with manipulatives and drawings. (3.MD.2)

MA-1-8-4 Estimate liquid volume using gallons and cups from manipulatives and drawings. (3.MD.2)

MA-1-8-5 Solve one-step word problems involving liquid volume using addition and subtraction. (3.MD.2)

Outcome MA-1-9:
Students will solve real world problems involving dimes, nickels, and pennies.

MA-1-9-1	Identify value of dollar bills, quarters, dimes, nickels, and pennies. (2.MD.8)
MA-1-9-2	Count groups of similar coins (dimes, nickels, and pennies) and write the amounts using $ and ¢ symbols appropriately. (2.MD.8)

Second Grade

2nd Grade Mathematical Terms and Definitions

expanded form - A multi digit number is expressed in expanded form when it is written as a sum of single digit multiples of powers of ten. For example, 643 = 600 + 40 + 3.

ESSENTIAL STANDARDS: Please see the complete Social Studies Proficiency Scales in the Curriculum Library.

Outcome MA-2-1:
Students will solve one- and two-step addition and subtraction word problems within 100 involving situations of adding to, taking from, putting together, taking apart and comparing, with unknowns in all positions. Students will solve by using drawings and equations with a symbol for the unknown number to represent the problem.

MA-2-1-1	Solve one-step addition and subtraction word problems by using drawings and equations, identifying key terms to determine the appropriate operation. (2.OA.1)
MA-2-1-2	Solve two-step addition and subtraction word problems by using drawings and equations, identifying key terms to determine the appropriate operation. (2.OA.1)
MA-2-1-3	Solve one-step addition and subtraction word problems with variables by using drawings and equations with a symbol for the unknown number, identifying key terms to determine the appropriate operation. (2.OA.1)
MA-2-1-4	Solve two-step addition and subtraction word problems with variables using drawings and equations with a symbol for the unknown number, identifying key terms to determine the appropriate operation. (2.OA.1)
MA-2-1-5	Distinguish between and solve one- and two-step addition and subtraction word problems with variables using drawings and equations with a symbol for the unknown number, identifying key terms to determine the appropriate operation. (2.OA.1)

Outcome MA-2-2:
Students will fluently solve addition and subtraction problems within 20, using strategies such as counting on, making ten, using the relationship between addition and subtraction and creating equivalent, but easier or known sums.

MA-2-2-1	Solve addition and subtraction problems within 20, identifying, explaining and justifying the strategy used. (2.OA.2)
MA-2-2-2	When given two one-digit numbers, students will automatically state the sum.

Outcome MA-2-3:
Students will analyze equal groups of objects to gain foundations for multiplication.

MA-2-3-1	Diagram repeated number patterns and identify repetition within the pattern (e.g., 36 has 3 equal groups of 12).
MA-2-3-2	Identify a given group of objects (up to 20) as odd or even by using and explaining strategies (e.g., pairing, counting by 2s). (2.OA.3)
MA-2-3-3	Make an equation to express an even number as a sum of two equal addends. (2.OA.3)
MA-2-3-4	Use repeated addition to find the number of objects arranged in rectangular arrays with up to 5 rows and up to 5 columns and write an equation to express the total as a sum of equal addends. (2.OA.4)

Outcome MA-2-4:
Students will recognize, name, and use place value up to 999.

MA-2-4-1	Compose and decompose 3-digit numbers to identify appropriate place value. (2.NBT.1)
MA-2-4-2	Produce a bundle of 10 tens and identify as a hundred. (2.NBT.1a)
MA-2-4-3	Identify 100, 200, 300, 400, 500, 600, 700, 800, 900 as 1, 2, 3, 4, 5, 6, 7, 8, 9, hundred(s) with 0 tens and 0 ones. (2.NBT.1b)
MA-2-4-4	Count by ones within 1,000 (e.g., count from 256 to 265). (2.NBT.2)
MA-2-4-5	Skip count by 5s, 10s, and 100s within 1000. (2.NBT.2)
MA-2-4-6	Read and write any number up to 1,000 using numerals and word form. (2.NBT.3)
MA-2-4-7	Write any number up to 1000 in expanded form, (e.g., 365 is represented as, 300 + 60 + 5). (2.NBT.3)
MA-2-4-8	Compare two three-digit numbers using >, =, < and use place value to explain their reasoning. (2.NBT.4)

Outcome MA-2-5:
Students will distinguish addition and subtraction properties of operations utilizing place value.

MA-2-5-1	Add and subtract within 100 using place value, properties of operations and the relationship between addition and subtraction. (2.NBT.5)
MA-2-5-2	State the sums of four two-digit numbers using appropriate place value and properties of operations. (2.NBT.6)
MA-2-5-3	Make concrete models and/or drawings based on place value, properties of operation and/or addition and subtraction relationships to add and subtract within 1,000. (2.NBT.7)
MA-2-5-4	Explain the place value rules (e.g., regrouping, carrying, borrowing) used to add and subtract three-digit numbers. (2.NBT.9)
MA-2-5-5	Automatically add or subtract 10 or 100 to a given number between 100 and 900. (2.NBT.8)

Outcome MA-2-6:
Students will estimate and measure lengths in standards units, using mathematical tools.

MA-2-6-1	Measure length of an object using more than one standard unit of measurement: inches, feet, centimeters and meters. (2.MD.1, 2.MD.2)
MA-2-6-2	Estimate lengths using units of inches, feet, centimeters and meters. (2.MD.3)
MA-2-6-3	Measure to determine how much longer one object is than another object, expressing the difference in standard length unit. (2.MD.4)

Outcomes MA-2-7:
Students will measure and estimate masses and use addition and subtraction to solve one-step word problems involving mass expressed with the same units.

MA-2-7-1	Define *mass* and identify the tools used to measure mass. (3.MD.2)
MA-2-7-2	Define the differences between *pounds* and *ounces* and identify and use their abbreviations. (3.MD.2)
MA-2-7-3	Measure masses using pounds and ounces with manipulatives and drawings. (3.MD.2)
MA-2-7-4	Estimate masses using pounds and ounces from manipulatives and drawings. (3.MD.2)
MA-2-7-5	Solve one-step word problems involving mass using addition and subtraction. (3.MD.2)

Outcome MA-2-8:
Students will solve addition and subtraction problems involving length.

MA-2-8-1	Represent and solve addition and subtraction problems within 100 involving lengths that are given in the same units (e.g., using drawings and equations with a symbol for the unknown number to represent the problem). (2.MD.5)
MA-2-8-2	Represent whole numbers in models as lengths from 0 on a number line with equal spaced points which correspond to the numbers 0, 1, 2… (2.MD.5)
MA-2-8-3	Use a number line to represent sums and differences of whole numbers within 100. (2.MD.6)

Outcome MA-2-9:
Students will tell time to the nearest five minutes, including a.m. and p.m.

MA-2-9-1	Tell and write time to the nearest five minutes using both analog and digital clocks. (2.MD.7)
MA-2-9-2	Explain the difference between a.m. and p.m. and give examples. (2.MD.7)

MA-2-9-3 Label a given event using a.m. and p.m. (2.MD.8)

Outcome MA-2-10:
Students will solve real world problems involving dollar bills, quarters, dimes, nickels, and pennies.

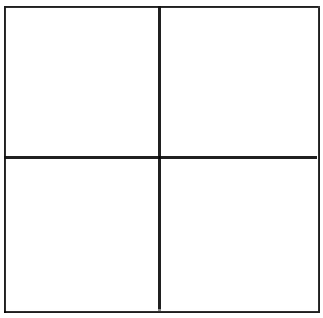
MA-2-10-1 Identify value of dollar bills, quarters, dimes, nickels, and pennies. (2.MD.8)
MA-2-10-2 Count groups of similar coins and dollar bills and write the amounts using $ and ¢ symbols appropriately. (2.MD.8)
MA-2-10-3 Count mixed collections of dollar bills, quarters, dimes, nickels and pennies and write the amounts using $ and ¢ symbols appropriately. (2.MD.8)

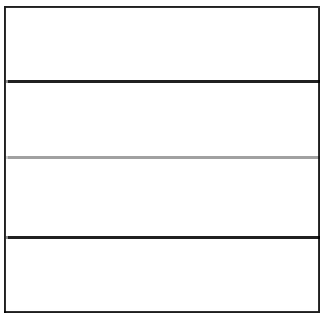
Outcome MA-2-11:
Students will analyze, represent, and interpret data.

MA-2-11-1 Identify and interpret line plots with a horizontal scale marked off in whole number units. (2.MD.9)
MA-2-11-2 Create a line plot which represents the measured length of an object using multiple standard units. (e.g., a student measures the length of a desk using inches and plots that. Then the student measures the length of a desk using centimeters and plots that on another line plot and compares the two.) (2.MD.9)
MA-2-11-3 Identify and interpret picture graphs and bar graphs. (2.MD.10)
MA-2-11-4 Draw a picture graph and a bar graph (all with single units), to represent a data set with up to four categories. (2.MD.10)
MA-2-11-5 Create simple addition and subtraction problems (put together, take apart and compare) using information presented in a bar graph. (2.MD.10)

Outcome MA-2-12:
Students will make patterns and/or structures as they integrate shapes and their attributes.

MA-2-12-1 Identify triangles, quadrilateral, pentagons, hexagons and cubes. (2.G.1)
MA-2-12-2 Create and draw shapes having specified attributes, such as a given number of angles or a given number of equal sides/faces. (2.G.1)
MA-2-12-3 Partition a rectangle into rows of columns of same size squares and count to find the total number of them, e.g. use color tiles. (2.G.2)
MA-2-12-4 Partition circles and rectangles into 2, 3, 4 equal shares; describe the shares (using the words *halves*, *thirds*, *half* or *third of*, etc.); and describe the whole as *two halves*, 3/3, 4/4. (2.G.3)
MA-2-12-5 Identify equal shares of identical wholes justifying why they need not have the same shape. (2.G.3)
Example:





Third Grade

3rd Grade Mathematical Terms and Definitions

area - the number of square units needed to cover a flat surface

array - an arrangement of objects in rows and columns

Associative Property of Multiplication - the property that states that when the grouping of factors is changed, the product remains the same

Commutative Property of Multiplication - the property that states that you can multiply two factors in any order and get the same product

denominator - the part of a fraction below the line, which tells how many equal parts there are in the whole or in the group

Distributive Property of Multiplication - the property that states that multiplying a sum by a number is the same as multiplying each addend by the number and then adding the products

dividend - the number that is to be divided in a division problem

division/divide - to separate into equal groups; the opposite operation of multiplication

divisor - the number that divides the dividend

equivalent - two or more sets that name the same amount

factor - a number that is multiplied by another number to find a product

grams - a metric unit that is used to measure mass

half past the hour - 30 minutes after a given hour

kilograms - a metric unit for measuring mass

liters - a metric unit for measuring capacity

mass - the amount of matter in an object

multiple - a number that is the product of a given number and a whole number

multiplication/multiply – the process of combining equal groups to find how many in all; the opposite operation of division

numerator - the part of a fraction above the line, which tells how many parts are being counted

parenthesis - symbols **(** and **)** to identify which numbers should be computed first in an equation

perimeter - the distance around a figure

polygon - a closed plane figure with straight sides that are line segments

product - the answer in a multiplication problem

quarter after/until the hour - fifteen minutes before or after any given hour

quotient - the number, not including the remainder, that results from division

rhombus - a quadrilateral with two pairs of parallel sides and four equal sides

square unit (centimeters, feet, inches, meters, units) - a square with a side length of one unit; used to measure area

volume – a system of units for measuring capacity

ESSENTIAL STANDARDS: Please see the complete Social Studies Proficiency Scales in the Curriculum Library.

Outcome MA-3-1:
Students will fluently recall all products of two one-digit whole numbers, including one-digit whole numbers multiplied by multiples of ten. Students will draw pictorial representations of multiplication as combinations of equal groups and division as separation into equal groups, including illustrating multiplication by creating arrays.

MA-3-1-1	Illustrate multiplication number sentences to demonstrate equal groups of objects, including multiples of ten. (3.OA.1, 3.OA.7, 3.NBT.2)
MA-3-1-2	Illustrate division number sentences to demonstrate separation into equal groups. (3.OA.2, 3.OA.7)
MA-3-1-3	Identify and define an *array*. (3.OA.3, 3.OA.7)
MA-3-1-4	Illustrate a multiplication number sentence by drawing an array. (3.OA.3, 3.OA.7)
MA-3-1-5	Fluently recall all products of two one-digit whole numbers. (3.OA.1, 3.OA.7)
MA-3-1-6	Solve multiplication and division word problems within 100. (3.OA.3, 3.OA.7)

MA-3-1-7 Multiply one-digit whole numbers by multiples of ten (10-90). (3.OA.1, 3.OA.3, 3.OA.7, 3.NBT.2)

Outcome MA-3-2:
Students will identify arithmetic patterns in both addition and multiplication tables and expand those patterns using the four operations, including identifying the rule.

MA-3-2-1 Using an addition table, identify a pattern. (3.OA.9)
MA-3-2-2 Using a multiplication table, identify a pattern (e.g., four times a number is always even and can be decomposed into two equal addends). (3.OA.9)
MA-3-2-3 Continue a pattern by writing the next four numbers for both addition and subtraction. (3.OA.9)
MA-3-2-4 Construct and solve sample problems to demonstrate a pattern, using the four operations. (3.OA.9)
MA-3-2-5 Identify and write the rules used to determine the missing numbers in the patterns. (3.OA.9)

Outcome MA-3-3:
Students will use the properties of operations (Commutative, Associative and Distributive) to multiply and divide.

MA-3-3-1 Rearrange multiplication number sentences to show the Commutative Property of Multiplication and simplify. (3.0A.5)
MA-3-3-2 Arrange a multiplication number sentence to show the Associative Property of Multiplication, including the purpose and use of parenthesis and simplify. (3.0A.5)
MA-3-3-3 Arrange a number sentence to show the Distributive Property, including the purpose and use of parenthesis and simplify. (3.0A.5)
MA-3-3-4 When given a list of equations, label each equation with the appropriate property. (3.0A.5)

Outcome MA-3-4:
Students will determine the unknown whole number in multiplication and division equations.

MA-3-4-1 Solve multiplication equations by determining the missing factor including equations in all formats (e.g., 8 × _ =48; __ × 4=12; 14=7 × __). (3.OA.4, 3.OA.7)
MA-3-4-2 Solve division equations by using multiplication (e.g., find 32 ÷ 8 by finding the number that makes 32 when multiplied by 8). (3.OA.4, 3.OA.6, 3.OA.7)
MA-3-4-3 Write both the multiplication and division equations (fact families) that compute equally (e.g., 4 x 8=32 and 32 ÷ 8=4). (3.OA.4, 3.0A.5, 3.OA.6, 3.OA.7)
MA-3-4-4 Create sample problems that depict the organization of unknown numbers in both multiplication and division (e.g., We have 32 apples. Put

them in 8 groups. How many apples are in each group?). (3.OA.4,3.0A.5, 3.OA.6, 3.OA.7)

Outcome MA-3-5:
Students will solve two-step real world word problems using the four operations by arranging the information in the problem into steps, using a letter to stand for the unknown quantity, using mental computation, and estimation strategies including rounding.

MA-3-5-1	Write and solve simple equations using a letter for the unknown quantity. (3.OA.8)
MA-3-5-2	Determine the two steps that must be followed to reach the answer, write those two steps out using a letter for the unknown quantity, and solve the equation. (3.OA.8)
MA-3-5-3	Justify the answer of an equation by writing the completed equation with the actual answer in place of the letter. (3.OA.8)

Outcome MA-3-6:
Students will tell and write time to the nearest minute, measure time intervals in minutes, and solve word problems involving adding and subtracting time intervals in minutes.

MA-3-6-1	Explain that each numeral on an analog clock represents five-minute intervals and the tick marks in between represent minutes. (3.MD.1)
MA-3-6-2	Compute number of minutes between any two given numbers on an analog clock. (3.MD.1)
MA-3-6-3	Using a schedule, identify start and end times and time intervals (elapsed time) in minutes. (3.MD.1)
MA-3-6-4	Compute time intervals in word problems. (3.MD.1)
MA-3-6-5	Solve word problems involving addition and subtraction of time intervals in minutes. (3.MD.1)
MA-3-6-6	Create word problems and schedules expressing time intervals using addition and subtraction. (3.MD.1)

Outcome MA-3-7:
Students will draw a scaled bar graph and a scaled picture graph, using data with several categories to solve one- and two-step "*how many more*" and "*how many less*" problems.

MA-3-7-1	Construct a scaled picture graph when survey data is given. (3.MD.3)
MA-3-7-2	Construct a scaled bar graph when survey data is given. (3.MD.3)
MA-3-7-3	Solve one-step "*how many more"* and "*how many less"* problems. (3.MD.3)
MA-3-7-4	Solve two-step "*how many more"* and "*how many less"* problems. (3.MD.3)

Outcomes MA-3-8:
Students will measure and estimate liquid volumes and masses and use the four operations to solve one-step word problems involving mass and volume expressed with the same units.

MA-3-8-1 Identify the definitions of *volume* and *mass* and identify the tools used to measure liquid volume and mass. (3.MD.2)

MA-3-8-2 Explain the differences between *grams, kilograms*, and *liters, milliliters* and identify and use their abbreviations. (3.MD.2)

MA-3-8-3 Measure liquid volumes and masses using grams, kilograms, liters, and milliliters, with manipulatives and drawings. (3.MD.2)

MA-3-8-4 Estimate liquid volumes and masses using grams, kilograms, and liters milliliters, from manipulatives and drawings. (3.MD.2)

MA-3-8-5 Solve one-step word problems involving liquid volume and mass using the four operations. (3.MD.2)

MA-3-8-6 Compose and solve one-step word problems using any of the four operations involving measurement of liquid volumes or masses with the appropriate units. (3.MD.2)

Outcomes MA-3-9:
Students will measure squares and rectangles to compute the area in real world and mathematical problems.

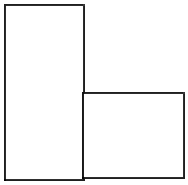
MA-3-9-1 Measure squares and rectangles using *square units, square centimeters, square meters, square inches, square feet* and improvised units. (3.MD.5a, 3.MD.6)

MA-3-9-2 Compute the area by multiplying side lengths. (3.MD.7a)

MA-3-9-3 Compute the area by tiling the figure. (3.MD.5a, 3.MD.5b, 3.MD.7c)

MA-3-9-4 Compute the area by using the Distributive Property with tiling. (3.MD.7c)

MA-3-9-5 Compute the area by decomposing the figure into non-overlapping parts and adding the areas of those non-overlapping parts. (3.MD.5b, 3.MD.7d)
Example:



MA-3-9-6 Solve real world and mathematical problems involving area. (3.MD.7b, 3.MD.7d)

Outcomes MA 3-10:
Students will identify, label, and categorize polygons. Students will measure polygons with an unknown side length to determine the perimeter to solve real world and mathematical problems and compile length data into a line plot.

MA-3-10-1 Name *polygons* in different categories that share attributes that can re-group them into a different category (e.g., rhombuses and rectangles both have four sides which puts them in the quadrilateral category). (3.G.1)

MA-3-10-2 Name and draw a quadrilateral in the form of a *rhombus*, rectangle and square. (3.G.1)

MA-3-10-3 Draw examples of quadrilaterals that do not belong to any subcategories. (3.G.1)

MA-3-10-4 Categorize all quadrilaterals and polygons in a columned chart. (3.G.1)

MA-3-10-5 Measure lengths of shapes to the nearest half and fourth of an inch and represent that data on a line plot. (3.MD.4)

MA-3-10-6 Solve real world and mathematical problems involving perimeter of polygons. (3.MD.8)

MA-3-10-7 Solve real world and mathematical problems in which the perimeter of polygons can be found when given the side lengths, finding an unknown side length, and when rectangles have the same perimeter with different areas or the same area with different perimeters. (3.MD.8)

Outcomes MA-3-11:
Students will create and solve addition and subtraction problems within 1,000 using strategies and algorithms of place value.

MA-3-11-1 Align numbers in addition problems based on place value rules (e.g., regrouping, borrowing, carrying), solve, and justify answers. (3.NBT.2)

MA-3-11-2 Align numbers in subtraction problems based on place value rules (e.g., regrouping, borrowing, carrying), solve, and justify answers. (3.NBT.2)

MA-3-11-3 Compose, solve, and justify addition and subtraction problems that are greater than 100 but less than 1,000. (3.NBT.2)

Outcomes MA-3-12:
Students will use the strategies and algorithms of place value to write and round whole numbers in written, standard, and expanded form to the nearest 10, 100, 1000.

MA-3-12-1 Write numbers, including those greater than 1000, in standard, written and expanded form.

MA-3-12-2 Explain what rounding is. Explain the rules of rounding. (3.NBT.1)

MA-3-12-3 Round numbers to the nearest ten. (3.NBT.1)

MA-3-12-4 Round numbers to the nearest hundred. (3.NBT.1)

MA-3-12-5 Round numbers to the nearest thousand. (3.NBT.1)

Outcome MA-3-13:
Students will identify and label parts of a fraction, and plot and compare fractions using number lines and manipulatives to demonstrate that fractions are parts of a whole.

