Yuba River Charter School

MATH STANDARDS

Grades 1-8

Vuba River Charter School Math Standards and Assessment Grades 1–8

The following document contains the standards and assessment for mathematics, grades 1 - 8, at the YRCS as developed by the YRCS Curriculum Committee, 1997-98. A great deal of study, research and exploration of the curricula of other Waldorf-Methods schools, state standards and national math standards have been merged with existing program goals and objectives to produce this YRCS document. The resulting compilation for grades 1 - 8 reflects both academic excellence and the aesthetic enlivening sought for in Waldorf-Methods schools.

MATH STANDARDS

The curriculum standards are formatted to display both the specific skills and their corresponding assessment scores on the same page. In this manner, teachers are able to quickly diagnose problem areas and design lessons to address specific needs. Six mathematical domains or standards hold the skills for each grade level.

- Number Sense
- Computation and Procedures
- Patterns and Algebra
- Data Analysis, Statistics and Probability
- Geometry
- Measurement

Each of these standards is in turn formatted in three columns. The far left column names the specific skills for the grade level. The center numerical rubric is the quantitative score of the student in the named skill. The rubric to the far right identifies the type of assessment utilized in determining the student's score.

Each grade level is preceded by a short narrative summarizing the nature of the students' learning and the curriculum approach of that grade level.

Problem solving and mathematical reasoning are not named as specific strands because they do not represent a content domain—they cut across all six strands and are needed to succeed in any of these six domains. This format is constructed, not to reduce the importance of problem solving and reasoning, but rather to encourage teachers to promote and establish this essential component in all areas of mathematical study. Extra attention to problem solving practice has been addressed by specific objectives in the Computation and Procedures strand of each grade.

ASSESSMENT

It has been observed through the 80-year history of Waldorf education and current research in Math Pedagogy that an inundation of unquestioned, cognitive information presented in fragmented skill drills leads to a one-sided or negative relationship with mathematics. Attempts have been made, therefore, to instill an appreciation to the realm of mathematics through the discovery of and interaction with interesting mathematical phenomena from the everyday world surrounding us. This includes, but is not limited to: rhythmical patterns in nature, musical and artistic correlations, and everyday practical experiences. These forms of curriculum implementation do not always easily lend themselves to traditional test forms for assessment. In addition, students in the early grades (particularly grade one) may not be proficient enough at reading to comprehend the test directions. Therefore, for these reasons, two additional means of assessment have been added. Below is an explanation of the forms of assessment.

Forms of Assessment

- **OB Observation.** Visual and auditory observation of the standard named by the teacher or aide. Rating is an objective view of the student's success/ability.
- LB Lesson Book entries. These are problems, exercises or constructions that the student performs in his or her lesson books in class with no outside help. Rating results from the teacher corrections.
- **AT Assessment Test.** Any quiz, exam or standardized test given to measure the student's ability of any grade level skill.

In order for YRCS to have an objective "baseline-of-performance" for every student, a standard grade-level test, assessing each skill, will be administered. This document includes the assessment test for grades 1, 3 and 5. These are representative of the tests to follow. (Note that the test for grade 1 is administered by the teacher and based on her observations. As the tests move through the grades, they become more individually read and written by the student.)

However, it is STRONGLY felt that one test does NOT accurately represent a student's true ability or performance skill. A better assessment is derived from a compilation of the rubric scores gathered from various assessments (OB, LB, and AT) administered throughout the year.

Multiple assessments require time and care taken by the teacher for record keeping. A sample form for this weekly/monthly record keeping is included (Appendix 1). The rubric score checked on the standards page (Appendix 2) for each student will then reflect the average of the weekly/monthly rubrics. Finally, the year-end report (Appendix 3) will reflect the average rubric scores for all the skills under each standard.

Quantitative Rubric Scores

- 4 85 100% of the criteria presented of the named skill performed correctly. **Mastery** level.
- 60 84% of the criteria presented of the named skill performed correctly. Partial Mastery level. (Falls short of full understanding.)
 Student can reach mastery with additional work.
- 2 25 59% of the criteria presented of the named skill performed correctly. **Fragmented Comprehension** level. (Significant gaps in understanding.) Student may be able to reach mastery with help and additional work.
- 1 Less than 24% of the criteria presented of the named skill performed correctly. **Limited Comprehension** level. (Little or no understanding of concepts involved.) Student would need considerable instruction to achieve mastery.