MA-3-13-1 Use number lines, shapes, and manipulatives to partition parts of a whole equally and write those parts in fraction form. (e.g., partition a shape into 4 equal parts with equal area, and describe the area of each part as ¼ of the area of the shape). (3.NF.1, 3.NF.2a, 3.G.2)

MA-3-13-2 Using the terms *numerator* and *denominator*, identify and label the parts of fractions appropriately. (3.NF.1)

MA-3-13-3	Using a number line, identify the whole as 0-1 and the parts of the whole by breaking it into equal parts. (3.NF.2a)
MA-3-13-4	Plot a fraction on a number line. (3.NF.2b)
MA-3-13-5	Using a number line and manipulatives, demonstrate equivalent fractions as being the same size or the same place on a number line. (3.NF.3a, 3.NF.3b, 3.NF.3d)
MA-3-13-6	Use the symbols for *greater than, less than*, and *equal to* to compare fractions with the same numerator or denominator.
MA-3-13-7	Construct fractions that display whole numbers as fractions (e.g., 3 =3/1). (3.NF.3c)

Outcome MA-3-14:
Students will solve real world problems involving money amounts, including using larger bills and counting back change.

MA-3-14-1	Identify the value of five, ten, twenty, fifty, and one hundred dollar bills. (4.MD.2)
MA-3-14-2	Solve real world problems involving adding money amounts. (4.MD.2)
MA-3-14-3	Solve real world problems involving counting back change. (4.MD.2)

Fourth Grade

4th Grade Mathematical Terms and Definitions

centimeter- a metric unit for measuring length or distance

common factor - a whole number that divides two (or more) numbers exactly

common multiple - a multiple that is shared by two or more numbers

composite number - a number with more than two factors

decimal fraction - a fraction written as a decimal
Example: 3/100=.03

greatest common factor - the biggest number that will divide two or more other numbers exactly

kilometer - a metric unit for measuring length or distance; 1 kilometer= 1,000 meters

least common multiple - the smallest number that is the multiple of two or more other numbers

meter – a metric unit for measuring length or distance; 1 meter = 100 centimeters

milliliter – a metric unit for measuring capacity

ounce – a customary unit for measuring weight

prime number – a number that has exactly two factors; a number that can only be divided evenly by itself and 1

pound - a customary unit for measuring weight; 1 pound = 16 ounces

ray - a part of a line, with one endpoint, that is straight and continues in one direction
Example: 2 is a common factor of 8, 10 and 12.

remainder - the amount left over when a number cannot be divided evenly

seconds - a unit used to measure short amounts of time

ESSENTIAL STANDARDS: Please see the complete Social Studies Proficiency Scales in the Curriculum Library.

Outcome MA-4-1:
Students will generate a number or shape pattern that follows a given rule and identify features of the pattern that were not explicit in the rule.

MA-4-1-1	Complete a given number or shape pattern. (e.g., 3, 6, 9, ___, ___, 18) (4.OA.5)
MA-4-1-2	Determine and write the rule of a given pattern. (e.g., 3, 6, 9, 12, 15, 18 Rule: skip count by 3 or are multiples of 3) (4.OA.5)
MA-4-1-3	Generate and record a shape pattern that follows a rule and state the rule. (4.OA.5)
MA-4-1-4	Generate and write a number pattern that follows a rule and state the rule. (4.OA.5)
MA-4-1-5	Identify and record alternative features of the pattern that are not specifically stated in the rule (e.g., 3, 6, 9, 12, 15, 18 Rule: skip count by 3 or are multiples of 3. The numbers also alternate between odd and even.). (4.OA.5)

Outcome 4-2:
Students will represent numbers as fractions and manipulate them to find equivalent fractions, compare fractions, and add/subtract fractions with like denominators.

MA-4-2-1	Define the *identity property of multiplication*.
MA-4-2-2	Explain how the identity property of multiplication transforms a fraction into its equivalent fraction. (4.NF.1)
MA-4-2-3	Create models to find equivalent fractions using manipulatives such as paper, color tiles, fraction bars, fraction circles or drawings and write the equivalent fractions. (4.NF.1)
MA-4-2-4	Create models to compare fractions with different denominators using manipulatives such as area models, number lines, set models, pattern blocks, fraction bars or pictorial representations. (4.NF.2)
MA-4-2-5	Compare benchmark fractions (1/4, 1/3, 1/2, 2/3, 3/4) using >, <, or =. (4.NF.2)
MA-4-2-6	Decompose a fraction into unit fractions (e.g., 3/8 = 1/8 + 1/8 + 1/8 or 1/8 + 2/8). Justify solution by using visual models. (4.NF.3)
MA-4-2-7	Add and subtract fractions with like denominators. (4.NF.3)
MA-4-2-8	Identify and define *mixed numbers*.
MA-4-2-9	Add and subtract mixed numbers with like denominators. (4.NF.3)
MA-4-2-10	Solve word problems involving addition and subtraction of fractions with like denominators by using visual fraction models and equations to represent the problem. (4.NF.3)

Outcome 4-3:
Students will draw and identify points, lines, line segments, rays, angles, and perpendicular and parallel lines in two-dimensional figures.

MA-4-3-1 Identify, define, and draw *points* in two-dimensional figures. (4.G.1)
MA-4-3-2 Identify, define, and draw *lines* in two-dimensional figures. (4.G.1)
MA-4-3-3 Identify, define, and draw *line segments* in two-dimensional figures. (4.G.1)
MA-4-3-4 Identify, define, and draw *rays* in two-dimensional figures. (4.G.1)
MA-4-3-5 Identify, define, and draw *perpendicular lines* in two-dimensional figures. (4.Gg1)
MA-4-3-6 Identify, define, and draw parallel lines in two-dimensional figures. (4.G.1)
MA-4-3-7 Identify, define, and draw angles (*obtuse, acute,* and *right*) in two-dimensional figures. (4.G.1)
MA-4-3-8 Construct a product that illustrates each of these geometric terms in real life setting. (4.G.1)

Outcome 4-4:
Students will classify two-dimensional figures based on the presence of parallel or perpendicular lines, or the presence or absence of angles of a specified size.

MA-4-4-1 Sort two-dimensional shapes by types of sides (e.g., parallel, perpendicular) and justify why they are sorted that way. (4.G.2)
MA-4-4-2 Sort two-dimensional shapes by types of angles and justify why they are sorted that way. (4.G.2)
MA-4-4-3 Construct shapes with acute, obtuse, and right angles. (4.G.2)
MA-4-4-4 Produce figures with a specified type of line (perpendicular or parallel) and justify why the figure meets the criteria. (4.G.2)
MA-4-4-5 Develop a product that demonstrates knowledge of parallel and perpendicular lines as well as acute, obtuse, and right angles. (4.G.2)

Outcome 4-5:
Students will define line of symmetry and draw lines of symmetry in two-dimensional figures.

MA-4-5-1 Identify and define *line of symmetry*. (4.G.3)
MA-4-5-2 Produce lines of symmetry by folding cut out figures. (4.G.3)
MA-4-5-3 Identify figures that are symmetric and justify reasoning. (4.G.3)
MA-4-5-4 Draw lines of symmetry in a two-dimensional figure. (4.G.3)
MA-4-5-5 Identify symmetric real world objects, draw them, and identify the lines of symmetry. (4.G.3)

Outcome 4-6:

Students will be able to find all factor pairs for whole numbers 1-100 and determine whether a whole number in the range of 1-100 is prime or composite.

MA-4-6-1	Identify and define *common multiples* and *common factors* of numbers. (4.OA.4)
MA-4-6-2	Define and determine the *least common multiple* of numbers. (4.OA.4)
MA-4-6-3	Define and determine the *greatest common factor* of numbers. (4.OA.4)
MA-4-6-4	Identify and list factor pairs of whole numbers 1-100. (4.OA.4)
MA-4-6-5	Identify and define *prime* and *composite* numbers.
MA-4-6-6	identify a given number as prime or composite. (4.OA.4)

Outcome 4-7:
Students will apply the area and perimeter formulas for rectangles in real world and mathematical problems.

MA-4-7-1	State patterns noticed when solving perimeter problems and create a formula to represent those patterns.
MA-4-7-2	State patterns noticed when solving area problems and create a formula to represent those patterns.
MA-4-7-3	Test formulas created for area and perimeter until a correct formula is determined.
MA-4-7-4	Apply area and perimeter formulas to real world situations.

Outcome 4-8:
Students will create a line plot to display a data set of measurement in fractions of a unit. Students will solve problems involving addition and subtraction of fractions by using information presented in line plots.

MA-4-8-1	When given a set of data, determine appropriate increments, plot the data, and justify your choice.
MA-4-8-2	Solve problems involving addition of fractions by using information presented in line plots.
MA-4-8-3	Solve problems involving subtraction of fractions by using information presented in line plots.
MA-4-8-4	Collect real world data, create a line plot, and create and solve addition and subtraction problems from the line plot.

Outcome 4-9:
Students will use concepts of angles to classify, interpret, and measure angles. (CCSS 4.MD)

MA-4-9-1	Identify and define angles as geometric shapes that are created when 2 rays meet at a common endpoint. (CCSS 4.MD.5)

MA-4-9-2	Identify a circle as having 360 degrees and measure angles with reference to a circle. (e.g., 1/360 of a circle is called a "one-degree angle") (CCSS 3.MD.5)
MA-4-9-3	Measure and record angles in whole-number degrees using a protractor. (CCSS 4.MD.6)
MA-4-9-4	Draw angles of a specified measure using a protractor. (CCSS 4.MD.6)
MA-4-9-5	Demonstrate that two smaller angles can be added together to create a larger angle. (e.g., 45 degrees + 45 degrees = 90 degrees right angle) (CCSS 4.MD.7)
MA-4-9-6	Solve addition and subtraction problems to find unknown angles by using a symbol for the unknown angle measure. (e.g., 25 degrees + 25 degrees + M = 90 degrees) (CCSS 4.MD.7)

Outcome 4-10:
Students will utilize their knowledge of place value to identify, write, compare, and round whole numbers up to 1,000,000 in mathematical and word problems. (CCSS 4.NBT.1, 4.NBT.2, 4.NBT.3, 3.NBT.4, 4.OA.3)

MA-4-10-1	Read and write multi-digit whole numbers up to 1,000,000 using base-ten numerals, number names, and expanded form.
MA-4-10-2	Compare two multi-digit whole numbers (greater than 1000 but less than 1,000,000) based on place value using >, <, and =.
MA-4-10-3	Utilize place value understanding to round multi-digit whole numbers to any place up to 1,000,000.

Outcome 4-11:
Students will use place value understanding and properties of operations to perform and solve multi-digit arithmetic. (CCSS 4.NBT)

MA-4-11-1	Solve multi-digit addition problems up to 1,000,000 with regrouping. (CCSS 4.NBT.4)
MA-4-11-2	Solve multi-digit subtraction problems up to 1,000,000 with regrouping.
MA-4-11-3	Solve multi-digit multiplication problems up to 4 digits by a one-digit number. (CCSS 4.NBT.5)
MA-4-11-4	Solve two-digit by two-digit multiplication problems. (CCSS 4.NBT.5)
MA-4-11-5	Identify and define quotients, dividends, divisors, and remainders.
MA-4-11-6	Calculate whole number quotients with remainders up to four-digit dividends and one-digit divisors. (CCSS 4.NBT.6)
MA-4-11-6	Illustrate and explain multiplication and division problems using equations, rectangular arrays, drawings, and/or area models. (CCSS 4.NBT.6)

Outcome 4-12:
Students will use decimal notation to show fractions and compare decimal fractions.

MA-4-12-1 Identify and define *decimal fractions*.

MA-4-12-2 Represent a fraction with a denominator of 10 or 100 in a place value table. (CCSS 4.NF.6)

MA-4-12-3 Identify a fraction with a denominator of 10 as an equivalent fraction with a denominator 100. (e.g., 3/10 as 30/100)

MA-4-12-4 Add two fractions with denominators 10 and 100. (e.g., 3/10 + 4/100 = 34/100) (CCSS 4.NF.5)

MA-4-12-5 Convert fractions and decimals and decimals to fractions with denominators of 10 or 100. (CCSS 4.NF.6)

MA-4-12-6 Compare two decimal amounts to the hundredths using >, <, or = and justify the conclusions. (CCSS 3.NF.7)

Outcome 4-13:
Students will use the four operations with whole numbers to solve real world problems.

MA-4-13-1 Define a multiplication problem as a comparison. (e.g., 35 = 5 x 7, 35 is 5 times as many as 7 and 7 times as many as 5) (CCSS MA-4.OA)

MA-4-13-2 Write a multiplication equation when given a verbal description. (Teacher says, "Sally is 5 years old. Her mom is 8 times older. How old is Sally's mom?" Students write 5 x 8 = 40) (CCSS 4.OA.1)

MA-4-13-3 Solve multiplication or division word problems that involve multiplication comparisons using drawings and equations with a symbol as the unknown value.

MA-4-13-4 Solve multi-step word problems with whole numbers and whole number answers using the 4 operations. (CCSS 4.OA.3)

MA-4-13-5 Solve equations with an unknown and justify reasonableness of answers using mental computation and estimation strategies. (CCSS 4.OA.3)

Outcome 4-14:
Students will express measurements of a larger unit in terms of a smaller unit and record measurement equivalents in a two column table.

MA-4-14-1 Identify relative sizes of measurement units within one system of units including: km, m, cm; kg, g; lb, oz; l, ml; hr, min, sec (CCSS 4.MD1)

MA-4-14-2 Within a single system of measurement, convert measurements of a larger unit to smaller units and record equivalents in a two column table. (e.g., 1 hour = 60 minutes) (CCSS 4.MD.2)

MA-4-14-3 Represent measurement quantities using diagrams that include a measurement scale. (e.g., number line, clock, ruler, etc.) (CCSS 2.MD.2)

MA-4-14-4 Create and solve word problems involving distances, intervals of time, liquid volumes, masses of objects and money, including problems involving simple fractions or decimals and conversions of measurement units. (CCSS 4.MD.2)

Outcome 4-15:
Students will multiply fractions by a whole numbers. (CCSS 4.NF.4)

MA-4-15-1	Form equivalent expressions by writing fractions as a multiple of a unit fraction and show thinking as a visual fraction model. (e.g., 4/3 = 4 x 1/3) (CCSS 4.NF.4)
MA-4-15-2	Express a fraction a/b as a multiple of 1/b by using a visual fraction model. (e.g., 3 x 2/5 is the same as 6 groups of 1/5 or 6 x 1/5) (CCSS 4.NF.4)
MA-4-15-3	Solve word problems and mathematical problems involving multiplication of a whole number times a fraction. (CCSS 4.NF.4)

Fifth Grade

5th Grade Mathematical Terms and Definitions

axes – plural of axis – usually means the X and Y lines that cross at right angles to make a graph or coordinate plane

benchmark fractions – common fractions that you can judge other numbers against- EX: ¼, ½, ¾

braces - symbols used in pairs to group things together. There are different kinds of braces and brackets EX: (round), [square], {curly}, <angled>

brackets – symbols used in pairs to group things together. There are different kinds of braces and brackets EX: (round), [square], {curly}, <angled>

coordinate plane - a plane formed by the intersection of a horizontal number line with a vertical number line; the horizontal number line is called the *x*-axis and the vertical number line is called the *y*-axis. The number lines intersect at their zero points. This point of intersection is called the origin and written as (0, 0).

equivalent fractions – fractions which have the same value, even though they may look different EX: ½ and 2/4 are equivalent because they are both half.

like denominators – the bottom number of a fraction; to have like denominators you must have two fractions or more with the same bottom number

line plots – shows data on a number line with X or other marks to show frequency

mixed numbers – a whole number plus a fraction – EX: 1 ¾

operations – a mathematical process – the most common are add, subtract, multiply and divide

ordered pairs – two numbers written in a certain order, usually written in parenthesis like this: (4, 5); can be used to show position on a graph, where the X (horizontal) value is first, and the Y (vertical) value is second

origin – the starting point on a number line – it is 0

perpendicular – means at 'right angles'

right rectangular prism – a solid (3 dimensional) object which has six faces that are rectangles; it is a prism because it has the same cross – section along a length

scaling – resizing fractions – by multiplying or dividing a fraction by a fraction equal to one you can resize fractions or change the denominators without changing the value

unlike denominators – the bottom number of a fraction; to have unlike denominators you must have two different bottom numbers, or denominators

ESSENTIAL STANDARDS: Please see the complete Social Studies Proficiency Scales in the Curriculum Library.

Outcome MA-5-1:
Read and analyze the place value structure of the base ten number system to represent, compare and analyze whole numbers and decimals.

MA-5-1-1	Identify place value through billions and write whole numbers in expanded form, standard form, and word form. (5.NBT.3a)
MA-5-1-2	Compare and order whole numbers up to billions. (5.NBT.3b)
MA-5-1-3	Round whole numbers up to the nearest billion. (5.NBT.4)
MA-5-1-4	Identify decimal place value through thousandths place and write in expanded form, standard form, and word form. (5.NBT.3a)
MA-5-1-5	Identify and create equivalent decimals through thousandths. (5NBT.3a, 5.NBT.3b)
MA-5-1-6	Compare and order decimal numbers up to the thousandths place. (5.NBT.3b)
MA-5-1-7	Round decimal numbers up to the nearest thousandths. (5.NBT.4)

Outcome MA-5-2:
Students will read, analyze, and solve addition and subtraction real world problems with whole numbers and decimals using mathematical properties. Students will also write and evaluate expressions using mathematical properties and variables.

MA-5-2-1	Add and subtract decimals to thousandths. (5.NBT.7, 5.OA.3)
MA-5-2-2	Determine the mathematical properties (associative, commutative, distributive, etc.) and use to solve addition problems. (5.NBT.7)
MA-5-2-3	Determine the mathematical properties (associative, commutative, distributive, etc.) and use to solve subtraction problems. (5.NBT.7)
MA-5-2-4	Write and evaluate expressions using mathematical properties and variables. (5.OA.1, 5.OA.2, 5.OA.3)
MA-5-2-5	Use addition and subtraction properties to solve real world problems. (5.NBT.7)
MA-5-2-6	Fluently add and subtract whole numbers to billions and decimals to thousandths. (5.NBT.6)

Outcome MA-5-3:
Students will read, analyze, and solve multiplication problems with whole numbers to thousands and decimals to thousandths.

MA-5-3-1 Write and evaluate multiplication expressions using mathematical properties and variables. (5.OA.1, 5.OA.2)

MA-5-3-2 Multiply numbers involving decimals to the thousandths by a one-digit number. (5.OA.1, 5.OA.2, 5.OA.3)

MA-5-3-3 Multiply two-, three-, and four-digit numbers involving decimals to the thousandths by two-digit numbers to solve mathematical and real world problems. (5.NBT.3, 5.NBT.5)

Outcome MA-5-4:
Students will read, analyze, and solve division problems with whole numbers to the thousands and decimals to the hundredths using mathematical properties.

MA-5-4-1 Write and evaluate division expressions using mathematical properties and variables. (5.OA.1, 5.OA.2, 5.OA.3)

MA-5-4-2 Divide whole numbers up to four digits by one- and two-digit whole number divisors with quotients involving remainders. (5.NBT.3, 5.NBT.6)

MA-5-4-3 Divide decimals to hundredths by whole numbers, rounding to the nearest hundredth, if needed. (5.NBT.7)

MA-5-4-4 Solve division word problems using concrete models, drawings, place value strategies, etc, and justify answers. (5.NBT.7)

Outcome MA-5-5:
Students will use prime numbers, divisibility, greatest common factor, and least common multiple to solve problems related to equivalent fractions, simplest form, and mixed numbers. Students will also compare and order fractions, mixed numbers, and decimal fractions.

MA-5-5-1 Distinguish *prime numbers* from *composite numbers*.

MA-5-5-2 Identify divisibility rules for the numbers 2, 3, 4, 5, 6, 9, 10.

MA-5-5-3 Find the *greatest common factor (GCF)* of a set of numbers.

MA-5-5-4 List multiples of numbers and identify the least common multiple of a set of numbers.

MA-5-5-5 Identify and create equivalent fractions.

MA-5-5-6 convert fractions to simplest form, using greatest common factor.

MA-5-5-7 Convert improper fractions to mixed numbers and mixed numbers to improper fractions.

MA-5-5-8 Compare and order fractions, mixed numbers, and decimal fractions.

Outcome MA-5-6:
Students will write and distinguish between like and unlike fractions, find the least common denominator, compute sums and differences of unlike fractions, and estimate sums and differences of fractions.

MA-5-6-1 Identify, define, and distinguish between like and unlike fractions. (5.NF.1)

MA-5-6-2	Add and subtract like fractions. (5.NF.1)
MA-5-6-3	Analyze fractions to find common denominators to add and subtract unlike fractions. (5.NF.1)
MA-5-6-4	Analyze fractions to find the least common denominator to add and subtract unlike fractions. (5.NF.1)
MA-5-6-5	Add and subtract unlike fractions. (5.NF.1)
MA-5-6-6	Check validity of answers by estimating sums and differences of like and unlike fractions. (5.NF.2)

Outcome MA-5-7:
Students will write and solve math problems with mixed numbers utilizing addition and subtraction properties, including subtracting with regrouping.

MA-5-7-1	Add mixed numbers. (5.NF.1)
MA-5-7-2	Subtract mixed numbers. (5.NF.1)
MA-5-7-3	Subtract mixed numbers regrouping. (5.NF.1)
MA-5-7-4	When given a scenario, write the appropriate equation and solve. (5.NF.2)

Outcome MA-5-8:
Students will use reciprocals and estimating fractions to read, differentiate and solve multiplication and division problems of fractions, and whole numbers.

MA-5-8-1	Multiply a fraction by a fraction. (5.NF.4a)
MA-5-8-2	Multiply a fraction by a whole number. (5.NF.4a)
MA-5-8-3	Write the reciprocal of a fraction. (5.NF.7a)
MA-5-8-4	Divide whole numbers by fractions. (5.NF.7b, 5.NF.7c)
MA-5-8-5	Divide fractions by non-zero whole numbers. (5.NF.7a)
MA-5-8-6	Estimate fractions to the nearest whole or half number. (5.NF.7b)

Outcome MA-5-9:
Students will compute the product and quotient of fractions with mixed numbers and two mixed numbers. Students will integrate reciprocals in solving problems of division of fractions and estimate to check.

MA-5-9-1	Multiply fractions and mixed numbers. (5.NF.5a, 5.NF.5b, 5.NF.6)
MA-5-9-2	Multiply with mixed numbers. (5.NF.5a, 5.NF.5b)
MA-5-9-3	Create a reciprocal to multiply and divide mixed numbers. (5.NF.7a)
MA-5-9-4	Estimate the product and quotient of mixed numbers to check answers. (5.NF.7a)
MA-5-9-5	Divide fractions and mixed numbers by a non-zero whole number. (5.NF.7a)

Outcome MA-5-10:
Analyze characteristics and properties of two and three dimensional geometric shapes and develop mathematical arguments about geometric relationships, as well as visualization, spatial reasoning, and geometric modeling to solve problems.

MA-5-10-1	Identify, compare, and analyze attributes of two and three dimensional shapes and develop vocabulary to describe the attributes. (5.G.3)
MA-5-10-2	Classify two and three dimensional shapes according to their properties and develop definitions of classes of shapes such as triangles and pyramids. (5.G.4)
MA-5-10-3	Compare and contrast congruency and similarity. (5.G.3)
MA-5-10-4	Build and draw two and three dimensional geometric shapes. (5.G.3)
MA-5-10-5	Solve real-world addition, subtraction, multiplication, and division problems using geometric models.

Outcome MA-5-11:
Distinguish and differentiate measurable attributes of objects and the units, systems, and processes of measurement using appropriate techniques, tools and formulas to determine measurements.

MA-5-11-1	Execute one-step conversions within a system of measurement. (e.g., centimeters to meters, inches to feet, etc.) (5.MD.1)
MA-5-11-2	Determine and use the appropriate unit to produce more precise measurements. (e.g., estimating the length of a desk to the nearest inch or nearest foot) (5.MD.1, 5.MD.2)
MA-5-11-3	Discriminate between length, area, weight, volume, time, temperature, and size of angle and select the appropriate type of unit for measuring an attribute. (5.MD.3)
MA-5-11-4	Select and apply appropriate standard units and tools to solve problems involving length, area, volume, weight, time, temperature, and the size of angles. (5.MD.1; 5.NF.4b; 5.MD.4; 5.MD.5a; 5.MD.5b; 5.MD.5c)

Outcome MA-5-12
Distinguish elements of a coordinate plane and graph points on the coordinate plane to solve real-world mathematical problems.

MA-5-12-1	Identify the following components of a coordinate plane, that a pair of perpendicular lines form two axes (x,y) the intersection of lines form the origin (0,0). (5.G.1)
MA-5-12-2	Graph and locate ordered pairs on the first quadrant of a coordinate plane to solve real-world mathematical problems. (5.G.2)

Sixth Grade

6th Grade Mathematical Terms and Definitions

absolute value – the distance of a number from zero on a number line

box plot – a graph that displays the highest and lowest quarters of data a whiskers, the middle of two quarters of the data as a box, and the median

coefficient – the number that is multiplied by one or more variables (in 3xy, 3 is the coefficient)

dependent variable – the output value in a function dependent on the input value

dot plot – also called a dot chart, is a type of simple histogram-like chart used in statistics for relatively small data sets where values fall into a number of discrete bins.

histogram – a bar graph that shows the frequency of data within equal intervals

Identity Property – the product of 1 and any number is that number

independent variable – the input value in a function

inequality – a mathematical sentence that show the relationship between quantities that are not equal

integer – a set of positive whole numbers, their opposites, and zero

irrational number - A real number that cannot be written as a simple fraction - the decimal goes on forever without repeating. Example: Pi is an irrational number.

mean – The sum of the items in a set of data divided by the number of items in the set (average)

median – The middle number or mean of the two middle numbers in an ordered set

mode – The number or numbers that occur most frequently in a set of data

net – an arrangement of two dimensional figures that can be folded to form a polyhedron

non-regular polygon – a polygon whose sides and angles are not congruent

numerical expression – an expression that contains only numbers and operations

quadrants – the x and y-axes divide the coordinate plane into four regions. Each region is called a quadrant

range – the difference between the greatest and least values in a data set

rate – a ratio that compares two quantities measured in different units

ratio – a comparison of two quantities by division

rational numbers – numbers that can appear on a number line, including integers, fractions, improper fractions, mixed numbers, and repeating or terminating decimals

regular polygon- a polygon with congruent sides and angles

surface area – the sum of the areas of the faces, or surfaces, or a three-dimensional figure

term - a separate part of an equation, series, or expression

variable – a symbol used to represent a quantity that can change

ESSENTIAL STANDARDS: Please see the complete Social Studies Proficiency Scales in the Curriculum Library.

Outcome MA-6-1:
Students will divide multi-digit numbers by one digit and multiple digit divisors.

MA-6-1-1	Divide multi-digit dividends by one digit divisors. (6.NS.2)
MA-6-1-2	Divide multi-digit dividends by two digit divisors. (6.NS.2)
MA-6-1-3	Divide multi-digit dividends by three digit divisors. (6.NS.2)
MA-6-1-4	Divide multi-digit dividends by one, two, and three digit divisors. (6.NS.2)

Outcome MA-6-2:
Students will interpret and compute quotients of fractions and solve word problems involving division of fractions by fractions.

MA-6-2-1	Use models to illustrate division of fractions by fractions. (6.NS.1)

MA-6-2-2	Solve equations dividing fractions by fractions. (6.NS.1)
MA-6-2-3	Solve word problems involving division of fractions by fractions. (6.NS.1)

Outcome MA-6-3:
Students will read, write, identify, and evaluate expressions and equivalent expressions using whole numbers and exponents.

MA-6-3-1	Identify parts of an expression using mathematical terms: sum, term, product, factor, quotient, and coefficient. (e.g., *Describe the expression 2(8+7) as a product of two factors; view (8+7) as both a single entity and a sum of two terms*) (6.EE.2b)
MA-6-3-2	Identify and write equivalent expressions. (6.EE.2a; 6.EE.2c; 6.EE.4)
MA-6-3-3	Write and evaluate numerical expressions using whole number exponents. (6.EE.1; 6.EE.2a; 6.EE.2c; 6.EE.4; 6.EE.6)
MA-6-3-4	Read, write, and evaluate expressions in which letters and variables stand for known and unknown numbers. (6.EE.1; 6.EE.2a; 6.EE.2c; 6.EE.4; 6.EE.6)
MA-6-3-5	Solve expressions in which variables represent specific values including expressions from formulas and arithmetic operations that include order of operations. (6.EE.1; 6.EE.2a; 6.EE.2c; 6.EE.4; 6.EE.6)
MA-6-3-6	Apply the properties (Commutative, Associative, Distributive, and Identity) of operations to generate equivalent expressions. (6.EE.2a; 6.EE.2c; 6.EE.3; 6.EE.46.EE.6)
MA-6-3-7	Compose and evaluate expressions using known and unknown variables from story problems. (6.EE.1; 6.EE.2a; 6.EE.2c; 6.EE.4; 6.EE.6)

Outcome MA-6-4:
Students will write and solve equations and inequalities using the four operations, identify independent and dependent variables of an equation, and show that inequalities may have an infinite number of solutions.

MA-6-4-1	Use different variables to represent two quantities that change in relationship to each other in real-world problems (e.g., d=65t). (6.EE.1; 6.EE.2a; 6.EE.2c; 6.EE.4; 6.EE; 6.EE.9)
MA-6-4-2	Write an equation and identify one quantity as a dependent variable and the other as an independent variable. (6.EE.5; 6.EE.6; 6.EE.7; 6.EE.9)
MA-6-4-3	Analyze the relationship between dependent and independent variables using graphs and tables and relate these to the equation. (6.EE.9)
MA-6-4-4	Solve addition equations and inequalities. (6.EE.5; 6.EE.7)
MA-6-4-5	Solve subtraction equations and inequalities. 6.EE.5; 6.EE.7)
MA-6-4-6	Solve multiplication equations and inequalities. (6.EE.5; 6.EE.7)
MA-6-4-7	Solve division equations and inequalities. 6.EE.5; 6.EE.7)
MA-6-4-8	Write and solve inequalities with and without infinite solutions. (6.EE.5; 6.EE.8)

MA-6-4-9 State whether a given number makes an equation or inequality true. (6.EE.5; 6.EE.8)

Outcome MA-6-5:
Students will solve decimal equations and story problems by using the four operations.

MA-6-5-1 Add decimal equations. (6.NS.3)
MA-6-5-2 Subtract decimal equations. (6.NS.3)
MA-6-5-3 Multiply decimal equations. (6.NS.3)
MA-6-5-4 Divide decimal equations. (6.NS.3)
MA-6-5-5 Solve story problems involving decimals using the four operations. (6.NS.3)

Outcome MA-6-6:
Students will identify the greatest common factor (GCF) of two whole numbers less than or equal to 100 and the least common multiple (LCM) of two whole numbers less than or equal to 12.

MA-6-6-1 Use a variety of methods (i.e., list, factor tree, ladder, etc.) to determine the GCF for two whole number less than or equal to 100. (6.NS.4)
MA-6-6-2 Use a variety of methods (i.e., list, factor tree, ladder, etc.) to determine the LCM for two or more whole numbers less than or equal to 12. (6.NS.4)
MA-6-6-3 Determine and use the GCF or LCM to solve real-world problems. (6.NS.4)

Outcome MA-6-7:
Students will identify, label, and graph positive and negative integers and rational numbers on a number line and coordinate plane and solve real-world mathematical problems.

MA-6-7-1 Locate and position rational numbers and integers on a number line. (6.NS.6a; 6NS.6c)
MA-6-7-2 Identify quadrants of the coordinate plane. (6.NS.6b; 6.NS.6c)
MA-6-7-3 Graph pairs of integers in the correct quadrant of the coordinate plane. (6.NS.6b; 6.NS.6c)
MA-6-7-4 Extend number lines and coordinate axes to represent points with positive and negative coordinates. (6.NS.6b; 6.NS.6c)
MA-6-7-5 Graph opposites and identify the opposite of an opposite as the number itself and zero as its own opposite (e.g.,- (-3)=3). (6.NS.6a)
MA-6-7-6 Use positive and negative numbers to represent quantities in real world contexts including direction (e.g., below and above sea levels). (6.NS.5)
MA-6-7-7 Use coordinates and absolute value to find distances between points with either the same first coordinate or the same second coordinate (6.NS.6b; 6.NS.6c; 6.NS.8)
MA-6-7-8 Solve real-world problems involving the coordinate plane (e.g., map the school yard) (6.NS.8)

Outcome MA-6-8:
Students will define, order, graph and compare the absolute value of rational numbers and write, interpret and explain statements of order for rational numbers and inequalities.

MA-6-8-1	Define absolute value of a rational number. (6.NS.7a; 6.NS.7b)
MA-6-8-2	Order the absolute value of rational numbers with and without a number line. (6.NS.7a; 6.NS.7b)
MA-6-8-3	Graph the absolute value of rational numbers as its distance from zero on a number line. (6.NS.7a; 6.NS.7b; 6.NS.7c; 6.NS.7d)
MA-6-8-4	Compare the absolute value of a number to the value the number really is. (6.NS.7a; 6.NS.7b; 6.NS.7c; 6.NS.7d)
MA-6-8-5	Write and explain statements of order for rational numbers. (e.g., $-30 is the same as $30 in debt) (6.NS.7c; 6.NS.7d)
MA-6-8-6	Describe statements of inequality as statements about the position of two numbers on a number line. (6.NS.7a; 6.NS.7b; 6.NS.7d)

Outcome MA-6-9:
Students will describe ratio and rate relationships using ratio and rate language, use ratio and rate reasoning to solve problems, unit rate problems, convert measurements, and find percentages as a rate per 100. Students will make tables for equivalent ratios; compare ratios, and find missing values on a coordinate plane.

MA-6-9-1	Use ratio and rate language to describe ratio relationships. (6.RP.1)
MA-6-9-2	Demonstrate ratio and rate reasoning to solve problems by using tables, diagrams, double line diagrams, or equations. (6.RP.3a)
MA-6-9-3	Make tables of equivalent ratios relating quantities with whole number measurements. (6.RP.3a)
MA-6-9-4	Use tables to compare ratios. (6.RP.3a)
MA-6-9-5	Find missing values in a table. (6.RP.3a)
MA-6-9-6	Solve unit rate problems (e.g., pricing and constant speed). (6.RP.3b)
MA-6-9-7	Use ratios to convert measurement units. (6.RP.3d)
MA-6-9-8	Find the percentage of a quantity as a rate per 100 including finding the whole when given a part and the percent. (6.RP.3c)
MA-6-9-9	Plot pairs of values from a table on a coordinate graph. (6.RP.3a)
MA-6-9-10	Identify a unit rate associated with a ratio in the context of a ratio relationship (e.g., we paid $75 for 15 hamburgers, which is a rate of $5 per hamburger). (6.RP.2)

Outcome MA-6-10:
Students will summarize numerical data sets by reporting data into tables, describe how the data was measured, record the mean, median, mode, and range, and relate which choice of measure best describes the data.

MA-6-10-1	Summarize data sets by reporting the number of observations. (6.SP.5a)

MA-6-10-2	Describe how the data is measured including units of measurement. (6.SP.5b)
MA-6-10-3	Calculate the mean of a set of data. (6.SP.5c)
MA-6-10-4	Record the median of a set of data. (6.SP.5c)
MA-6-10-5	Identify the mode of a set of data. (6.SP.5c)
MA-6-10-6	Find the range of a set of data. (6.SP.5c)
MA-6-10-7	Relate the choice of measure (mean, median, mode, range) that best describes the data. (6.SP.5d)

Outcome MA-6-11:
Students will identify regular and irregular polygons, represent 3-dimensional figures using nets, use nets to find surface area, and draw polygons in a coordinate plane. Students will find volume of rectangular prisms, area of triangles, and area of special quadrilaterals.

MA-6-11-1	Identify and describe regular and irregular polygons. (6.G.1)
MA-6-11-2	Calculate the area of triangles. (6.G.1)
MA-6-11-3	Find the area of special quadrilaterals (e.g., trapezoids, parallelograms, rhombi) (6.G.1)
MA-6-11-4	Use nets to represent three dimensional figures. (6.G.4)
MA-6-11-5	Use nets to find surface area of three dimensional figures. (6.G.4)
MA-6-11-6	Draw polygons in a coordinate plane when given coordinates for vertices. (6.G.3)
MA-6-11-7	Use coordinates to find the length of side joining points. (6.G.3)
MA-6-11-8	Calculate volume of right rectangular prisms with and without fractional edges using both formulas (V=lwh) (V=Bh). (6.G.2)

Outcome MA-6-12:
Students will describe a statistical question as one that anticipates variability and illustrate that a set of data has a center, spread, and overall shape. Students will display data in plots on a number line including dot plots, box plots and histograms.

MA-6-12-1	Describe why a statistical question may generate variability. (6.SP.1)
MA-6-12-2	Illustrate that a set of data has a distribution described as a center (mean or median), spread (range), and overall shape (narrow, spread out, skewed). (6.SP.2)
MA-6-12-3	Calculate the mean for a numerical data set. (6.SP.3)
MA-6-12-4	Use the data to construct dot plots, box plots, and histograms on a number line. (6.SP.4)

Seventh Grade

7th Grade Mathematical Terms and Definitions

adjacent angle - Angles that share a vertex and a common side.

bias - A sample that does not fairly represent the whole population.

complimentary angles - Angles in which measures add up to 90 degrees.

compound event - An event focusing on more than one outcome *e.g. flipping a coin heads AND rolling a 4 on a dice.*

cross products - The two products after multiplying the diagonals of two ratios.

cross section - The two-dimensional shape resulting from "slicing" a three-dimensional shape along a certain axis.

degree - A unit of measure for angles recognizing that a circle has 360 degrees.

expand (an expression) - Applying the Distributive Property or factoring an expression to simplify or re-write an algebraic or numerical expression. *e.g. 3(x+2) = 3x + 3*2*

experimental probability - Developing a probability based on observed frequency. (Doing an experiment and keeping tallies each time an event occurs.)

inverse operations - Mathematical operations that "undo" another mathematical operation. *e.g. Subtracting 5 is the inverse operation of adding 5.*

like terms - Terms in an equation or expression that have the same variable and exponent.

measures of center - Measures used to show the middle of data (mean, median, mode)

population - The entire group of interest.

probability - The likelihood of an event occurring.

proportion - An equation stating that two ratios are equal.

sample - A part of a larger population.

sample space - All the possible outcomes of a chance event.

scale drawings - A real world model enlarged or shrunk by a constant factor.

similar figures - Same shape but not necessarily the same size. Enlarged or shrunk by a constant factor.

simple event - An event focusing on one outcome *e.g. flipping a coin heads up.*

supplementary angles - Angles in which measures add up to 180 degrees.

theoretical probability - Calculating a probability of a chance event based on number of possible outcomes.

unit rate - A rate given in terms of "per one".

variability - The inconsistency of data.

vertex - The point on an angle or polygon where two lines intersect.

vertical angles - A pair of angles that are opposite the intersection of two lines and are therefore congruent.

zero pair - Recognizing that a positive 1 combined with a negative 1 will "cancel" each other out and make 0.

ESSENTIAL STANDARDS: Please see details about each in the curriculum that follows.

1) Integer operations
2) Operations with rational numbers
3) Expressions with variables
4) Solving one and two step equations
5) Proportional reasoning (necessary vocab Unit rate, proportions, unit multiplier)
6) Statistics (make more specific)
7) Probability (make more specific)
8) Angle Relationships
9) Geometry

Outcome MA-7-1:
Students will apply the order of operations and properties of operations (Associative, Commutative, and Distributive) to simplify numerical and algebraic expressions involving both positive and negative rational numbers.

MA-7-1-1	Simplify multi-step expressions including factoring and expanding linear expressions. (7.EE.1)

MA-7-1-2	Illustrate and explain operations with positive and negative numbers including zero pairs and division of integers as a rational number. (7.NS.1a, 7.NS.1b, 7.NS.1c, 7.NS.2b)
MA-7-1-3	Represent real-world situations as expressions in simplest form (e.g., percent change problems). (7.NS.2b, 7.EE.2, 7.EE.3)
MA-7-1-4	Using the properties (Associative, Commutative, and Distributive), write equivalent algebraic expressions, identifying and combining like terms (e.g., a+0.05a=1.05a). (7.EE.2)

Outcome MA-7-2:
Students will compare, estimate, add, subtract, multiply and divide with rational numbers and apply these concepts to mathematical and real-world problems.

MA-7-2-1	Convert fractions to decimals to show equivalency. (7.NS.2d)
MA-7-2-2	Compare rational numbers in different forms.
MA-7-2-3	Apply estimation strategies to real world problems and to check the reasonableness of an answer. (7.NS.3, 7.EE.3)
MA-7-2-4	Add, subtract, multiply, and divide rational numbers. (7.NS.1d, 7.NS.2a, 7.NS.2c)
MA-7-2-5	Interpret and explain rational number operations in story problems. (7.NS.3)

Outcome MA-7-3:
Students will solve one and two step equations using inverse operations and fluently solve inequalities and represent them graphically.

MA-7-3-1	Use inverse operations in the appropriate order to solve one and two step equations. (7.EE.3)
MA-7-3-2	Create equations from story problems identifying and solving for a variable. (7.EE.3, 7.EE.4a, 7.EE.4b)
MA-7-3-3	Illustrate the difference between solutions of equations and inequalities graphically. (7.EE.4b)
MA-7-3-4	Determine whether real world situations can be represented as an equation or inequality. (7.EE.4a, 7.EE.4b)

Outcome MA-7-4:
Students will analyze, create, and solve ratios, rates, and proportions in mathematical and real world situations.

MA-7-4-1	Create ratios as a comparison of two numbers. (7.RP.1, 7.RP.2c)
MA-7-4-2	Explain the relationship in ratios and rates and create ratios and rates from story problems, identifying a unit rate when applicable. (7.RP.1, 7.RP.2b)

MA-7-4-3	Define, illustrate, and describe proportional relationships on a coordinate plane. (7.RP.1, 7.RP.2a, 7.RP.2b, 7.RB.2c, 7.RB.2d)
MA-7-4-4	Create and solve proportions involving percent and side lengths of similar figures and create scale drawings. (7.RP.1, 7.RP.3, 7.G.1)
MA-7-4-5	Create and solve equations involving percents, including percent change.

Outcome MA-7-5:
Students will use random sampling to collect data from populations and to draw inferences and make comparisons about the population(s) focusing on measures of center and variability.

MA-7-5-1	Classify samples as random or biased. (7.SP.1)
MA-7-5-2	Calculate mean, median, mode and range. (7.SP.3)
MA-7-5-3	Identify and analyze measures of center and variability for a population. (7.SP.2, 7.SP.3)
MA-7-5-4	Collect and analyze data to compare two populations. (7.SP.1, 7.SP.3, 7.SP.4)
MA-7-5-5	Use the data from the population(s) to draw inferences and make predictions. (7.SP.1, 7.SP.2, 7.SP.4)

Outcome MA-7-6:
Students will create and evaluate probability models for simple and compound chance events.

MA-7-6-1	Define and describe the probability of chance events.
MA-7-6-2	Create a probability model based on long-run relative frequency (experimental probability). (7.SP.6)
MA-7-6-3	Create a probability model to make predictions and compare and analyze observed frequency to explain any discrepancies. (7.SP.6, 7.SP.7a, 7.SP.8b, 7.SP.8c)
MA-7-6-4	Describe and illustrate probabilities as fractions of the sample space for simple and compound events. (7.SP.5, 7.SP.7a, 7.SP.8a, 7.SP.8b, 7.Sp.8c)

Outcome MA-7-7:
Students will apply formulas to calculate area, volume, and surface area of 2 and 3 dimensional figures involving triangles, quadrilaterals, polygons, cubes, right prisms, and circles in mathematical and real-world settings.