MATH STANDARDS

GRADE ONE

In first grade, math is taught through movement, drama, music, art, and storytelling. These multisensory approaches enliven the subject.

The qualitative aspects of whole numbers one through twelve are introduced using simple arithmetic stories and visual imaginations, as are the quantitative relations of numbers up to 100 using visual representations (patterns, pictures, simple geometric forms, and models). The idea that a whole can be divided into many parts is stressed. Manipulatives, handmade or gathered from nature, give the children an opportunity to explore these concepts.

The four arithmetic operations are presented through imaginative and concrete experiences. The natures, uses, and qualities of the four processes (addition, subtraction, multiplication, division) are stressed via personifications, stories, and pictures. Their interrelatedness is important, especially the ability to move from one operation to another.

Teaching often starts with archetypal number patterns from nature. Rhythmic movement exercises are used to strengthen the memory forces and activate the children's wills.

S	TANDARDS AND SKILLS	RI	JBI	RIC	AS	SE	SSN	AENT
Α.	NUMBER SENSE	1	2	34	Ċ	DB	LB	AT
2. 3.	Compares numbers to show greater than, less than, equal to 30 Skip counts number families 2, 3, 5, 10 to the 12th multiple Can recite the 2, 5 and 10 times tables to the 12th multiple							
B.	COMPUTATION AND PROCEDURES							
	Knows addition and subtraction math facts to 12 Can represent on paper a sum or product to 12 in algorithmic form in a variety							
	of ways (e.g., 4+4, 6+2, 7+1) both horizontally and vertically							
	Can show relationship between all 4 processes by acting out number stories with real objects or by writing an algorithm that illustrates the story							
4. 5.	Knows the different "jobs" of addition, subtraction, multiplication and division Can solve mentally or in writing problems using all 4 processes (up to 12)							
C .	PATTERNS AND ALGEBRA							
1.	Can continue and extend a pattern rhythmically, symbolically, in shape or color, or numerically							
D.	DATA ANALYSIS, STATISTICS, AND PROBABILITY							
1.	With a group, can collect data and form a display and be able to indicate greater than, less than, or equal							
E.	GEOMETRY							
2.	Can kinesthetically form a circle, a square, an oval, and a rectangle with class Knows right from left Can arrange objects in space according to position and direction	=						
4.	(e.g., near, far, below, above, up, down, left, right) Can order objects by shape, volume, and size Can give and follow directions about location							
F.	MEASUREMENT							
2.	Uses non-standard units to measure Uses non-standard units to compare and order objects Estimates quantity		_ :					

GRADE TWO

In second grade students largely continue and deepen the work begun in first grade. Where first grade was the foundation, second grade is the platform upon which the higher structures will be built.

The imaginative, personified quality which still lives strongly in the 7/8year-old is used to fully develop inspiring pictures, with strong visual/narrative elements, of the operations involved in the four processes. The students are taught to differentiate between the processes and know when to use each one as well as to be able to work simple problems of each type in their head and on paper. (In written work, a strict orderliness should be remembered.)

The concepts and mechanics of carrying and borrowing are introduced with the use of manipulatives, imaginative pictures, and grouping and regrouping activities. The neat columnar writing of problems is stressed.

Review and practice of previous work is performed. The ability to write dictated and read written numbers 1-100 is firmly established before the students move on to place value. Counting by the various multiples is secured before moving on to written multiplication and division. In second grade, rhythmic counting is transformed into the times tables (2s, 3s, 4s, 5s, 10s).

Rhythmic and patterning work increase in sophistication, emphasizing the aesthetic and dynamic quality of the number line through arranging number families in various ways. Students are encouraged to consciously see order and beauty in number patterns. Visualizations of the counting patterns are introduced—string boards, group geometric forms in space, etc. Opening exercises can be built around number work—from group forms to simple computation games—and can include moving more geometric forms.