MA-7-7-1	Define circles and right prisms in mathematical terms.
MA-7-7-2	Define triangles, quadrilaterals, polygons, cubes, right prisms, and circles.
MA-7-7-3	Identify components of figures required for formulas and evaluate those formulas. (7.G.4)
MA-7-7-4	Create and solve real-world problems involving area, volume, and surface area of two and three dimensional figures.. (7.G.4, 7.G.6)

Outcome MA-7-8:
Students will create and solve problems involving complementary, supplementary, vertical, and adjacent angles.

MA-7-8-1	Define the terms complementary, supplementary, vertical, and adjacent.
MA-7-8-2	Identify and illustrate the characteristics of complementary, supplementary, vertical, and adjacent angles. (7.G.5)
MA-7-8-3	Write and solve one and two step equations to find unknown angles in a figure. (7.G.5)
MA-7-8-4	Create and solve real world problems involving complementary, supplementary, vertical, and adjacent angles. (7.G.5)

Outcome MA-7-9:
Students will construct geometric shapes with given conditions and identify two dimensional shapes resulting from cross sections of three-dimensional figures.

MA-7-9-1	Construct triangles using a protractor given three angle measurements. (7.G.2)
MA-7-9-2	Construct triangles given three specific side lengths. (7.G.2)
MA-7-9-3	Identify when the given conditions determine a unique triangle, multiple triangles or no triangle. (7.G.2)
MA-7-9-4	Identify the two dimensional shape resulting from a cross section of a three dimensional figure. (7.G.3)

Eighth Grade

8th Grade Mathematical Terms and Definitions

cone – a three dimensional figure with one vertex and a circular base

congruent – having the same shape and size

cylinder – a three-dimensional figure with two parallel, congruent circular bases

dilation – a transformation that enlarges or reduces a figure

domain – set of all possible input values of a function

elimination by linear combination – method of solving systems of linear equations by eliminating variables

exterior angles – angle created outside a polygon by extending one side

function – a relationship that has exactly one output for each input

hypotenuse – side opposite the right angle on a right triangle

image – a figure resulting from a transformation

infinite – an unlimited or immeasurable amount

intercept – point at which a line crosses an axis on the coordinate plane

Slope-intercept form – a linear equation in the form $y = mx + b$, where *m* is the slope and *b* is the *y*-

interior angles – angle inside a polygon

irrational – a number that cannot be expressed as a ratio of two integers or as a terminating or repeating decimal.

leg – one of the two sides forming the right angle in a right triangle

line of best fit – a straight line that comes closest to the points on a scatter plot

linear – having properties of or creating lines

non-function – any relation that fails to have exactly one output for each input

parallel – Lines in a plane that do not intersect

perfect squares – a square of a whole number

point-slope form – a linear equation in the form $y - y_1 = m(x - x_1)$, where *m* is the slope and (x_1, y_1) is a point on the line.

pre-image – figure prior to transformations being performed

radical – symbol used to indicate calculating the root of a number

range – set of all possible output values of a function

reflection – a transformation that flips a figure across a line

rotation – a transformation that spins a figure around a point

scatter plot – a graph with points showing relationship between two sets of data

scientific notation – a method of writing very large or very small numbers using powers of 10

slope – steepness of a line

solve literally – manipulate a formula to isolate a specified variable

sphere – three-dimensional figure with all points the same distance from the center

square root – one of two equal factors of a number

substitution – method of solving systems of linear equations by replacing variables

system of equations – a set of two or more equations containing two or more variables

table of values – a list of numbers for *x* and *y*

transformation – a change in the size or position of a figure

translation – a transformation that slides a figure along a straight line

transversal – a line intersecting two or more lines

two-way table – data organization that shows totals for the rows and columns

ESSENTIAL STANDARDS: Please see details about each in the curriculum that follows.

- Properties of exponents
- Rational and Irrational Numbers
- Pythagorean Theorem
- Similar and congruent figures
- Conversions/ Unit Rate
- Solving multi-step equations
- Linear and proportional functions
- Comparing lines
- Volume (cone, cylinder, pyramids)

Outcome MA-8-1:
Students will classify numbers as rational or irrational. Students will calculate rational approximations to estimate, locate on a number line, and compare irrational numbers.

MA-8-1-1	Define and identify perfect squares.
MA-8-1-2	Calculate square roots of perfect squares. (8.NS.1)
MA-8-1-3	Estimate irrational numbers by narrowing down rational numbers it is between. (8.NS.1, 8.NS.2)
MA-8-1-4	Plot rational approximations of irrational numbers on a number line. (8.NS.2)
MA-8-1-5	Compare two irrational numbers using >, =, <. (8.NS.2)

Outcome MA-8-2:
Students will solve multi-step equations and determine and justify the number of solutions for the equations. Students will solve an equation literally (for any given variable).

MA-8-2-1	Identify the parts of an equation (variable, constant, term, coefficient).
MA-8-2-2	Identify and combine like terms.
MA-8-2-3	Solve single step equations, including those with rational coefficients. (8.EE.7b)
MA-8-2-4	Solve multi-step equations including those with distribution. (8.EE.7b)
MA-8-2-5	Determine and justify the number of solutions in an equation based on the following results. (8.EE.7a) x=a – one solution a=a – infinitely many solutions a=b – no solutions
MA-8-2-6	Solve an equation or formula with multiple variables for any given variable.

Outcome MA-8-3:
Students will graph a linear function in slope-intercept form. Students will create an equation of a linear function from a graph or table of values. Students will create linear functions to model real world problems and restate the units of the slope to give its "real- world" meaning.

MA-8-3-1	Recite from memory slope-intercept form (e.g., y=mx+b). (8.F.3)
MA-8-3-2	Identify the key components (m & b) in the equation. (8.F.3)
MA-8-3-3	Graph a line from a slope-intercept equation. (8.F.3)
MA-8-3-4	Calculate the slope and intercept for an equation from a graph. (8.F.3, 8.EE.6)
MA-8-3-5	Derive the slope and intercept for an equation from a table of values. (8.F.3)
MA-8-3-6	Compose an equation to represent a real world problem. (8.F.3, 8.F.4)
MA-8-3-7	Distinguish the real world relation represented by a slope (e.g., miles per hour). (8.F.3, 8.F.5, 8.EE.5)
MA-8-3-8	Extension – Point-slope form.

Outcome MA-8-4:
Students will graphically and algebraically solve a system of equations including those in real-world problems. Students will determine how many solutions a system has by evaluating features of the equations. Students will verify that a solution satisfies both equations.

MA-8-4-1	Graph two linear equations to find a solution at the intersections, estimating if needed. (8.EE.8a, 8.EE.8c)
MA-8-4-2	Solve a system of equations using substitution. (8.EE.8b, 8.EE.8c)
MA-8-4-3	Solve a system of equations using elimination by linear combination. (8.EE.8b, 8.EE.8c)
MA-8-4-4	Classify two lines as being parallel, perpendicular, or intersecting based on their slopes. (8.EE.8a, 8.EE.8b)
MA-8-4-5	Determine number of solutions of a system based on their slopes – one, none, or infinitely many. (8.EE.8c)
MA-8-4-6	Verify a solution by evaluating it in both equations. (8.EE.8a, 8.EE.8c)

Outcome MA-8-5:
Students will define, identify and compare linear functions in various forms and verify functions by examining the domain and range.

MA-8-5-1	Define in their own words function, domain, and range. (8.F.1)
MA-8-5-2	Distinguish a function from a non-function in graph, table, equation and verbal form. (8.F.2)
MA-8-5-3	Compare features of functions presented in similar forms (e.g., intercepts, slopes, etc.). (8.F.3)

MA-8-5-4	Compare features of functions presented in different forms (e.g., tables, graphs, equations). (8.F.4)
MA-8-5-5	Examine relation of domain and range to verify or disprove a function. (8.F.2, 8.F.4)

Outcome MA-8-6:
Students will collect data to create a two-way table and create a scatter plot from that table. Students will construct a line of best fit to represent the data of a scatter plot and derive the linear function that produces the line of best fit.

MA-8-6-1	Collect data using a variety of methods. (8.SP.4)
MA-8-6-2	Organize data in a two-way table. (8.SP.4)
MA-8-6-3	Assign variables to data and plot on a coordinate plane. (8.SP.1)
MA-8-6-4	Determine the line of best fit for a scatter plot. (8.SP.2, 8.SP.3)
MA-8-6-5	Identify key elements of the line (slope, y-intercept, points). (8.SP.3)
MA-8-6-6	Formulate a linear function from key elements. (8.SP.3)

Outcome MA-8-7:
Students will create and solve equations involving squared and cubed variables. Students will apply properties of exponents to simplify expressions and perform operations on numbers written in scientific notation.

MA-8-7-1	Simplify exponent expressions using properties of exponents (product, quotient, power, zero, negatives). (8.EE.1)
MA-8-7-2	Create an equation with a variable squared or cubed from real world situations. (8.EE.2)
MA-8-7-3	Solve equations with a variable squared or cubed set equal to a positive rational number. (8.EE.2)
MA-8-7-4	Define scientific notation and use to estimate very large or very small numbers. (8.EE.3)
MA-8-7-5	Perform operations of two numbers written in scientific notation. (8.EE.4)
MA-8-7-6	Perform operations of a decimal and a number in scientific notation. (8.EE.4)

Outcome MA-8-8:
Students will explain the principles and uses of the Pythagorean Theorem and apply to find a missing side of a right triangle, the distance between two points on a coordinate plane and in real-world situations.

MA-8-8-1	Identify the parts of a right triangle as they pertain to Pythagorean Theorem. (8.G.6)
MA-8-8-2	Reproduce from memory the Pythagorean Theorem. (8.G.6)
MA-8-8-3	Explain the principles of the Pythagorean Theorem. (8.G.6)
MA-8-8-4	List possible uses of the Pythagorean Theorem. (8.G.6)
MA-8-8-5	Solve for an unknown hypotenuse of a right triangle. (8.G.7)

MA-8-8-6	Solve for an unknown leg of a right triangle using the Pythagorean Theorem. (8.G.7)
MA-8-8-7	Solve for an unknown side of a right triangle in a real-world problem. (8.G.7)
MA-8-8-8	Calculate distance between two points on a coordinate plane using the Pythagorean Theorem. (8.G.8)

Outcome MA-8-9:
Students will verify that two figures are congruent through a series of transformations and that two figures are similar through a series of dilations and transformations. Students will produce a figure on a coordinate plane described by a series of transformations and dilations.

MA-8-9-1	Identify congruent and similar figures.
MA-8-9-2	Define translations, reflections, and rotations.
MA-8-9-3	Perform translations, reflections and rotations on a figure. (8.G.1a, 8.G.1b, 8.G.1c)
MA-8-9-4	Create a similar figure when given a factor of dilation. (8.G.4)
MA-8-9-5	Given two congruent figures describe a series of transformations to align one with the other. (8.G.2, 8.G.3)
MA-8-9-6	Given two similar figures describe a series of dilations and transformations to align one with the other. (8.G.4)

Outcome MA-8-10:
Students will reproduce from memory and apply formulas for the volumes of cones, cylinders, and spheres to solve real-world problems.

MA-8-10-1	Reproduce from memory the formulas for the volume of a cone, cylinder, and sphere. (8.G.9)
MA-8-10-2	Identify all components required for a formula from a figure. (8.G.9)
MA-8-10-3	Identify all components required for a formula from a word problem. (8.G.9)
MA-8-10-4	Evaluate a formula applied to a real-world problem. (8.G.9)

Outcome MA-8-11

Students will describe and utilize angle relationships of polygons (interior and exterior angles) and parallel lines cut by a transversal. Students will identify similar triangles based on "angle-angle" criteria.

MA-8-11-1	Define and identify interior and exterior angles. (8.G.5)
MA-8-11-2	Describe relation of interior and exterior angles. (8.G.5)
MA-8-11-3	Derive and calculate formulas for sum of interior and exterior angles of a polygon by examining patterns. (8.G.5)

MA-8-11-4 Identify and describe all angle relationships created by cutting parallel lines by a transversal. (8.G.5)

MA-8-11-5 Calculate all angles created by cutting parallel lines by a transversal when given one angle measurement. (8.G.5)

MA-8-11-6 Identify similar triangles based on “angle-angle” criteria. (8.G.5)

Pre-Algebra

Pre-Algebra Mathematical Terms and Definitions

causation - determining if one data set creates or affects another data set

conditional event – an event that is affected by other events

correlation – description of the relationship between two data sets

independent event – an event not affected by any other event

mean – the sum of a data set divided by the number of items in that data set (average)

median – the middle number of an ordered data set

mode – the number(s) that occur most frequently in a data set

quartiles – three values that divide the data set into fourths

range – difference between the greatest and least value in a data set

tendencies – description of what a data set represents or projects

ESSENTIAL STANDARDS: Please see details about each in the curriculum that follows.

To be determined

Outcome MA-PA-1:

Students will collect and represent data using a variety of methods and infer future behavior based on observed tendencies. Students will compare features of two data sets and defend results mathematically.

MA-PA-1-1	Collect data using surveys. (S.IC.4)
MA-PA-1-2	Organize data using various methods including frequency tables. (S.ID.5, S.CP.4)
MA-PA-1-3	Calculate mean, median, mode, and range of a given set of data. (S.ID.2)
MA-PA-1-4	Calculate quartiles. (S.ID.1)
MA-PA-1-5	Create visual data representations from calculations. (S.ID.4)
MA-PA-1-6	Identify tendencies of given data. (S.IC.6, S.ID.3)
MA-PA-1-7	Project changes to calculations when introducing new values. (S.IC.6)
MA-PA-1-8	Describe and defend noted differences and similarities to two data sets. (S.IC.6, S.ID.3)

Outcome MA-PA-2:
Students will describe the purpose of surveys, experiments, and observational studies and make inferences based on the data including the consistency of the results to the generated model.

MA-PA-2-1	Describe and design surveys and experiments to collect data. (S.ID.4, S.CP.4, S.IC.3)
MA-PA-2-2	Describe correlation and causation. (S.ID.9)
MA-PA-2-3	Differentiate between correlation and causation. (S.IC.2, S.ID.9)
MA-PA-2-4	Identify and justify any discrepancies by comparing the consistency of a model and the data generated results. (S.IC.1, S.IC.5)
MA-PA-2-5	Make inferences about populations based on the data. (S.IC.1)

Outcome MA-PA-3:
Students will identify independent and conditional events, describe the relationship of such events, and calculate the probabilities both theoretically and experimentally.

MA-PA-3-1	List the properties of an independent event and a conditional event. (S.CP.1, S.CP.2, S.CP.3)
MA-PA-3-2	Identify an event as independent or conditional. (S.CP.1, S.CP.2, S.CP.3, S.CP.5)
MA-PA-3-3	Illustrate the probabilities of such events using lists and diagrams to show a sample space. (S.CP.4, S.CP.6, S.CP.7)
MA-PA-3-4	Calculate probabilities of independent and conditional events theoretically and experimentally. (S.CP.6, S.CP.7)

Outcome MA-PA-4:
Students will write and solve algebraic equations and inequalities with and variable from word statements and real world problems.

MA-PA-4-1	Evaluate algebraic expressions using substitution. (A.SSE.1)
MA-PA-4-2	Write algebraic expressions from word statements. (A.SSE.1)
MA-PA-4-3	Solve one and two step equations and inequalities and justify the solution method. (A.REI.1)
MA-PA-4-4	Solve multi-step equations and inequalities involving distribution, combining like terms and variables on both sides of the equation. (A.REI.3)
MA-PA-4-5	Rearrange formulas to highlight a quantity of interest using techniques used to solve equations (e.g., solve literal equations). (A.CED.4)
MA-PA-4-6	Evaluate formulas, write and solve real-world problems involving single variable equations and inequalities, and write solutions using appropriate units. (A.CED.1, A.REI.3, N.Q.1, N.Q.2, N.Q.3)

Outcome MA-PA-5:
Students will represent linear functions algebraically, graphically and in table form and convert from one form to another and use linear functions to solve real world problems.

MA-PA-5-1	Isolate the y-value in a linear equation, create a table of ordered pairs using substitution, graph the equation, and identify the line as the set of all solutions for the equation. (A.REI.10, F.IF.4, F.IF.7)
MA-PA-5-2	Define a linear function. (F.IF.1)
MA-PA-5-3	Analyze a table of values and identify the "add-add" pattern of linear functions. (F.IF.1, F.IF.6, F.IF.9, F.LE.1)
MA-PA-5-4	Identify the slope of a line from a table and graph. (F.IF.6)
MA-PA-5-5	Graph linear equations using intercepts. (F.IF.4, F.IF.7)
MA-PA-5-6	Graph linear equations written in slope-intercept form using the slope and y-intercept. (F.IF.4, F.IF.7)
MA-PA-5-7	Graph linear equations written in point-slope form. (F.IF.4, F.IF.7)
MA-PA-5-8	Write the equation of a line from a description or a graph. (F.IF.4, F.IF.7)
MA-PA-5-9	Identify the slopes of parallel and perpendicular lines and write equations for parallel and perpendicular lines from a description or graph. (F.IF.9)
MA-PA-5-10	Write and solve real world problems involving linear functions, identify the independent and dependent variables, write the function using function notation, identify a reasonable domain for the function, choose an appropriate scale and graph the solution. (A.CED.2, A.CED.3, F.IF.2, F.IF.5, F.IF.7, F.LE.1, N.Q.1, N.Q.2, N.Q.3)
MA-PA-5-11	Create a scatterplot and estimate the line-of-best-fit (regression line) then make predictions based on the data. (S.ID.6, S.ID.7)
MA-PA-5-12	Create a scatterplot, use a calculator to generate the equation of the regression line, graph the line on the scatterplot and interpret the correlation coefficient. (S.ID.8, S.ID.9)

Outcome MA-PA-6:
Students will classify numbers as rational or irrational. Students will calculate rational approximations to estimate, locate on a number line, and compare irrational numbers.

MA-PA-6-1	Define and identify perfect squares.
MA-PA-6-2	Calculate square roots of perfect squares. (8.NS.1)
MA-PA-6-3	Estimate irrational numbers by narrowing down rational numbers it is between. (8.NS.1, 8.NS.2)
MA-PA-6-4	Plot rational approximations of irrational numbers on a number line. (8.NS.2)
MA-PA-6-5	Compare two irrational numbers using >, =, <. (8.NS.2)

Outcome MA-PA-7:
Students will create and solve equations involving squared and cubed variables. Students will apply properties of exponents to simplify expressions and perform operations on numbers written in scientific notation.

MA-PA-7-1	Simplify exponent expressions. (8.EE.1)
MA-PA-7-2	Create an equation with a variable squared or cubed from real world situations. (8.EE.2)
MA-PA-7-3	Solve equations with a variable squared or cubed set equal to a positive rational number. (8.EE.2)
MA-PA-7-4	Define scientific notation and use to estimate very large or very small numbers. (8.EE.3)
MA-PA-7-5	Perform operations of two numbers written in scientific notation. (8.EE.4)
MA-PA-7-6	Perform operations of a decimal and a number in scientific notation. (8.EE.4)

Outcome MA-PA-8:
Students will explain the principles and uses of the Pythagorean Theorem and apply to find a missing side of a right triangle, the distance between two points on a coordinate plane and in real-world situations.

MA-PA-8-1	Identify the parts of a right triangle as they pertain to Pythagorean Theorem. (8.G.6)
MA-PA-8-2	Reproduce from memory the Pythagorean Theorem. (8.G.6)
MA-PA-8-3	Explain the principles of the Pythagorean Theorem. (8.G.6)
MA-PA-8-4	List possible uses of the Pythagorean Theorem. (8.G.6)
MA-PA-8-5	Solve for an unknown hypotenuse of a right triangle. (8.G.7)
MA-PA-8-6	Solve for an unknown leg of a right triangle using the Pythagorean Theorem. (8.G.7)
MA-PA-8-7	Solve for an unknown side of a right triangle in a real-world problem. (8.G.7)
MA-PA-8-8	Calculate distance between two points on a coordinate plane using the Pythagorean Theorem. (8.G.8)

Outcome MA-PA-9:
Students will define, identify and compare linear functions in various forms and verify functions by examining the domain and range.

MA-PA-9-1	Define in their own words function, domain, and range. (8.F.1)
MA-PA-9-2	Distinguish a function from a non-function in graph, table, equation and verbal form. (8.F.2)
MA-PA-9-3	Compare features of functions presented in similar forms (e.g., intercepts, slopes, etc.). (8.F.3)
MA-PA-9-4	Compare features of functions presented in different forms (e.g., tables, graphs, equations). (8.F.4)

MA-PA-9-5 Examine relation of domain and range to verify or disprove a function. (8.F.2, 8.F.4)

Outcome MA-PA-10:
Students will graphically and algebraically solve a system of equations including those in real-world problems. Students will determine how many solutions a system has by evaluating features of the equations. Students will verify that a solution satisfies both equations.

MA-PA-10-1 Graph two linear equations to find a solution at the intersections, estimating if needed. (8.EE.8a, 8.EE.8c)
MA-PA-10-2 Solve a system of equations using substitution. (8.EE.8b, 8.EE.8c)
MA-PA-10-3 Solve a system of equations using elimination by linear combination. (8.EE.8b, 8.EE.8c)
MA-PA-10-4 Classify two lines as being parallel, perpendicular, or intersecting based on their slopes. (8.EE.8a, 8.EE.8b)
MA-PA-10-5 Determine number of solutions of a system based on their slopes – one, none, or infinitely many. (8.EE.8c)
MA-PA-10-6 Verify a solution by evaluating it in both equations. (8.EE.8a, 8.EE.8c)

Outcome MA-PA-11:
Students will graph a linear function in slope-intercept form. Students will create an equation of a linear function from a graph or table of values. Students will create linear functions to model real world problems and restate the units of the slope to give its "real world" meaning.

MA-PA-11-1 Recite from memory slope-intercept form, y=mx+b. (8.F.3)
MA-PA-11-2 Identify the key components (m & b) in the equation. (8.F.3)
MA-PA-11-3 Graph a line from a slope-intercept equation. (8.F.3)
MA-PA-11-4 Calculate the slope and intercept for an equation from a graph. (8.F.3, 8.EE.6)
MA-PA-11-5 Derive the slope and intercept for an equation from table of values. (8.F.3)
MA-PA-11-6 Compose an equation to represent a real world problem. (8.F.3, 8.F.4)
MA-PA-11-7 Distinguish the real world relation represented by a slope. (8.F.3, 8.F.5, 8.EE.5)
MA-PA-11-8 Extension – Point-slope form.

Outcome MA-PA-12:
Students will solve multi-step equations, also determine and justify the number of solutions for the equations. Students will solve an equation literally (for any given variable).

MA-PA-12-1 Identify the parts of an equation (variable, constant, term, coefficient).
MA-PA-12-2 Identify and combine like terms.
MA-PA-12-3 Solve single step equations, including those with rational coefficients. (8.EE.7b)

MA-PA-12-4 Solve multi-step equations including those with distribution. (8.EE.7b)

MA-PA-12-5 Determine and justify the number of solutions (8.EE.7a)

- x=a – one solution
- a=a – infinitely many solutions
- a=b – no solutions

MA-PA-12-6 Solve an equation/formula with multiple variables for any given variable.

Algebra I

NOTE:
To encourage an accelerated path for students who might be interested, Algebra I may be taken as an 8th grader if the student meets the following requirements:

- an A in Math 7 both semesters
- two of the three following requirements:
  - 240 or above on the Spring MAP
  - 730 or above on the current year's PAWS
  - 75% or better on the 8th grade math assessment

Algebra I Mathematical Terms and Definitions

conjugates – two binomials in which the terms are equivalent but the signs of the second term are opposite (x+3) (x-3)

correlation coefficient – a calculated value between -1 and 1 that tells whether there is a significant linear relationship between two variables. -1 and 1 show perfect correlation meaning all the data points lie in a line. 0 shows that there is no relationship between the variables.

decreasing – as x increases, y decreases (negative slope)

dependent variable

explicit sequence – the specific order is described by a constant difference or constant ratio between terms.

increasing – as x increases, y also increases (positive slope)

independent variable

interval

polynomial

quadratic

recursive sequence – combinations of pervious terms create the next term

regression line – a "line of best fit", a specific line through a set of data points that minimizes the sum of the distances from each data point to the line

sequence – a set of numbers in which the numbers have a specific order

zeros (of a function)

ESSENTIAL STANDARDS: Please see details about each in the curriculum that follows.

- Basic polynomial operations
- Factoring quadratics
- Solving linear equations
- Exponent properties
- Working with radicals (with rational exponents)
- Graphing linear equations and inequalities
- Solving systems of linear equations
- Solving quadratics

Outcome MA-AI-1:
Students will evaluate formulas, write single variable equations and inequalities to solve real-world problems, and express solutions using appropriate units.

MA-AI-1-1	Evaluate algebraic expressions using substitution. (A.SSE.1)
MA-AI-1-2	Write algebraic expressions from word statements. (A.SSE.1)
MA-AI-1-3	Solve one and two step equations and inequalities and justify the solution method. (A.REI.1)
MA-AI-1-4	Solve multi-step equations and inequalities involving distribution, combining like terms and variables on both sides of the equation. (A.REI.3)
MA-AI-1-5	Rearrange formulas to highlight a quantity of interest using techniques used to solve equations (e.g., solve literal equations). (A.CED.4)
MA-AI-1-6	Evaluate formulas, write and solve real-world problems involving single variable equations and inequalities, and write solutions using appropriate units. (A.CED.1, A.REI.3, N.Q.1, N.Q.2, N.Q.3)

Outcome MA-AI-2:
Students will define a function, identify the domain and range, evaluate functions written in function notation, and identify sequences as functions and graph sequences.

MA-AI-2-1	Define a function. (F.IF.1)
MA-AI-2-2	Identify the domain and range of a function. (F.IF.1)
MA-AI-2-3	Identify the graph of a function using the vertical line test. (F.IF.1)
MA-AI-2-4	Sketch the graph of a function from a description and given the graph of a function. State the domain for which the function is increasing or decreasing. (F.IF.4)
MA-AI-2-5	Evaluate functions with domains written in function notation. (F.IF.2)
MA-AI-2-6	Given a sequence, identify the domain as a subset of integers and the range as the term value of the sequence, graph the order pairs (include

explicit sequences and sequences determined recursively, e.g., the Fibonacci sequence). (F.IF.3)

Outcome MA-AI-3:
Students will represent linear functions algebraically, graphically and in table form and convert from one form to another and use linear functions to solve real world problems.

MA-AI-3-1	Isolate the y-value in a linear equation, create a table of ordered pairs using substitution, graph the equation, and identify the line as the set of all solutions for the equation. (A.REI.10, F.IF.4, F.IF.7)
MA-AI-3-2	Define a linear function. (F.IF.1)
MA-AI-3-3	Analyze a table of values and identify the "add-add" pattern of linear functions. (F.IF.1, F.IF.6, F.IF.9, F.LE.1)
MA-AI-3-4	Identify the slope of a line from a table and graph. (F.IF.6)
MA-AI-3-5	Graph linear equations using intercepts. (F.IF.4, F.IF.7)
MA-AI-3-6	Graph linear equations written in slope-intercept form using the slope and y-intercept. (F.IF.4, F.IF.7)
MA-AI-3-7	Graph linear equations written in point-slope form. (F.IF.4, F.IF.7)
MA-AI-3-8	Write the equation of a line from a description or a graph. (F.IF.4, F.IF.7)
MA-AI-3-9	Identify the slopes of parallel and perpendicular lines and write equations for parallel and perpendicular lines from a description or graph. (F.IF.9)
MA-AI-3-10	Write and solve real world problems involving linear functions, identify the independent and dependent variables, write the function using function notation, identify a reasonable domain for the function, choose an appropriate scale and graph the solution. (A.CED.2, A.CED.3, F.IF.2, F.IF.5, F.IF.7, F.LE.1, N.Q.1, N.Q.2, N.Q.3)
MA-AI-3-11	Create a scatterplot and estimate the line-of-best-fit (regression line) then make predictions based on the data. (S.ID.6, S.ID.7)
MA-AI-3-12	Create a scatterplot, use a calculator to generate the equation of the regression line, graph the line on the scatterplot and interpret the correlation coefficient. (S.ID.8, S.ID.9)

Outcome MA-AI-4:
Students will write and solve systems of linear equations with two variables and use them to solve real-world problems.

MA-AI-4-1	Graph systems of linear equations (by hand and using technology) and explain why the point of intersection is the solution. (A.CED.3, A.REI.6, A.REI.11)
MA-AI-4-2	Solve systems of linear equations by substitution. (A.CED.3, A.REI.6)
MA-AI-4-3	Solve systems of linear equations by elimination. (A.CED.3, A.REI.5, A.REI.6)
MA-AI-4-4	Write and solve systems of linear equations from real-world problems. (A.CED.3, A.REI.6, N.Q.1, N.Q.2, N.Q.3)

Outcome MA-AI-5:
Students will write and solve linear inequalities and systems of linear inequalities and use them to solve real world problems.

MA-AI-5-1	Graph linear inequalities (by hand and using technology) and identify the solution as a region above or below the line and including or not including the line. (A.CED.3, A.REI.12)
MA-AI-5-2	Graph systems of linear inequalities (by hand and using technology) and identify the solution as a region where the individual inequalities overlap. (A.CED.3, A.REI.12)
MA-AI-5-3	Write linear inequalities and systems of linear inequalities and use them to solve real world problems. (A.CED.3, A.REI.12, N.Q.1, N.Q.2, N.Q.3)

Outcome MA-AI-6:
Students will classify polynomials, add, subtract, multiply polynomials, and solve real-world problems involving polynomials.

MA-AI-6-1	Simplify algebraic expressions using the properties of exponents. (N.RN.1, A.SSE.3, F.IF.8)
MA-AI-6-2	Simplify higher order radicals and numeric & algebraic expressions with rational exponents of the form $x^{\frac{1}{n}}$ by rewriting the expressions as radicals. (N.RN.2)
MA-AI-6-3	Identify coefficients, factors and terms in polynomials. (A.SSE.1)
MA-AI-6-4	Classify polynomials by degree and number of terms. (A.SSE.1)
MA-AI-6-5	Add polynomials. (A.APR.1)
MA-AI-6-6	Subtract polynomials. (A.APR.1)
MA-AI-6-7	Multiply two binomials. (A.APR.1)
MA-AI-6-8	Multiply a binomial and a trinomial. (A.APR.1)
MA-AI-6-9	Multiply three binomials. (A.APR.1)
MA-AI-6-10	Square a binomial and identify the pattern in the resulting trinomial. (A.APR.1)

Outcome MA-AI-7:
Students will factor quadratic expressions to produce an equivalent form of the expression in order to reveal properties of that expression.

MA-AI-7-1	Identify and factor out the greatest common factor from an algebraic expression. (A.SSE.3)
MA-AI-7-2	Factor quadratic trinomials with a leading coefficient of 1 and a positive last term. (A.SSE.3)
MA-AI-7-3	Factor quadratic trinomials with leading coefficient of 1 and a negative last term. (A.SSE.3)

MA-AI-7-4 Factor quadratic trinomials with leading coefficient not equal to 1 by inspection. (A.SSE.3)

MA-AI-7-5 Identify conjugate binomials and factor the difference of two squares, including more complex problems like $x^4 - y^4$. (A.SSE.3)

MA-AI-7-6 Factor trinomial squares which result in factors that are squared binomials. (A.SSE.3)

MA-AI-7-7 Factor by grouping. (A.SSE.3)

Outcome MA-AI-8:
Students will simplify radical expressions, solve quadratic equations by factoring, completing the square, and using the quadratic formula, solve vertical motion problems and graph quadratics written in standard form.

MA-AI-8-1 Simplify radical expressions (square-roots). (A.SSE.2)

MA-AI-8-2 Solve quadratic equations by factoring. (A.SSE.3)

MA-AI-8-3 Solve quadratic equations using the square-root property. (A.REI.4)

MA-AI-8-4 Solve quadratic equations by completing the square. (A.SSE.3, A.REI.4)

MA-AI-8-5 Solve quadratic equations using the quadratic formula and solve real-world problems using the quadratic formula (e.g., rectangle problems). (A.REI.4)

MA-AI-8-6 Reproduce from memory the quadratic formula. (A.REI.4)

MA-AI-8-7 Solve and sketch graphs for vertical motion problems, analyze the properties of the graphs to show zeros, symmetries and extreme values. (F.IF.4)

MA-AI-8-8 Graph quadratic functions written in standard form ($x^2 - bx + c = 0$), using $x = \frac{-b}{2a}$ to identify the vertex, plot the y-intercept and symmetric point, explain the symmetries, locate the zeros and identify the maximum or minimum. (F.IF.7)

Outcome MA-AI-9:
Students will simplify expressions using the properties of exponents, compare linear and exponential functions using tables and graphs, identify situations that are modeled by linear and exponential functions, and evaluate real-world problems involving exponential growth and decay.

MA-AI-9-1 Compare tables of values and identify the “add-add” pattern of linear functions vs. the “add-multiply” pattern of exponential functions. (F.LE.1)

MA-AI-9-2 Construct and compare tables and graphs of linear and exponential functions derived from arithmetic and geometric sequences and show the exponential function will eventually exceed the linear function. (F.IF.7, F.LE.2, F.LE.3)

MA-AI-9-3 Given a written description, identify the situation as linear or exponential. (F.LE.1)

MA-AI-9-4 Evaluate real world problems involving exponential growth and decay. (F.LE.1)

Outcome MA-AI-10:
Students will solve absolute value equations and inequalities and compound inequalities.

MA-AI-10-1 Solve one & two step absolute value equations. (A.CED.1, A.REI.1)

MA-AI-10-2 Solve and graph compound inequalities. (A.CED.1, A.REI.3)

MA-AI-10-3 Solve and graph absolute value inequalities. (A.CED.1, A.REI.1)

Algebra II

Algebra II Mathematical Terms and Definitions

asymptote – a line which a graph gets closer to but never touches

cosine – ratio of the side adjacent to an angle and the hypotenuse

discontinuity – a point in the domain that has no corresponding point in the range

imaginary number – square root of a negative real number

logarithm – the power to which it is necessary to raise a base number to produce a desired number

matrix – a rectangular array of numbers used to represent sets of values

sine – ratio of the side opposite an angle and the hypotenuse

tangent – ratio of the side opposite an angle and the leg adjacent that angle

trigonometry – deals with the relationship of sides and angles of triangles

ESSENTIAL STANDARDS: Please see details about each in the curriculum that follows.

- Factoring (Quadratics, Sum and Difference of Curves, Grouping)
- Solve Quadratic Equations
- Graphing Quadratic Functions
- Solving Absolute Value Equations/Inequalities
- Solving Radical Equations
- Trig (Unit Circle)
- 3x3 Systems (elimination and ref/rref)
- Solving exponential equations
- Rational Expressions (simplify, multiply, divide, add, subtract)
- Add/Subtract Radicals

Outcome MA-AII-1:
Students will create and solve single linear equations and inequalities, including those created from real-world problems. Students will solve radical and absolute value equations. Students will solve formulas for any variable.

MA-AII-1-1	Solve multi-step linear equations. (A.SSE.1, A.REI.1, A.REI.3)
MA-AII-1-2	Solve compound linear inequalities. (A.REI.3)

MA-AII-1-3 Solve multi-step absolute value equations. (A.REI.3)
MA-AII-1-4 Solve multi-step radical equations. (A.REI.2)
MA-AII-1-5 Solve linear equations and inequalities created from real-world problems. (A.CED.1, A.CED.2)
MA-AII-1-6 Solve a formula for a given variable. (A.CED.4)

Outcome MA-AII-2:
Students will graphically and algebraically solve multiple linear equations and inequalities including those created from real-world problems. Students will graphically and algebraically solve a system containing a linear and non-linear equation.

MA-AII-2-1 Solve systems of two linear equations by graphing, substitution, and elimination by linear combination. (A.REI.5, A.REI.6, A.REI.10, A.REI.11, F.LE.1b)
MA-AII-2-2 Solve systems of two or three linear equations by elimination and matrices. (A.REI.8, A.REI.9)
MA-AII-2-3 Create systems of linear equations and inequalities from real-world problems. (A.REI.6)
MA-AII-2-4 Solve real-world problems by graphing systems of linear equations and inequalities. (A.REI.10, A.REI.12, F.IF.4, F.IF.5, F.IF.6, F.IF.7a, F.LE.1b)
MA-AII-2-5 Solve a system of equations involving a linear equation and a non-linear equation. (A.REI.7, A.REI.11, F.IF.7a, F.LE.1a)
MA-AII-2-6 Verify a solution to a system within constraints of the equations or inequalities. (A.CED.3)

Outcome MA-AII-3:
Students will graph, evaluate, and solve quadratic equations including those created from real-world problems.

MA-AII-3-1 Reproduce from memory the general form of a quadratic equation
MA-AII-3-2 Describe features of the graph of a quadratic equation from the general form. (F.IF.8a, F.IF.9
a – determines the amplitude and direction
c – y-intercept
Symmetric about vertex
MA-AII-3-3 Evaluate a quadratic equation when given an *x* value.
MA-AII-3-4 Reproduce from memory the vertex form of a quadratic equation.
MA-AII-3-5 Transform between general and vertex form of a quadratic equation. (A.SSE.2, A.SSE.3b, A.REI.4a)
MA-AII-3-6 Describe transformations of the parent graph from a given equation in vertex form. (F.IF.7c, F.BF.3)
MA-AII-3-7 Identify and simplify imaginary numbers. (N.CN.2)
MA-AII-3-8 Solve a quadratic equation when given a *y* value. (N.CN.1, N.CN.2, N.CN.7, A.SSE.3a, A.REI.4a, A.REI.4b)

MA-AII-3-9 Create a quadratic equation when given points or a table of values. (F.IF.4, A.SSE.4)

MA-AII-3-10 Graph, evaluate, and solve quadratic equations including those created from real world problems. (F.IF.4, F.IF.7c, N.CN.1, N.CN.2, N.CN.7, A.SSE.3a, A.SSE.4, A.REI.4a, A.REI.4b)

Outcome MA-AII-4:
Students will apply laws of exponents to simplify expressions and evaluate logarithms. Students will graph, evaluate, and solve exponential functions in real world situations using logarithms.

MA-AII-4-1 Apply laws of exponential functions in simplifying expressions with exponents. (N.CN.1, N.CN.2, A.SSE.3c)

MA-AII-4-2 Apply properties of logs to evaluate larger logs (e.g., log3+log5=log15)

MA-AII-4-3 Identify exponential growth and decay graphs. (F.LE.1c)

MA-AII-4-4 Graph exponential functions, noting how the equation affects the transformation. (F.IF.7e, A.REI.11)

MA-AII-4-5 Evaluate exponential functions. (F.BF.1b)

MA-AII-4-6 Create an exponential equation from a table of values or real-world situation. (F.BF.1b, A.SSE.4)

MA-AII-4-7 Solve exponential functions using logarithms in real-world situations. (F.LE.4, A.REI.11)

Outcome MA-AII-5:
Students will factor, graph and solve polynomial functions.

MA-AII-5-1 Factor polynomials using a variety of methods. (A.SSE.3a, A. SSE.3b, A.SSE.3c)

MA-AII-5-2 Find zeros algebraically from factorizations. (A.APR.2)

MA-AII-5-3 Graph zeros of a polynomial function. (A.APR.3)

MA-AII-5-4 Describe behavior of graphs in intervals defined by zeros. (A.APR.3)

MA-AII-5-5 Graph a polynomial function. (F.IF.7c)

Outcome MA-AII-6
Students will simplify, evaluate, and solve rational functions. Students will identify and verify extraneous solutions, describe these features on a graph and graph rational functions.

MA-AII-6-1 Factor polynomials. (A.APR.2)

MA-AII-6-2 Reduce rational expressions by factoring. (A.APR.6)

MA-AII-6-3 Simplify rational expression by reducing and combining. (A.APR.6)

MA-AII-6-4 Solve simplified equations for all values. (A.APR.2, A.APR.3, A.REI.2)

MA-AII-6-5 Identify and verify extraneous solutions. (A.REI.2)

MA-AII-6-6 Describe features of the graph including asymptotes and removable discontinuities. (A.APR.3, F.IF.7d)

MA-AII-6-7 Graph rational functions. (F.IF.7c, F.IF.7d)

Outcome MA-AII-7:
Students will add, subtract, multiply, divide and simplify numeric expressions containing radicals, solve radical equations, and real-world variation problems in which on variable is proportional to a non-integer power of another variable.

MA-AII-7-1	Rationalize denominators containing radicals.
MA-AII-7-2	Add, subtract, multiply, divide and simplify numeric expressions containing radicals. (N.RN.2)
MA-AII-7-3	Solve radical equations, eliminate extraneous solutions, and write the solution set. (A.REI.2)
MA-AII-7-4	Solve real-world variation problems in which one variable is proportional to a non-integer power of another variable. (A.REI.2)

Outcome MA-AII-8:
Students will relate angles on a unit circle to reference angles and calculate trigonometric ratios of those angles, prove and apply the Pythagorean identity to find trigonometric ratios, and choose an equation to represent a given trigonometric graph.