Word problems will continue as students write the simple algorithm that applies. Students solve written, oral story, and mental math problems using math concepts.

GRADE 1	rwo
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STANDARDS AND SKILLS

A. NUMBER SENSE

- 1. Rote counts to 1000
- 2. Demonstrates understanding of numbers to the hundredth place
- 3. Demonstrates 1:1 correspondence to 100 and labels with a numb
- 4. Reads and writes 3-digit whole numbers
- 5. Breaks down a 3-digit number into ones, tens and hundreds
- 6. Orders numbers to 900
- 7. Compares numbers to show greater than, less than, equal to 900
- 8. Skip counts number families 6, 9, 11 forwards and backwards to the twelfth multiple
- 9. Can recite the 2, 3, 4, 5, and 10 times tables to the twelfth multiple
- 10. Can regroup objects to show different representations of sums to 18, products to 48, and corresponding differences and quotients
- 11. Can demonstrate, using manipulatives, the concept of regrouping as used in carrying and borrowing

B. COMPUTATION AND PROCEDURES

- Knows addition and subtraction math facts to 18
 Can represent on paper a sum to 18 and a product to 24 or their oppose operations in algorithmic form in a variety of ways (e.g., 4+4, 6+2, 7-both horizontally and vertically
- 3. Can show relationship between all 4 processes by acting out number stories with real objects or by writing an algorithm that illustrates the story
- 4. Knows the different "jobs" of addition, subtraction, multiplication and division
- 5. Can solve mentally, up to a 2-digit +, algorithm or on paper, 3-digit one
- 6. Can check addition by using subtraction and vice versa
- 7. Can solve mentally or on paper very simple \times or \div fact if in 2, 3, 4, 5, 10 tables
- 8. Can draw a model as a problem-solving tool
- 9. Uses number sense to justify the reasonableness of solutions to story problems

C. PATTERNS AND ALGEBRA

1.	Can continue and extend a more complex pattern rhythmically, symbolically, in shape or color, or numerically			
	Can describe and construct patterns that show relationships among basic arithmetic facts to 18 Can identify missing object or number in a given pattern			
4.	Can create and solve problems using words, symbols, drawings, algorithms, or objects			
D.	DATA ANALYSIS, STATISTICS, AND PROBABILITY			
1.	Collects and sorts a set of objects with two or three attributes			
2.	With a group, collects data and forms a display. Able to indicate greater			
	than, less than, or equal			
3.	Analyzes data displays by making comparisons, inferences, and predictions			

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ASSESSMENT

OB LB AT

n place a number eds to 900					
h multiple					
sums to 18, nts grouping as used in					
or their opposite 4+4, 6+2, 7+1)					
but number stories s the story plication and division per, 3-digit one in 2, 3, 4, 5, 10 tables ons to story problems					
ically, ps among basic					
awings, algorithms,					
PROBABILITY outes					

GRADE	TWO
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STANDARDS AND SKILLS

E. GEOMETRY

- 1. Knows right from left
- 2. Can order objects by shape, volume, and size
- 3. Can find patterns in geometric figures
- 4. Recognizes shapes in different orientations and in relationship to each other (symmetry and congruence) through form drawing

F. MEASUREMENT

- 1. Uses non-standard units to measure length and width
- 2. Uses non-standard units to compare and order objects by length and width
- 3. Uses units of measurement in simple problem-solving situations
- 4. Estimates quantity

RUBRIC	ASSESSMENT

1	2	3	4	OB LB AT

GRADE THREE

In third grade, the students begin to develop a basic sense for practical math and an appreciation for the work which numbers and the processes can do. This first practical picture of numbers can be introduced through the work with analog clocks and calendars as well as with counting money and making change.

All forms of counting (all number families) are firmly established. (Concerns should be raised regarding children who are still experiencing difficulty in this area.) Likewise, basic additive/subtractive number facts are memorized as well as the times tables (2, 3, 4, 5, 6, 8, 9, 11). Also, by year's end, place value is established and computations using multiple place value are developed. Long addition, subtraction, and multiplication will be mastered. Subtracting from zeroes can be introduced.