MA-AII-8-1	Reproduce trigonometric ratios. (G.SRT.6, G.SRT.7)
MA-AII-8-2	Create a reference table from a unit circle. (F.TF.1, F.TF.2)
MA-AII-8-3	Calculate reference angles. (F.TF.2)
MA-AII-8-4	Calculate trigonometric ratios using a reference table. (F.TF.2, F.TF.3, G.SRT.7, G.SRT.8)
MA-AII-8-5	Prove the Pythagorean identity. (F.TF.8)
MA-AII-8-6	Calculate trigonometric ratios using Pythagorean identities. (F.TF.8)
MA-AII-8-7	Graph trigonometric functions. (F.TF.5)
MA-AII-8-8	Perform transformations on trigonometric graphs. (F.TF.5)
MA-AII-8-9	Create an equation from a trigonometric graph. (F.TF.5)

Geometry

Geometry Mathematical Terms and Definitions

altitude - a segment whose endpoints are from the vertex/plane of the base perpendicular to the other base

angle of depression - the angle formed by the horizontal line and a line of sight to a point below

angle of elevation - The angle formed by the horizontal line and the line of sight to a point above

apothem - the perpendicular distance from the center of a regular polygon to a side of the polygon

arc - any unbroken part of the circumference of a circle or other curved line

auxiliary line - a line drawn in a figure to aid in a proof

between - given the three point A,b, and C, B is between A and C if and only if all three of the points lie on the same line, and AB + BC = AC

bi-conditional statement - a statement that can be written in form "p if and only if q"

bisector - a line or plane that bisects an angle or line segment

central angle - an angle formed at the center of a circle by two radii

centroid - the point of concurrency of the three medians of a triangle(center of gravity)

chord - the line segment between two points on a given curve

circumcenter - the point of concurrency of the three perpendicular bisectors of a triangle

circumscribed polygon - each side of the polygon is tangent to the circle

collinear - lying in the same straight line

composite figure - a plane figure made up of other plane figure such as semi-circles, triangles, rectangles, inc…

concentric circles - circles the share the same center

conclusion - the part of the conditional statement following the word then
concurrent - three or more lines that intersect in one point

conjecture - a statement that is believed to be true

contrapositive - a conditional statement derived from another by negating and interchanging antecedent and consequent

concave polygon - a polygon such that there is a straight line that cuts it in four or more points

converse - a statement that is formed by exchanging the hypothesis and conclusion

convex polygon - a polygon such that no side extended cuts any other side or vertex; it can be cut by a straight line in at most two points

coplanar - being or operating in the same plane

corollary - a theorem whose proof follows direction from another proof

counter-example - an example that refutes an assertion or claim

deductive reasoning - the process of using logic to draw conclusions

diagonal

direction - the orientation of the vector, which is determined by the angle the vector makes with the horizontal line

edge - a segment that is formed by the intersection of two faces of a three dimensional object

extremes - in the proportion a/b=c/d; a and d are the extremes

face - a flat surface of a polyhedron

geometric mean - for positive numbers a and b, the positive number x such that a/x=x/b

geometric probability - a form of theoretical probability determined by a ratio of geometric measurers such as lengths, areas or volumes

hemisphere - half of a sphere

horizon - the horizontal line in a perspective drawing that contains the vanishing point

hypothesis - the part of the conditional statement following the word if

in-center - the point of concurrency of the three angle bisectors of a triangle

include side - the side between two angles

included angle - an angle formed by to adjacent sides of a polygon

indirect proof - a proof in which the statement to be proved is assumed to be false and a contradiction is shown

inductive reasoning - the process of reasoning that a rule or statement is true because specific cases are true

intercepted arc - an arc that consists of endpoints that lie on the sides of an inscribed angle and all the points of the circle between a common vertex

inscribe angle - an angle whose vertex is on the circle and whose sides contain chords or the circle

inscribed circle - a circle in which each side of a polygon is tangent to the circle

isometry - a transformation that does not change the size or shape of the figure

lateral face - the face of the prism or pyramid that is not the base

legs of a trapezoid - The two non-parallel sides of a trapezoid

linear pair - two angles that are adjacent and supplementary

locus - a set of points that satisfies a given condition

magnitude - the length of the vector, written

major arc - an arc of a circle whose points are on or in the exterior of a central angle

means - in the proportion a/b=c/d; b and c are the means

median of triangle - a segment whose endpoints are the vertex of the triangle and the midpoint of the opposite side

minor arc - an arc of a circle whose points are on or in the interior of a central angle

mid-segment of a triangle/trapezoid - a segment whose endpoints are the midpoints of two sides/legs of the figure

midpoint - a point equidistant from, both ends, as of a line, line segment the midpoint of a boundary.

negation - the absence or opposite of something that is actual, positive, or affirmative: (p) and it's opposite (*~p)*

oblique prism - a prism that has at least one nonrectangular lateral face

opposite rays - two rays with a common endpoint that form a straight line

orthocenter of triangle - the point of concurrency of the three altitudes of the triangle

orthographic drawing - a drawing that shows a three-dimensional object in which the line of sight for each view is perpendicular to the plane of the picture

perspective drawing - a drawing in which non-vertical parallel lines meet at a point called the vanishing point

polyhedron - a closed three-dimensional figure formed by four or more polygons that intersect at the edges

postulate - something taken as self-evident or assumed without proof as a basis for reasoning

proof - an argument that uses logic to show that a conclusion is true

regular polygon - a polygon that is both equilateral and equiangular

remote interior angle - an interior angle that is not adjacent to the exterior angle

resultant vector - the vector the represents the sum of two given vectors

secant segment - a segment of a secant with at least one endpoint on the circle

sector - a plane figure bounded by two radii and the included arc of a circle

slant height - the distance from the vertex of a regular pyramid to the midpoint of and edge of the base

subtend - to extend under or be opposite to: *a chord subtending an arc*

tangent segment - a segment of a tangent with one endpoint on the circle

theorem - a statement or formula that can be deduced from the axioms of a formal system by means of its rules of inference, a statement that is proven

truth value – a statement can have a truth value of true(T) or false(F)

undefined - a basic figure that is not defined in terms of other figures, examples; points, lines, and planes

vanishing point - In a perspective drawing, a point on the horizontal line where parallel lines appear to meet

vector - a quantity that has both magnitude and direction

ESSENTIAL STANDARDS: Please see details about each in the curriculum that follows.

To be determined

Outcome MA-G-1:

Students will define Euclidean facts and notation of points, lines, and planes, construct two dimensional shapes using straight edge and compass, and measure and calculate segments and angles on a two dimensional plane.

MA-G-1-1	Define undefined terms, postulate, axioms, and the rules of geometric notation. (G.CO.1)
MA-G-1-2	Define Euclidean points, lines, planes, and congruents. (G.CO.1)
MA-G-1-3	Measure and construct segments & segment bisectors. (G.CO.12)
MA-G-1-4	Measure and construct angles & angle bisectors. (G.CO.12)
MA-G-1-5	Construct and measure arcs of angles; adjacent, linear, supplementary, and complementary. (G.CO.12)
MA-G-1-6	Solve using formulas in geometry; area of rectangles, triangle, and circle. (G.C.5)
MA-G-1-7	Define perimeter of two dimensional shapes; polygons and circles. (G.C.5)
MA-G-1-8	Solve using midpoint and distance formula from measurements on the coordinate plane. (G.CO.1, G.CO.9)
MA-G-1-9	Determine transformation; translation, rotation reflection, and dilation of two dimensional shapes on coordinate plane. (G.CO.2, G.CO.3, G.CO.4, G.CO.5)

Outcome MA-G-2:
Students will define and use inductive and deductive reasoning, write Algebraic and Geometric proofs, and dissect symbolic logic.

MA-G-2-1	Use inductive reasoning to make conjectures. (G.CO.9)
MA-G-2-2	Produce conditional statements: -Define notation of conditional statements -Define hypothesis and conclusion (if lower case p, then lower case q) -Define types of conditional statements (G.CO.9)

MA-G-2-3	Use deductive reasoning to verify conjectures, determine a truth value, and produce the negation of a statement. (G.CO.9)
MA-G-2-4	Diagnose bi-conditional statements (if and only if statement). (G.CO.9)
MA-G-2-5	Compile algebraic proofs, define properties of equality and properties of congruence. (G.CO.9)
MA-G-2-6	Compile geometric proofs; using a two column proof, a paragraph proof, and a flow chart proof. (G.CO.9)
MA-G-2-7	Define conjunctions and disjunctions. (G.CO.9)
MA-G-2-8	Produce sound conclusions using symbolic logic and define the types of compound statements using truth tables. (G.CO.9)

Outcome MA-G-3:
Students will define and classify properties of lines with transversals and the properties of lines on a coordinate plane.

MA-G-3-1	Define lines and angles relationships (parallel, perpendicular, skew, and transversal) (G.CO.1)
MA-G-3-2	Classify angles formed by parallel lines and transferals. (G.CO.1)
MA-G-3-3	Prove lines parallel, by using established postulates and theorems. (G.CO.9)
MA-G-3-4	Construct perpendicular lines. (G.CO.12)
MA-G-3-5	Classify slope of a line on a coordinate plane. (G.GPE.5)
MA-G-3-6	Diagnose slope and the equation of a line on a coordinate plane, compute slope formula, and illustrate the equations of lines in point/slope form. (G.GPE.6, G.GPE.5)
MA-G-3-7	Classify types of lines (perpendicular, parallel, overlapping and intersecting) on a coordinate plane. (G.CO.1)

Outcome MA-G-4:
Students will classify triangles, prove triangles congruent, and produce a coordinate proof.

MA-G-4-1	Classify triangles by side length or angle measure. (G.CO.10)
MA-G-4-2	Analyze angle relationships in triangles. (G.CO.10)
MA-G-4-3	Identify congruent triangles. (G.CO.6)
MA-G-4-4	Prove triangles are congruent by: SSS, SAS, ASA, AAS, HL theorems (G.CO.7, G.CO.8)
MA-G-4-5	Prove parts of separate triangles congruent by disserting corresponding parts of congruent triangles are congruent. (G.CO.7)
MA-G-4-6	Prove a variety of geometric topics using the properties of coordinate geometry and algebra. (G.CO.9)
MA-G-4-7	Define the properties of isosceles and equilateral triangles. (G.CO.10)

Outcome MA-G-5:
Students will translate geometric symbols using geometric notation. Students will construct segments in triangles and justify relationships in triangles.

MA-G-5-1	Construct perpendicular, angle bisectors, altitudes, and mid-segments of triangles. (G.CO.12)
MA-G-5-2	Define types of line of locus: perpendicular bisector, angle bisector (G.CO.12)
MA-G-5-3	Construct four different points of concurrency in triangles: Circumcenter, In Center, Centroid, Ortho Center (G.C.3, G.CO.12, G.CO.13)
MA-G-5-4	Apply the properties of points of concurrency in triangles to solve real-world problems. (G.CO.12)
MA-G-5-5	Derive the Pythagorean Theorem by construction. (G.CO.12)
MA-G-5-6	Use properties of Pythagorean inequalities to classify types of triangles by side. (G.CO.10, G.SRT.4)
MA-G-5-7	Categorize angle-side relationships: Hinge Theorem, Triangle Inequality Theorem. (G.CO.10)
MA-G-5-8	Solve real problems using special right triangles: the 45-45-90 side ratios, the 30-60-90 side ratios. (G.SRT.5, G.SRT.6)

Outcome MA-G-6:
Students will categorize polygons and differentiate between types of quadrilaterals.

MA-G-6-1	Categorize polygons by properties and attributes; number of sides, shape, and length. (G.CO.11, G.CO.13)
MA-G-6-2	Derive the sum of interior angles formula. (G.CO.11, G.CO.13)
MA-G-6-3	Use properties of parallelograms in problem solving situations. (G.CO.11, G.CO.13)
MA-G-6-4	Use conditions of parallelograms to prove quadrilaterals are parallelograms. (G.CO.11, G.CO.13)
MA-G-6-5	Use properties of special parallelograms to differentiate parallelograms as rectangles, rhombi, or squares. (G.CO.11, G.CO.13)
MA-G-6-6	Use conditions of special parallelograms to prove parallelogram as rectangles, rhombi, or squares. (G.CO.11, G.CO.13)
MA-G-6-7	Use special properties of quadrilaterals to derive shapes of kites and trapezoids. (G.CO.11, G.CO.13)
MA-G-6-8	Construct mid-segment of trapezoids. (G.CO.11, G.CO.13)
MA-G-6-9	Use properties of mid-segments of trapezoids to solve real-world problems. (G.CO.11, G.CO.13)

Outcome MA-G-7:
Students will diagnose similarity between two dimensional shapes and use the properties of similarity to solve real world problems.

MA-G-7-1	Calculate when ratios are proportional and write proportions in a variety of forms; ratio, a:b or a to b. Use the properties of proportions to solve real word problems. (G.SRT.2)
MA-G-7-2	Deduce when figures are similar (e.g., corresponding parts between these figures are proportional). (G.SRT.2)
MA-G-7-3	Deduce when triangles are similar by: AA means AAA, Side, Side, Side,, Side, Angle, Side. (G.SRT.3)
MA-G-7-4	Modify the properties of reflexive, symmetric, and transitive to similar figures. (G.CO.5)
MA-G-7-5	Solve real-world problems using the properties of similar triangles. (G.GMD.3)
MA-G-7-6	Find measurement lengths indirectly u. (G.SRT.2)
MA-G-7-7	Use proportions to dilate shapes in a two dimensional plane and locate the center of dilation. (G.SRT.1a)

Outcome MA-G-8:
Students will use side lengths from right triangles to compose the ratios of Sine, Cosine, and Tangent and use the trigonometric ratios to solve real-world problems. Students will derive the Law of Sine and the Law of Cosine and use the law of Sine and Cosine to solve real world problems.

MA-G-8-1	Derive special relationships of right triangles. (G.SRT.6)
MA-G-8-2	Derive the trigonometric ratios of Sine, Cosine, and Tangent to find missing parts of right triangle's given enough information. (G.SRT.6)
MA-G-8-3	Find unknown angle measurements given the side lengths of right triangles. (G.SRT.7)
MA-G-8-4	Solve real world problems using properties of the angle of depression and the angle of elevation. (G.SRT.8)
MA-G-8-5	Prove Law of Sine by construction. (G.SRT.10)
MA-G-8-6	Solve real world problems using the Law of Sine and the Law of Cosine. (G.SRT.10, G.SRT.11)

Outcome MA-G-9:
Students will construct three dimensional figures on a two dimensional plane. Students will solve real-world problems, using formulas for volume and surface area of pyramids, prisms, cylinders, cones, and spheres.

MA-G-9-1	Define parts of three dimensional shapes and draw cross sections of three dimensional shapes. (G.GMD.1)
MA-G-9-2	Draw three dimensional shapes using one point and two point perspective in a two dimensional plane. (G.MD.4)
MA-G-9-3	Calculate lateral and surface area of three dimensional shapes. (G.MD.1)
MA-G-9-4	Calculate volume of three dimensional shapes. (G.MD.3)

Outcome MA-G-10:
Students will define relationships of segments and angles with circles to solve real-world problems.

MA-G-10-1	Define or label lines or segments that intersect circles. (G.C.2)
MA-G-10-2	Define relationships of circle pairs. (G.C.2)
MA-G-10-3	Use circle theorems to solve real-world problems. (G.C.5)
MA-G-10-4	Construct and define arcs of circles (major and minor). (G.C.5)
MA-G-10-5	Solve area of sectors and segments of circles. (G.C.5)
MA-G-10-6	Solve real-world problems involving segment relationships of circles. (G.C.5)
MA-G-10-7	Define end scribed angles of a circle. (G.C.5)
MA-G-10-8	Prove all circles are similar. (G.C.1)

Applied Math

ESSENTIAL STANDARDS: Please see details about each in the curriculum that follows.

To be determined

Outcome MA-AP-1:

Students will identify and define the building blocks of geometry, as well as common two and three dimensional figures. Students will apply perimeter, area and volume to creating and solving real-world problems.

MA-AP-1-1	Define point, line, ray, segment, angle and plane. (G.CO.1)
MA-AP-1-2	Describe distinguishing features of two and three dimensional figures. (G.GMG.1)
MA-AP-1-3	Classify triangles by side length and angle measure. (G.CO.10)
MA-AP-1-4	Classify various quadrilaterals. (G.CO.11)
MA-AP-1-5	Calculate the perimeter and area of two dimensional figures. (G.GMD.1)
MA-AP-1-6	Calculate the surface area and volume of three dimensional figures. (G.GMD.1, G.GMD.2)
MA-AP-1-7	Assess and solve real-world problems involving two and three dimensional figures. (G.GMG.2, G.GMG.3)
MA-AP-1-8	Construct real-world problems involving two and three dimensional figures. (G.GMG.2, G.GMG.3)

Outcome MA-AP-2:

Students will demonstrate money management techniques in a variety of real-world scenarios.

MA-AP-2-1	Reconcile a checkbook to a bank statement.
MA-AP-2-2	Complete a columnar budget table.
MA-AP-2-3	Calculate simple and compound interest.
MA-AP-2-4	Calculate a paycheck by utilizing a time card.

Outcome MA-AP-3:
Students will calculate, verify and evaluate utility bills. Students will compute an income tax return. Students will calculate, verify and evaluate automobile, home and health insurance policies and examine the process of purchasing an automobile and house.

MA-AP-3-1	Calculate usage of energy, water and electricity.
MA-AP-3-2	Apply rates to generate the total utility costs.
MA-AP-3-3	Compute a tax refund using tables.

MA-AP-3-4	Define terms used in the insurance field.
MA-AP-3-5	Calculate premium payments for given insurance requirements.
MA-AP-3-6	Contrast and evaluate different insurance policies.
MA-AP-3-7	Compute the cost of an insurance claim in a variety of scenarios.
MA-AP-3-8	Contrast the benefits of renting or leasing versus buying a home or vehicle.
MA-AP-3-9	Calculate the cost of buying a home or vehicle based on different loans.
MA-AP-3-10	Calculate the cost of maintaining a home or vehicle.

Outcome MA-AP-4:
Students will calculate the number of outcomes for an event and sample space, calculate simple, compound and conditional probabilities, graph probability distributions and solve expected value and other real-world probability problems.

MA-AP-4-1	Calculate the number of outcomes for an event and/or sample space using the Addition Rule, Multiplication Rule, Fundamental Counting Principle, Permutations and Combinations. (S.CP.1)
MA-AP-4-2	Calculate probabilities involving Permutations and Combinations. (S.CP.9)
MA-AP-4-3	Identify mutually exclusive and not mutually exclusive events and use the Addition Rules to calculate probabilities for these events. (S.CP.7)
MA-AP-4-4	Identify independent and dependent events and use the Multiplication Rules to calculate probabilities for these events. (S.CP.2, S.CP.8)
MA-AP-4-5	Calculate probabilities for “at least” problems. (S.CP.2)
MA-AP-4-6	Explain the concept of conditional probability, independence and calculate conditional probabilities. (S.CP.3, S.CP.5, S.CP.6)
MA-AP-4-7	Construct a two-way frequency table and use the data to approximate a conditional probability. (S.CP.4)
MA-AP-4-8	Use the binomial probability formula to calculate the probability of a binomial event and graph the probability distribution. (A.APR.5, S.MD.1)
MA-AP-4-9	Graph a probability distribution, identify the expected value as the mean of the distribution and calculate the expected value. (S.MD.1, S.MD.2, S.MD.3, S.MD.4, S.MD.5)
MA-AP-4-10	Solve real-world problems involving probability. (S.MD.3, S.MD.4, S.MD.5, S.MD.6, S.MD.7)

Outcome MA-AP-5:
Students will summarize, represent and interpret single variable and two variable data, use data from samples to make inferences about populations, compare treatments in random experiments, write algebraic equations to model a set of data and use those equations to solve problems.

MA-AP-5-1	Create frequency distributions and represent single variable data using dot plots, histograms and box plots. (S.ID.1)

MA-AP-5-2	Calculate measures of central tendency, variation, account for the effects of outliers, and compare distributions for two or more data sets. (S.ID.2, S.ID.3)
MA-AP-5-3	Summarize the properties of the normal curve, state the empirical rule, identify sets of data that approximate a normal curve, and use calculators, spreadsheets and tables to estimate areas under the normal curve. (S.ID.4)
MA-AP-5-4	Summarize and interpret categorical data in two-way frequency tables. (S.ID.5)
MA-AP-5-5	Represent data on two quantitative variables that suggest a linear model on a scatterplot, informally fit a linear function to the data, write the equation of the line, and use the equation to make predictions. (S.ID.6)
MA-AP-5-6	Represent data on two quantitative variables using scatterplots, identify the algebraic model that fits the data (linear, quadratic or exponential), use technology to generate an equation that fits the data, interpret the correlation coefficient, and use the model to solve problems. (S.ID.8)
MA-AP-5-7	Explain the difference between correlation and causation. (S.ID.9)
MA-AP-5-8	Compare sample surveys, experiments and observational studies and use data from a sample survey to estimate a population mean or proportion. (S.IC.1, S.IC.2, S.IC.4)
MA-AP-5-9	Use data from a randomized experiment to compare two treatments. (S.IC.3, S.IC.5)
MA-AP-5-10	Evaluate reports based on data. (S.IC.6)

Advanced Math

ESSENTIAL STANDARDS: Please see details about each in the curriculum that follows.

- Complex Number
- Inverse Functions
- Rational Function
- Conic Sections
- Sequences and Series
- Probability
- Statistics

Outcome MA-AD-1:
Students will perform operations on complex numbers, represent complex numbers on the complex plane and show the Fundamental Theorem of Algebra is true for quadratic polynomials.

MA-AD-1-1	Define the imaginary unit *i* and simplify expressions involving powers of *i* (N.CN.1)
MA-AD-1-2	Identify numbers of the form $a + bi$ as complex and identify the real and imaginary parts. (N.CN.1)
MA-AD-1-3	Represent complex numbers on the complex plane in rectangular and polar form and explain why they represent the same number. (N.CN.4)
MA-AD-1-4	Calculate the absolute value (moduli) of a complex number located on the complex plane using the Pythagorean Theorem. (N.CN.6)
MA-AD-1-5	Add, subtract, multiply, write complex conjugates and use the conjugates to find the moduli and quotients of complex numbers. (N.CN.2, N.CN.3)
MA-AD-1-6	Represent addition, subtraction, multiplication and conjugation of complex numbers geometrically on the complex plane. (N.CN.5)
MA-AD-1-7	Calculate the distance between two numbers and midpoints of two numbers on the complex plane. (N.CN.6)
MA-AD-1-8	Write quadratic equations in standard form from linear factors involving complex numbers (e.g., $x^2 + 4 = (x + 2i)(x - 2i)$). (N.CN.8)
MA-AD-1-9	State the Fundamental Theorem of Algebra and show that any quadratic polynomial will have two linear factors when zeros can be written as complex numbers. (N.CN.9)

Outcome MA-AD-2:
Students will write and graph inverse functions, compose functions and solve real-world problems using inverse relationships and composition of functions.

MA-AD-2-1 Define and identify a function using the vertical line test and state the domain and range of a function. (F.IF.1)

MA-AD-2-2 Evaluate functions written in function notation. (F.IF.2)

MA-AD-2-3 Graph a function and its inverse from a table, and given the graph of a function plot its inverse and show it is a reflection over the line, $y = x$. (F.IF.9)

MA-AD-2-4 Write an equation for the inverse of a function. (F.IF.4)

MA-AD-2-5 Produce an invertible function from a non-invertible function by restricting the domain. (F.IF.9)

MA-AD-2-6 Compose two functions to create a new function. (F.BF.1)

MA-AD-2-7 Verify by composition that one function is the inverse of another function. (F.BF.4)

MA-AD-2-8 Transform expressions from exponential to logarithmic form. (F.BF.5)

MA-AD-2-9 Solve real-world problems using the inverse relationship between exponential and logarithmic functions. (F.BF.5)

MA-AD-2-10 Solve real-world problems involving the composition of functions. (F.BF.1)

Outcome MA-AD-3:
Students will graph rational functions, add, subtract, multiply and divide rational expressions, solve rational equations, and real-world variation and inverse variation problems.

MA-AD-3-1 Graph rational functions, identifying zeros, asymptotes, discontinuities and end behavior. (F.IF.7)

MA-AD-3-2 Add, subtract, multiply, and divide rational expressions, write the result in simplest form, and state the values for which the expression is undefined. (A.APR.7, A.APR.6)

MA-AD-3-3 Solve rational equations, eliminate extraneous solutions, and write the solution set. (A.REI.2)

MA-AD-3-4 Solve real-world variation and inverse variation problems. (A.REI.2)

Outcome MA-AD-4:
Students will derive the equations for conic sections (circles, ellipses, hyperbolas and parabolas) from their geometric definitions and use completing the square to transform equations written in expanded form to general form, and then graph the conic section.

MA-AD-4-1 Derive the equation of a circle when given a center and radius using the Pythagorean Theorem. (G.GPE.1)

MA-AD-4-2 Derive the equation of a parabola when given a focus and directrix. (G.GPE.2)

MA-AD-4-3 Derive the equation of an ellipse and a hyperbola when given foci, using the fact that the sum or difference of the distances from the foci is constant. (G.GPE.3)

MA-AD-4-4 Use completing the square to transform the equations of a circle, an ellipse, a hyperbola and a parabola written in expanded form to general form, and then graph the conic section. (G.GPE.1)

Outcome MA-AD-5:
Students will write formulas for arithmetic and geometric sequences, use formulas to find term values, calculate arithmetic and geometric means and partial sums, expand powers of a binomial using the Binomial Theorem and solve real-world problems involving sequences and series.

MA-AD-5-1	Identify the pattern and write the formula for an arithmetic or geometric sequence. (F.IF.3, F.BF.1)
MA-AD-5-2	Use formulas to identify the term value of a sequence when given a term number or identify the term number when given the term value. (F.BF.1, F.BF.2)
MA-AD-5-3	Calculate arithmetic and geometric means. (F.BF.1, F.BF.2)
MA-AD-5-4	Calculate the partial sum of a series. (A.SSE.4)
MA-AD-5-5	Expand powers of a binomial using the Binomial Theorem and Pascal's Triangle. (A.APR.5)
MA-AD-5-6	Solve real-world problems involving arithmetic and geometric sequences. (A.APR.5, F.BF.2)

Outcome MA-AD-6:

Students will calculate the number of outcomes for an event and sample space, calculate simple, compound and conditional probabilities, graph probability distributions and solve expected value and other real-world probability problems.

MA-AD-6-1	Calculate the number of outcomes for an event and/or sample space using the Addition Rule, Multiplication Rule, Fundamental Counting Principle, Permutations and Combinations. (S.CP.1)
MA-AD-6-2	Calculate probabilities involving Permutations and Combinations. (S.CP.9)
MA-AD-6-3	Identify mutually exclusive and not mutually exclusive events and use the Addition Rules to calculate probabilities for these events. (S.CP.7)
MA-AD-6-4	Identify independent and dependent events and use the Multiplication Rules to calculate probabilities for these events. (S.CP.2, S.CP.8)
MA-AD-6-5	Calculate probabilities for "at least" problems. (e.g., 1-P(none)) (S.CP.2)
MA-AD-6-6	Explain the concept of conditional probability, independence and calculate conditional probabilities. (S.CP.3, S.CP.5, S.CP.6)
MA-AD-6-7	Construct a two-way frequency table and use the data to approximate a conditional probability. (S.CP.4)
MA-AD-6-8	Use the binomial probability formula to calculate the probability of a binomial event and graph the probability distribution. (A.APR.5, S.MD.1)

MA-AD-6-9 Graph a probability distribution, identify the expected value as the mean of the distribution and calculate the expected value. (S.MD.1, S.MD.2, S.MD.3, S.MD.4, S.MD.5)

MA-AD-6-10 Solve real-world problems involving probability. (S.MD.3, S.MD.4, S.MD.5, S.MD.6, S.MD.7)

Outcome MA-AD-7:

Students will summarize, represent and interpret single variable and two variable data, use data from samples to make inferences about populations, compare treatments in random experiments, write algebraic equations to model a set of data and use those equations to solve problems.

MA-AD-7-1 Create frequency distributions and represent single variable data using dot plots, histograms and box plots. (S.ID.1)

MA-AD-7-2 Calculate measures of central tendency, variation, account for the effects of outliers, and compare distributions for two or more data sets. (S.ID.2, S.ID.3)

MA-AD-7-3 Summarize the properties of the normal curve, state the empirical rule, identify sets of data that approximate a normal curve, and use calculators, spreadsheets and tables to estimate areas under the normal curve. (S.ID.4)

MA-AD-7-4 Summarize and interpret categorical data in two-way frequency tables. (S.ID.5)

MA-AD-7-5 Represent data on two quantitative variables that suggest a linear model on a scatterplot, informally fit a linear function to the data, write the equation of the line, and use the equation to make predictions. (S.ID.6)

MA-AD-7-6 Represent data on two quantitative variables using scatterplots, identify the algebraic model that fits the data (linear, quadratic or exponential), use technology to generate an equation that fits the data, interpret the correlation coefficient, and use the model to solve problems. (S.ID.8)

MA-AD-7-7 Explain the difference between correlation and causation. (S.ID.9)

MA-AD-7-8 Compare sample surveys, experiments and observational studies and use data from a sample survey to estimate a population mean or proportion. (S.IC.1, S.IC.2, S.IC.4)

MA-AD-7-9 Use data from a randomized experiment to compare two treatments. (S.IC.3, S.IC.5)

MA-AD-7-10 Evaluate reports based on data. (S.IC.6)

Outcome MA-AD-8:

Students will use the unit circle to locate angles of rotation, identify conterminal angles, reference angles and explain the symmetry and periodicity of trigonometric functions.

Students will graph periodic functions and solve real-world problems modeled by periodic functions.

MA-AD-8-1	Use special right triangles to show geometrically the values for sine, cosine and tangent of 30°, 45°, and 60° angles. (F.TF.3)
MA-AD-8-2	Use the unit circle to: locate special angles, locate angles of rotation written in radians and degrees, identify co-terminal angles, reference angles, the quadrants in which trigonometric ratios are positive and negative and to explain the symmetry and periodicity of trigonometric functions. (F.TF.3, F.TF.4)
MA-AD-8-3	Convert angles from radians to degrees, from degrees to radians, and from degrees, minutes and seconds to decimal degrees. (F.TF.1, F.TF.2)
MA-AD-8-4	Evaluate expressions involving the exact values of trigonometric functions for angles that are multiples of 30° and 45°. (F.TF.6)
MA-AD-8-5	Graph the sine, cosine, tangent, cosecant, secant and cotangent functions. (F.TF.6)
MA-AD-8-6	Graph transformations of the sine and cosine function and identify the amplitude, period, vertical shift and phase displacement in the transformation. (F.TF.5)
MA-AD-8-7	Graph inverse trigonometric relations and restrict the domain to construct inverse trigonometric functions. (F.TF.6)
MA-AD-8-8	Solve real-world problems modeled by trigonometric functions and inverse trigonometric functions. (F.TF.7)

Outcome MA-AD-9:

Students will perform operations on matrices and solve systems of equations using matrices.

MA-AD-9-1	Add and subtract matrices. (N.VM.8, N.VM.10)
MA-AD-9-2	Multiply a matrix by a scalar and multiply two matrices. (N.VM.8, N.VM.9, N.VM.10)
MA-AD-9-3	Use matrix multiplication to solve problems. (N.VM.7, N.VM.11)
MA-AD-9-4	Use matrices to represent directed networks and interpret the results. (N.VM.6)
MA-AD-9-5	Calculate the determinant of a matrix to show the matrix has an inverse and use inverse matrices to solve systems of equations. (N.VM.10, N.VM.12, A.REI.8, A.REI.9)

Outcome MA-AD-10:
Students will use trigonometric properties to prove trigonometric identities and solve trigonometric equations.

MA-AD-10-1	Use the reciprocal, quotient and Pythagorean properties to prove trigonometric identities. (F.TF.8)
MA-AD-10-2	Identify odd and even trigonometric functions. (F.TF.4)

MA-AD-10-3 Prove addition and subtraction formulas for sine, cosine and tangent and use them to solve problems. (F.TF.9)

MA-AD-10-4 Calculate sine, cosine and tangent for double angles and half-angles when given values for sine, cosine and tangent of an angle.

MA-AD-10-5 Solve trigonometric equations. (F.TF.7)

Outcome MA-AD-11:

Students will solve real-world right triangle problems, prove the Law of Sines and Law of Cosines and use them to solve real-world problems involving oblique triangles, derive the formula for the area of a triangle and evaluate area problems, and solve real-world vector problems.

MA-AD-11-1 Use trigonometric ratios and inverse trigonometric functions to solve real-world right triangle problems. (G.SRT.8)

MA-AD-11-2 Prove the Law of Cosines and use it to solve oblique triangle problems. (G.SRT.10, G.SRT.11)

MA-AD-11-3 Derive the formula for the area of a triangle and evaluate area problems. (G.SRT.9)

MA-AD-11-4 Use Hero's formula to evaluate area problems.

MA-AD-11-5 Prove the Law of Sines and use it to solve oblique triangle problems. (G.SRT.10, G.SRT.11)

MA-AD-11-6 Show SSA triangles are ambiguous, state the number of possible triangles when given side lengths and an angle measure, and calculate the possible values for the missing side lengths and angle measures.

MA-AD-11-7 Represent vector quantities using directed line segments and add/subtract vectors geometrically using the parallelogram rule and end-to-end methods. (N.VM.1, N.VM.2, N.VM.4)

MA-AD-11-8 Add and subtract vectors written in component form. (N.VM.4)

MA-AD-11-9 Represent scalar multiplication of vectors graphically and perform scalar multiplication component-wise. (N.VM.5)

MA-AD-11-10 Solve bearing, velocity and other real world problems that can be represented by vectors. (N.VM.3)

Calculus

Calculus Mathematical Terms and Definitions

Acceleration- The rate of change of velocity over time

Chain Rule-- A method for finding the derivative of a composition of functions; the formula is

$$\frac{d}{dx}f(g(x)) = f'(g(x))\,g'(x)$$

Concavity— if a curve is concave up (convex), the graph of the curve is bent upward, like an upright bowl. If a curve is concave down (or simply concave), then the graph of the curve is bent down, like a bridge. For a function $f(x)$ where $f(x)$ and $f'(x)$ are both differentiable, $f(x)$ is concave up if $f''(x) \geq 0$ and concave down if $f''(x) \leq 0$. If $f''(x) = 0$, then *x* is an inflection point, where the graph changes direction of concavity

Continuous functions— A function is continuous at $x = a$ if

1. $f(x)$ *exists*
2. $f(a)$ *exists*
3. $f(x) = f(a)$

Derivative(s)— A function which gives the slope of a curve; that is, the slope of the line tangent to a function; the derivative of a function *f* at a point *x* is commonly written *f* '(*x*)

Difference Quotient—For a function *f*, the formula $\frac{(x+h)-f(x)}{h}$; this formula computes the slope of the secant line through two points on the graph of *f*; these are the points with *x*-coordinates *x* and *x* + *h*; the difference quotient is used in the definition the derivative

Differentiability— A curve that is smooth and contains no discontinuities or cusps; formally, a curve is differentiable at all values of the domain variable(s) for which the derivative exists

Fundamental Theorem of Calculus— The theorem that establishes the connection between derivatives, antiderivatives, and definite integrals

Evaluation part of the FTC: If f is continuous on $[a,\ b]$, and F is any antiderivative of f, then

$$\int_a^b f(x)\,dx = F(b) - F(a)$$

Antiderivative part of the FTC: If f is continuous on $[a,\ b]$, then $\frac{d}{dx}\int_a^x f(t)\,dt = f(x)$ for every x in $[a,\ b]$

Indefinite Integral(s)— The family of functions that have a given function as a common

derivative; the indefinite integral of $f(x)$ is written $\int f(x)dx$ [e.g., $\int x^2 dx = \frac{1}{3}x^3 + C$]

Infinite Limits— A limit that has an infinite result (either ∞ or $-\infty$), or a limit taken as the variable approaches ∞ (infinity) or $-\infty$ (negative infinity); the limit can be one-sided

Intermediate Value theorem— If f is a function that is continuous over the domain $[a,\ b]$ and if m is a number between $f(a)$ and $f(b)$, then there is some number c between a and b such that $f(c) = m$

Limit(s)— The value that a function or expression approaches as the domain variable(s) approach a specific value; limits are written in the form $f(x)$ [e.g., the limit of $f(x) = \frac{1}{x}$ as x approaches 3 is $\frac{1}{3}$; this is written $\frac{1}{x} = \frac{1}{3}$]

Mean Value Theorem— If function f is continuous on $[a,\ b]$ and differentiable on $(a,\ b)$, then there exists a number c in $(a,\ b)$ such that $f'(c) = \frac{f(b)-f(a)}{b-a}$

Power Rule— A formula for finding the derivative of a power of a variable; $\frac{d}{dx}(x^n) = nx^{n-1}$

Product Rule— A formula for the derivative of the product of two functions;

$$\frac{d}{dx}(uv) = u\frac{dv}{dx} + v\frac{du}{dx} \quad or \quad (uv)' = u'v + uv'$$

Quotient Rule— A formula for the derivative of the quotient of two functions;

$$\frac{d}{dx}\left(\frac{u}{v}\right) = \frac{v\frac{du}{dx} - u\frac{dv}{dx}}{v^2} \quad or \quad \left(\frac{u}{v}\right)' = \frac{u'v - uv'}{v^2}$$

Rolle's Theorem— Let f be continuous on a closed interval [a, b] and differentiable on the open interval $(a,\ b)$. If $f(a) = f(b),$ then there is at least one point c in $(a,\ b)$ where $f'(c) = 0$.

Tangent Line— A line that touches a curve at a point without crossing over; formally, it is a line which intersects a differentiable curve at a point where the slope of the curve equals the slope of the line

ESSENTIAL STANDARDS: Please see details about each in the curriculum that follows.

To be determined

Outcome MA-CA-1:
Students will determine the limit of a function at a value numerically, graphically, and analytically.

MA-CA-1-1	Identify vertical asymptotes in rational and logarithmic functions by identifying locations where the function value approaches infinity. (F-IF.7d)
MA-CA-1-2	Estimate limits numerically and graphically.
MA-CA-1-3	Calculate limits analytically through algebraic simplification, direct substitution, one sided limits, and rationalization.
MA-CA-1-4	Calculate infinite limits and use the result to identify vertical asymptotes in rational and logarithmic functions.
MA-CA-1-5	Calculate limits at infinity and use the result to identify unbounded behavior in rational, exponential, and logarithmic forms.
MA-CA-1-6	Identify and classify graphically, algebraically, and numerically if a discontinuity is removable or non-removable.
MA-CA-1-7	Identify the three conditions that must exist in order for a function to be continuous at x=a ($f(a)$ is defined, the limit as x approaches a of $f(x)$ equals $f(a)$, and the limit as x approaches a of $f(x)$ exists).
MA-CA-1-8	Identify and apply the Intermediate Value theorem for continuous functions.

Outcome MA-CA-2
Students will use derivatives to solve problems both theoretically and contextually.

MA-CA-2-1	Approximate the derivative graphically by finding the slope of a tangent line drawn to a curve at a given point.
MA-CA-2-2	Approximate the derivative numerically by using the difference quotient.
MA-CA-2-3	Find the equation of the tangent line using the definition of derivative.
MA-CA-2-4	Write and apply the relationship between differentiability and continuity.
MA-CA-2-5	Evaluate the derivative of a function using the power rule, product rule, and quotient rule.
MA-CA-2-6	Evaluate the derivative of an implicitly defined function.
MA-CA-2-7	Differentiate composite functions using the chain rule.
MA-CA-2-8	Find the derivative of exponential and Logarithmic functions.
MA-CA-2-9	Find derivatives of functions requiring the use of more than one differentiation rule.
MA-CA-2-10	Find the equation of a tangent line and a normal line to a function at a point.

Outcome MA-CA-3
Students will use theoretical concepts of derivatives to solve problems in a real world context.

MA-CA-3-1	Compare the characteristics of f and f' by generating the graph of f given the graph of f' and vice versa.
MA-CA-3-2	Explain the relationship between the increasing and decreasing behavior of f and the sign of f'.
MA-CA-3-3	Identify maxima and minima as points where increasing and decreasing behavior change.
MA-CA-3-4	Compare characteristics of the graphs of f, f', and f'' by generating the graphs of f and f' given the graph of f'' and vice versa.
MA-CA-3-5	Explain the relationship between the concavity of f and the sign of f''.
MA-CA-3-6	Identify points of inflection as points where concavity changes.
MA-CA-3-7	Apply Mean Value Theorem and Rolle's Theorem on a given interval.
MA-CA-3-8	Solve real-world application problems involving optimization and related rates.
MA-CA-3-9	Solve real-world application problems involving velocity, speed, and acceleration.

Outcome MA-CA-4
Students will apply the techniques of integration to solve problems in theoretical and contextual models that represent real world phenomena.

MA-CA-4-1	Apply basic differentiation rules to define an antiderivative and solve problems using the techniques of antidifferentiation.

MA-CA-4-2 Compute indefinite integrals.

MA-CA-4-3 Define the definite integral of the rate of change of a quantity over an interval interpreted as the change of the quantity over the interval

$$\int_a^b f'(x)\,dx = f(b) - f(a)$$

MA-CA-4-4 Estimate definite integrals by using Riemann sums and trapezoidal sums, and identify the integral as a limit of Riemann sums.

MA-CA-4-5 Determine the area between two curves and identify the definite integral as the area of the region bounded by two curves.

MA-CA-4-6 Apply the Fundamental Theorem of Calculus to solve contextual models that represent real-world occurrences.

MA-CA-4-7 Apply different integration techniques (e.g. integration by parts, "u" substitution, integration by parts, etc.)

Glossary

Numbers in parentheses following each word indicate the grade level in which the word is first introduced to students. Additional words are also included in this glossary that may be beneficial for the teacher.

absolute value (6) – the distance of a number from zero on a number line

above (K) – positioned in a higher place

add, addition (K) – to combine parts to make a whole

adjacent angle (7) - Angles that share a vertex and a common side.

after (K) – following in time or place, next

altitude (G) - a segment whose endpoints are from the vertex/plane of the base perpendicular to the other base

analog clock (1) – a clock or watch is called "analog" when it has moving hands and hours marked 1 to 12 to show time

analyze – examine critically

angle (K) – the figure formed by two lines extending from the same point

angle of depression (G) - the angle formed by the horizontal line and a line of sight to a point below

angle of elevation (G) - The angle formed by the horizontal line and the line of sight to a point above

apothem (G) - the perpendicular distance from the center of a regular polygon to a side of the polygon

arc (G) - any unbroken part of the circumference of a circle or other curved line

area (3) - the number of square units needed to cover a flat surface

array (3) - an arrangement of objects in rows and columns

Associative Property of Addition (1) - states that the sum of a set of numbers is the same, no matter how they are grouped – ex. (2+3)+7=2+(7+3)

Associative Property of Multiplication (3) - the property that states that when the grouping of factors is changed, the product remains the same

Asymptote (AII) – a line which a graph gets closer to but never touches

attribute (1) – a characteristic of an object

auxiliary line (G) - a line drawn in a figure to aid in a proof

axes (5) – plural of axis – usually means the X and Y lines that cross at right angles to make a graph or coordinate plane

bar graph (1) - a graph that uses bars to stand for data

before (K) – ahead of

behind (K) – positioned after

below (K) – positioned under

benchmark fractions (5) – common fractions that you can judge other numbers against- EX: ¼, ½, ¾

beside (K) – positioned next to

between (G) - given the three point A,b, and C, B is between A and C if and only if all three of the points lie on the same line, and AB + BC = AC

bias (7) - A sample that does not fairly represent the whole population.

bi-conditional statement (G) - a statement that can be written in form "p if and only if q"

bisector (G) - a line or plane that bisects an angle or line segment

box plot (6)– a graph that displays the highest and lowest quarters of data a whiskers, the middle of two quarters of the data as a box, and the median

braces (5) - symbols used in pairs to group things together. There are different kinds of braces and brackets EX: (round), [square], {curly}, <angled>

brackets (5) – symbols used in pairs to group things together. There are different kinds of braces and brackets EX: (round), [square], {curly}, <angled>

categorize (K) – group objects

causation (PA) - determining if one data set creates or affects another data set

centimeter (4) - a metric unit for measuring length or distance

central angle (G) - an angle formed at the center of a circle by two radii

centroid (G) - the point of concurrency of the three medians of a triangle(center of gravity)

chord (G) - the line segment between two points on a given curve

circle (K) – a line segment that is curved so that its ends meet and every point on the line is equally far away from a single point inside

circumcenter (G) - the point of concurrency of the three perpendicular bisectors of a triangle

circumscribed polygon (G) - each side of the polygon is tangent to the circle

classify (K) – arrange or assign

coefficient (6) – the number that is multiplied by one or more variables (in 3xy, 3 is the coefficient)

collinear (G) - lying in the same straight line

combine (K) – put parts together

common factor (4) - a whole number that divides two (or more) numbers exactly

common multiple (4) - a multiple that is shared by two or more numbers

Commutative Property of Addition (1) - changing the order of addends does not change the sum –ex. (3+4+6 = 4+6+3)

Commutative Property of Multiplication (3) - the property that states that you can multiply two factors in any order and get the same product

compare (K) – determine similarities and differences

complimentary angles (7) - Angles in which measures add up to 90 degrees.

compose (K) – put together

composite figure (G) - a plane figure made up of other plane figure such as semi-circles, triangles, rectangles, inc…

composite number (4) - a number with more than two factors

compound event (7) - An event focusing on more than one outcome *e.g. flipping a coin heads AND rolling a 4 on a dice.*

concave polygon (G) - a polygon such that there is a straight line that cuts it in four or more points

concentric circles (G) - circles the share the same center

conclusion (G) - the part of the conditional statement following the word then

concurrent (G) - three or more lines that intersect in one point

conditional event (PA) – an event that is affected by other events

cone (K) – a solid figure that slopes evenly to a point from a circular base; **(8)** a three dimensional figure with one vertex and a circular base

congruent (7) – having the same shape and size

conjecture (G) - a statement that is believed to be true

contrapositive (G) - a conditional statement derived from another by negating and interchanging antecedent and consequent

converse (G) - a statement that is formed by exchanging the hypothesis and conclusion

convex polygon (G) - a polygon such that no side extended cuts any other side or vertex; it can be cut by a straight line in at most two points

coordinate plane (5) - a plane formed by the intersection of a horizontal number line with a vertical number line; the horizontal number line is called the *x*-axis and the vertical number line is called the *y*-axis. The number lines intersect at their zero points. This point of intersection is called the origin and written as (0, 0).

coplanar (G) - being or operating in the same plane

corner/point (K) – the point or place where edges or sides meet

corollary (G) - a theorem whose proof follows direction from another proof

correlation (PA) – description of the relationship between two data sets

cosine (AII) – ratio of the side adjacent to an angle and the hypotenuse

count (K) – add one by one to find how many, name next number(s)

count back (K) – start at a given number and say the next lowest number(s)

count backward (1) - to count in a negative direction

count on, count forward (K) – start at a given number and say the next highest number(s)

counter-example (G) - an example that refutes an assertion or claim

cross products (7) - The two products after multiplying the diagonals of two ratios.

cross section (7) - The two-dimensional shape resulting from "slicing" a three-dimensional shape along a certain axis.

cube (K) – solid body having six equal square sides

curve (K) – rounded edge

cylinder (K) – a geometric shape composed of two parallel faces of identical size and shape (as circles) and a curved surface that completely connects their borders; **(8)** a three-dimensional figure with two parallel, congruent circular bases

decimal fraction (4) - a fraction written as a decimal
Example: 3/100=.03

decompose (K) – take apart

deductive reasoning (G) - the process of using logic to draw conclusions

degree (7) - A unit of measure for angles recognizing that a circle has 360 degrees.

denominator (3) - the part of a fraction below the line, which tells how many equal parts there are in the whole or in the group

dependent variable (6) – the output value in a function dependent on the input value

different (K) – how things are not alike

difference (1) - answer to a subtraction problem

digit – a symbol used to make numerals (example: the numeral 153 is made of 3 digits, 1, 5, and 3)

digital clock (1) – a type of clock that displays the time digitally – in numbers or other symbols

dilation (8) – a transformation that enlarges or reduces a figure

direction (G) - the orientation of the vector, which is determined by the angle the vector makes with the horizontal line

discontinuity (AII) – a point in the domain that has no corresponding point in the range

Distributive Property of Multiplication (3) - the property that states that multiplying a sum by a number is the same as multiplying each addend by the number and then adding the products

dividend (3) - the number that is to be divided in a division problem

division/divide (3) - to separate into equal groups; the opposite operation of multiplication

divisor (3) - the number that divides the dividend

domain (8) – set of all possible input values of a function

dot plot (6) – also called a dot chart, is a type of simple histogram-like chart used in statistics for relatively small data sets where values fall into a number of discrete bins.

doubles (1) - an addition fact that includes two of the same number

edge (K) – the line where an object or surface begins or ends; **(G)** a segment that is formed by the intersection of two faces of a three dimensional object

elimination by linear combination (8) – method of solving systems of linear equations by eliminating variables

equal sign (=) (K) – mathematical symbol used to represent the total

equal, equal to (K) – the same amount

equation (K) – a number sentence

equivalent (3) - two or more sets that name the same amount

equivalent fractions (5) – fractions which have the same value, even though they may look different EX: ½ and 2/4 are equivalent because they are both half.

expand (an expression) (8) - Applying the Distributive Property or factoring an expression to simplify or re-write an algebraic or numerical expression. *e.g. 3(x+2) = 3x + 3*2*

expanded form (2) - A multi digit number is expressed in expanded form when it is written as a sum of single digit multiples of powers of ten. For example, 643 = 600 + 40 + 3.

experimental probability (8) - Developing a probability based on observed frequency. (Doing an experiment and keeping tallies each time an event occurs.)

expression (K) – numbers and symbols grouped together to show the value of something (example: 2+3)

exterior angles (8) – angle created outside a polygon by extending one side

extremes (G) - in the proportion a/b=c/d; a and d are the extremes

face (K) – any of the flat surfaces that form the boundary of a solid in geometry; **(G)** a flat surface of a polyhedron

fact family (1) - a group of facts made up of two addition facts with the same addends and two subtraction facts in which the addends are now the subtrahends

factor (3) - a number that is multiplied by another number to find a product

fewer (K) – less than

fluency, fluently – spoken or written with ease (example: in addition and subtraction to 5, fluency would be demonstrated by giving the sum without hesitation)

forward (K) – move ahead

fourth of (1) – one fourth of a whole

function (8) – a relationship that has exactly one output for each input

geometric mean (G) - for positive numbers a and b, the positive number x such that a/x=x/b

geometric probability (G) - a form of theoretical probability determined by a ratio of geometric measurers such as lengths, areas or volumes

gram (3) - a metric unit that is used to measure mass

greater (K) – more than

greater than (K) – a larger amount, more

greatest (K) – the most, largest amount

greatest common factor (4) - the biggest number that will divide two or more other numbers exactly

half of (1) – one half of a whole

half-hour (1) - a period of time equal to 30 minutes

half past the hour (3) - 30 minutes after a given hour

heavy (K) – greater than usual weight

hemisphere (G) - half of a sphere

hexagon (K) – a polygon of six angles and six sides

histogram (6) – a bar graph that shows the frequency of data within equal intervals

horizon (G) - the horizontal line in a perspective drawing that contains the vanishing point

hour (1) - a period of time equal to 60 minutes

hour hand (1) - the shorter hand on a clock that tells what hour of the day it is

how many, in all, total, all together (K) – whole amount

hypotenuse (8) – side opposite the right angle on a right triangle

hypothesis (G) - the part of the conditional statement following the word if

Identity Property (6) – the product of 1 and any number is that number

image (8) – a figure resulting from a transformation

imaginary number (AII) – square root of a negative real number

in front of (K) – positioned before

in-center (G) - the point of concurrency of the three angle bisectors of a triangle

include side (G) - the side between two angles

included angle(G) - an angle formed by to adjacent sides of a polygon

independent event (PA) – an event not affected by any other event

independent variable (6) – the input value in a function

indirect proof (G) - a proof in which the statement to be proved is assumed to be false and a contradiction is shown

inductive reasoning (G) - the process of reasoning that a rule or statement is true because specific cases are true

inequality (6) – a mathematical sentence that show the relationship between quantities that are not equal

infinite (8) – an unlimited or immeasurable amount

inscribe angle (G) - an angle whose vertex is on the circle and whose sides contain chords or the circle

inscribed circle (G) - a circle in which each side of a polygon is tangent to the circle

isometry (G) - a transformation that does not change the size or shape of the figure

integer (6) – a set of positive whole numbers, their opposites, and zero

intercept (8) – point at which a line crosses an axis on the coordinate plane

Slope-intercept form – a linear equation in the form $y = mx + b$, where *m* is the slope and *b* is the *y*-

intercepted arc (G) - an arc that consists of endpoints that lie on the sides of an inscribed angle and all the points of the circle between a common vertex

interior angles (8) – angle inside a polygon

inverse operations (7) - Mathematical operations that "undo" another mathematical operation. *e.g. Subtracting 5 is the inverse operation of adding 5.*

irrational number (7, 8) - A real number that cannot be written as a simple fraction - the decimal goes on forever without repeating. Example: Pi is an irrational number.

join (K) – put together

justify – explain reasoning

kilogram (3) - a metric unit for measuring mass

kilometer (4) - a metric unit for measuring length or distance; 1 kilometer= 1,000 meters

larger (K) – bigger than usual size

lateral face (G) - the face of the prism or pyramid that is not the base

leg (8) – one of the two sides forming the right angle in a right triangle

legs of a trapezoid (G) - The two non-parallel sides of a trapezoid

least (K) – smallest amount

least common multiple (4) - the smallest number that is the multiple of two or more other numbers

left (K) – how many are still there

less (K) – smaller than usual size

less than (K) – the least, smallest amount

light (K) – less than usual weight

like denominators (5) – the bottom number of a fraction; to have like denominators you must have two fractions or more with the same bottom number

like terms (7) - Terms in an equation or expression that have the same variable and exponent.

line of best fit (8) – a straight line that comes closest to the points on a scatter plot

line plots (5) – shows data on a number line with X or other marks to show frequency

linear (8) – having properties of or creating lines

linear pair (G) - two angles that are adjacent and supplementary

liter (3) - a metric unit for measuring capacity

locus (G) - a set of points that satisfies a given condition

logarithm (AII) – the power to which it is necessary to raise a base number to produce a desired number

long, length (K) – measurement from end to end

longer (K) – covers further distance than usual

longest (K) – comparison of something of greater measurement from end to end

magnitude (G) - the length of the vector, written

major arc (G) - an arc of a circle whose points are on or in the exterior of a central angle

mass (3) - the amount of matter in an object

match (K) – the same, equal to

matrix (AII) – a rectangular array of numbers used to represent sets of values

mean (6) – The sum of the items in a set of data divided by the number of items in the set (average); **(PA)** the sum of a data set divided by the number of items in that data set (average)

means (G) - in the proportion a/b=c/d; b and c are the means

measure, measurement (K) – determine specific unit of size

measures of center (7) - Measures used to show the middle of data (mean, median, mode)

median (6) – The middle number or mean of the two middle numbers in an ordered set; **(PA)** the middle number of an ordered data set

median of triangle (G) - a segment whose endpoints are the vertex of the triangle and the midpoint of the opposite side

meter (4) – a metric unit for measuring length or distance; 1 meter = 100 centimeters

mid-segment of a triangle/trapezoid (G) - a segment whose endpoints are the midpoints of two sides/legs of the figure

midpoint (G) - a point equidistant from, both ends, as of a line, line segment the midpoint of a boundary.

milliliter (4) – a metric unit for measuring capacity

minor arc (G) - an arc of a circle whose points are on or in the interior of a central angle

minus (–)(K) – symbol used to represent subtraction

minute (1) - a period of time equal to 60 seconds

minute hand (1) - the longer hand on a clock that tells how many minutes

mixed numbers (5) – a whole number plus a fraction – EX: 1 ¾

mode (6, PA) – The number or numbers that occur most frequently in a set of data

model (K) – to show

more (K) – amounting to a larger number

most (K) – largest amount

multiple (3) - a number that is the product of a given number and a whole number

multiplication/multiply (3) – the process of combining equal groups to find how many in all; the opposite operation of division

negation (G) - the absence or opposite of something that is actual, positive, or affirmative: (p) and it's opposite (*~p)*

net (6) – an arrangement of two dimensional figures that can be folded to form a polyhedron

next to (K) – positioned beside

non-function (8) – any relation that fails to have exactly one output for each input

non-regular polygon (6) – a polygon whose sides and angles are not congruent

number (K) – word or symbol to tell how many

number line (1) - a line marked with a sequence of numbers at regularly spaced points along its length

number sentence, addition sentence, subtraction sentence (K) – equation that includes numbers and operation symbols (example: 3+4=7 or 9-5=4)

number words (0-20) (K) – Zero (0), One (1), Two (2)…Twenty (20)

number words (multiples of 10) (K) – Ten (10), Twenty (20), Thirty (30)…One Hundred (100)

numerals – A symbol or name that represents a number

numerator (3) - the part of a fraction above the line, which tells how many parts are being counted

numerical expression (6) – an expression that contains only numbers and operations

oblique prism (G) - a prism that has at least one nonrectangular lateral face

one-half- ½ **(1)** - one of two equal parts that make up a whole

one – fourth ¼ **(1)** - one of four equal parts that make up a whole

one – third 1/3 **(1)** - one of three equal parts that make up a whole

ones (K) – a single unit, used for numbers 0-9

operations (5) – a mathematical process – the most common are add, subtract, multiply and divide

opposite rays (G) - two rays with a common endpoint that form a straight line

ordered pairs (5) – two numbers written in a certain order, usually written in parenthesis like this: (4, 5); can be used to show position on a graph, where the X (horizontal) value is first, and the Y (vertical) value is second

orientation (K) – placement of an object

origin (5) – the starting point on a number line – it is 0

orthocenter of triangle (G) - the point of concurrency of the three altitudes of the triangle

orthographic drawing (G) - a drawing that shows a three-dimensional object in which the line of sight for each view is perpendicular to the plane of the picture

ounce (4) – a customary unit for measuring weight

over (K) – positioned above

overall shape (6) –

parallel (8) – Lines in a plane that do not intersect

parenthesis (3) - symbols **(** and **)** to identify which numbers should be computed first in an equation

perfect squares (8) – a square of a whole number

perimeter (3) - the distance around a figure

perpendicular (5) – means at 'right angles'

perspective drawing (G) - a drawing in which non-vertical parallel lines meet at a point called the vanishing point

picture graph (1) - graph that uses pictures

place value (K) – where a digit is in a larger number

plus (+)(K) – symbol used to represent addition

point-slope form (8) – a linear equation in the form $y - y_1 = m(x - x_1)$, where *m* is the slope and (x_1, y_1) is a point on the line.

polygon (3) - a closed plane figure with straight sides that are line segments

polyhedron (G) - a closed three-dimensional figure formed by four or more polygons that intersect at the edges

population (7) - The entire group of interest.
postulate (G) - something taken as self-evident or assumed without proof as a basis for reasoning

pound (4) - a customary unit for measuring weight; 1 pound = 16 ounces

pre-image (8) – figure prior to transformations being performed

prime number (4) – a number that has exactly two factors; a number that can only be divided evenly by itself and 1

probability (7) - The likelihood of an event occurring.

product (3) - the answer in a multiplication problem

proof (G) - an argument that uses logic to show that a conclusion is true

proportion (7) - An equation stating that two ratios are equal.

quadrants (6) – the x and y-axes divide the coordinate plane into four regions. Each region is called a quadrant

quadrilateral – a flat shape with 4 straight sides

quantity (K) – total, how many

quarter of (1) – one fourth of a whole

quarter after/until the hour (3) - fifteen minutes before or after any given hour

quartiles (PA) – three values that divide the data set into fourths

quotient (3) - the number, not including the remainder, that results from division

radical (8) – symbol used to indicate calculating the root of a number

range (6, PA) – the difference between the greatest and least values in a data set; **(8)** set of all possible output values of a function

rate (6) – a ratio that compares two quantities measured in different units

ratio (6) – a comparison of two quantities by division

rational numbers (6) – numbers that can appear on a number line, including integers, fractions, improper fractions, mixed numbers, and repeating or terminating decimals

ray (4) - a part of a line, with one endpoint, that is straight and continues in one direction
Example: 2 is a common factor of 8, 10 and 12.

real-world – objects and scenarios people encounter in their daily lives

record – write down, make note of

rectangle (K) – a four-sided polygon that has four right angles and each pair of opposite sides parallel and of the same length

rectangular prism (1) - a rectangular solid figure such as a brick

reflection (8) – a transformation that flips a figure across a line

regular polygon (6)- a polygon with congruent sides and angles; **(G)** a polygon that is both equilateral and equiangular

remainder (4) - the amount left over when a number cannot be divided evenly

remote interior angle (G) - an interior angle that is not adjacent to the exterior angle

remove (K) – take away

represent – show, demonstrate

resultant vector (G) - the vector the represents the sum of two given vectors

rhombus (3) - a quadrilateral with two pairs of parallel sides and four equal sides

right circular cone (1) – a right cone with a base that is a circle (similar to a regular pyramid except that its base is a circle)

right circular cylinder (1) – a three dimensional object with two congruent circles as parallel bases and a lateral surface consisting of a rectangle

right rectangular prism (5) – a solid (3 dimensional) object which has six faces that are rectangles; it is a prism because it has the same cross – section along a length

rotation (8) – a transformation that spins a figure around a point

same (K) – alike

sample (7) - A part of a larger population.

sample space (7) - All the possible outcomes of a chance event.

scale drawings (7) - A real world model enlarged or shrunk by a constant factor.

scaling – resizing fractions (5) – by multiplying or dividing a fraction by a fraction equal to one you can resize fractions or change the denominators without changing the value

scatter plot (8) – a graph with points showing relationship between two sets of data

scientific notation (8) – a method of writing very large or very small numbers using powers of 10

secant segment (G) - a segment of a secant with at least one endpoint on the circle

seconds (4) - a unit used to measure short amounts of time

sector (G) - a plane figure bounded by two radii and the included arc of a circle

separate (K) – divide

sequence (K) – to put in order

set (K) – a group with a like attribute

shape (K) – specific form of an object

short (K) – less than usual length

shorter (K) – comparison of something of smaller measurement from end to end

side, sides (K) – a straight-line segment forming part of the boundary of a geometric figure

similar (K) – ways things are the same

similar figures (7) - Same shape but not necessarily the same size. Enlarged or shrunk by a constant factor.

simple event (7) - An event focusing on one outcome *e.g. flipping a coin heads up.*

Sine (AII) – ratio of the side opposite an angle and the hypotenuse

size (K) – measurement of an object

slant height (G) - the distance from the vertex of a regular pyramid to the midpoint of and edge of the base

slope (8) – steepness of a line

smaller (K) – less than usual size

solve – find the answer

solve literally (8) – manipulate a formula to isolate a specified variable

sort (K) – group with a common attribute

sphere (K) – a solid shape whose surface is made up of all the points that are an equal distance from the point that is the shape's center; **(8)** three-dimensional figure with all points the same distance from the center

square (K) – shape with four equal sides and angles

square root (8) – one of two equal factors of a number

square unit (centimeters, feet, inches, meters, units) (3) - a square with a side length of one unit; used to measure area

straight (K) – free from curves, bends, angles, or unevenness

subitize – to perceive at a glance the number of items presented, the limit for humans being about seven

substitution (8) – method of solving systems of linear equations by replacing variables

subtend (G) - to extend under or be opposite to: *a chord subtending an arc*

subtract, subtraction (K) – take away, determine what is left

sum, total (K) – whole amount, all together, in all

surface area (6) – the sum of the areas of the faces, or surfaces, or a three-dimensional figure

supplementary angles (7) - Angles in which measures add up to 180 degrees.

system of equations (8) – a set of two or more equations containing two or more variables

table of values (8) – a list of numbers for *x* and *y*

tall (K) – height measurement

taller (K) – higher than usual height measurement

tally table (1) - a table in which objects are counted and recorded by using tallies

tangent (AII) – ratio of the side opposite an angle and the leg adjacent that angle

tangent segment (G) - a segment of a tangent with one endpoint on the circle

ten frame (K) – mathematical tool used to organize units

tendencies (PA) – description of what a data set represents or projects

tens (K) – ten units

term (6) - a separate part of an equation, series, or expression

theorem (G) - a statement or formula that can be deduced from the axioms of a formal system by means of its rules of inference, a statement that is proven

theoretical probability (7) - Calculating a probability of a chance event based on number of possible outcomes.

three-dimensional, solid (K) – an object that has height, width, and depth

transformation (8) – a change in the size or position of a figure

translation (8) – a transformation that slides a figure along a straight line

transversal (8) – a line intersecting two or more lines

trapezoid (1) – a quadrilateral with only one pair of parallel sides

triangle (K) – three sides, three angles

trigonometry (AII) – deals with the relationship of sides and angles of triangles

truth value (G) – a statement can have a truth value of true(T) or false(F)

two-dimensional, flat (K) – a shape that only has two dimensions (example: width and height) and no thickness

two-way table (8) – data organization that shows totals for the rows and columns

undefined (G) - a basic figure that is not defined in terms of other figures, examples; points, lines, and planes

under (K) – position beneath something

unit (K) – a single thing, a group of objects making up a whole

unit rate (7) - A rate given in terms of “per one”.

unlike denominators (5) – the bottom number of a fraction; to have unlike denominators you must have two different bottom numbers, or denominators

vanishing point (G) - In a perspective drawing, a point on the horizontal line where parallel lines appear to meet

variable (6) – a symbol used to represent a quantity that can change

variability (7) - The inconsistency of data.

Vector (G) - a quantity that has both magnitude and direction

vertex (7) - The point on an angle or polygon where two lines intersect.

vertical angles (7) - A pair of angles that are opposite the intersection of two lines and are therefore congruent.

vertices/corners (K) – point where edges or sides meet

volume (K) - the amount that something holds. **(3)** A system of units for measuring capacity.

weight (K) – measurement of mass

word problem (K) – math story to be solved

zero (K) – none

zero pair (7) - Recognizing that a positive 1 combined with a negative 1 will "cancel" each other out and make 0.