Students are introduced to various units of measurement, beginning with how the standards were derived from the human form. Length, liquid weight, and money are taught using concrete experiences of measurement and measuring tools.

Some students may find division difficult and for them, instruction proceeds methodically. Work begins with even quotients and moves on to remainders. Personifications are still useful. (Avoid two-digit divisors until the mechanics of division are secure and there is some sense of estimation.) Attention is paid to memorizing the steps and their repetitive nature, as well as keeping work neatly aligned. Checking (proving) one process by using the reverse process continues.

Continued emphasis is placed on the importance of informal guessing and estimating. Students are encouraged to problem solve using various strategies.

GRADE THREE

STANDARDS AND SKILLS

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- 1. Can read, write and order numbers to 10,000
- 2. Knows place value concepts. Can break down a 4-digit number into ones, tens, hundreds and thousands
- 3. Compares numbers to show greater than, less than, equal to 10,000
- 4. Can round to tens and hundreds
- 5. Can recite 2, 3, 4, 5, 6, 8, 9, 10 and 11 times tables, to the 12th multiple, forwards and backwards
- 6. Can regroup objects to show different representations of sums and products to 144 and corresponding differences and quotients

COMPUTATION AND PROCEDURES Β.

- 1. Can access math facts (+ and to 18; \times and \div to 60) as a tool for problem solving
- 2. Uses paper and pencil to solve:
 - 3-digit addition and subtraction problems with and without regrouping
 - 3- and 4-digit multiplication problems with a 1-digit multiplier
 - 2-digit multiplication problems with a 2-digit multiplier
 - Simple long division with a remainder (i.e., 4 into 38 = 9R2)
- 3. Can check one process by using the reverse process
- 4. Can mentally solve 2-digit addition and subtraction problems and problems involving multiplication and division facts through the first 6 tables
- 5. Can use a variety of problem-solving strategies: guess and check; solve a simpler problem; make a model or drawing; act it out

C. PATTERNS AND ALGEBRA

- 1. Interprets and extends number patterns
- 2. Describes and constructs patterns that show relationships among basic multiplication facts to 9×9
- 3. Finds a missing number in an equation through 100 involving any of the 4 processes
- 4. Can create and solve problems using words, symbols, drawings, algorithms, or objects

D. DATA ANALYSIS, STATISTICS, AND PROBABILITY

- 1. Can collect data and construct displays or simple graphs. Able to indicate greater than, less than, or equal
- 2. Can analyze data displays by making comparisons, inferences, and predictions

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RUBRIC ASSESSMENT

1	2	3	4	OB LB AT
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GRADE THREE

STANDARDS AND SKILLS

E. GEOMETRY

- 1. Develops concepts of shape, size, symmetry, congruence, and similarity with two and three-dimensional shapes, using form drawing where appropriate
- 2. Determines perimeter and area of a rectangle, pictorially and arithmetically

F. MEASUREMENT

- 1. Uses non-standard units to estimate and order objects and measure lengths
- 2. Uses standard units (U.S.) to estimate, measure and compare objects
- 3. Can convert liquid measurement (cups, pints and gallons) with manipulatives
- 4. Can define units of weight measure
- 5. Selects and uses appropriate units of measurement for problem-solving
- 6. Reads and writes time to the nearest minute
- 7. Counts minutes by 1s, 5s and 10s
- 8. Knows terms before and after the hour
- 9. Can read a calendar
- 10. Solves problems requiring the use of a calendar
- 11. Reads and writes money notation to \$10,000
- 12. Uses money in real life situations up to \$10.00 to describe equivalence and make change

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1	2	3	4		OB	LB	AT	

GRADE FOUR

As a fourth grade student advances in abstract reasoning ability, the experience of the fracturing of the whole into lawfully reconstructable parts can be explored. Fractions are introduced for the first time.

However, before fractions are introduced, the 9/10-year-old must have a good facility for working with whole numbers using all four processes in long form. Students will continue to refine their understanding of multiplication, division, and number relationship, and link these to the real world. Number facts must be in place. The memorization of the tables to 12 will be completed this year, and all third grade skills are reviewed and established.

Fractions are then introduced and brought to life through story problems, manipulatives, illustrations, and group projects. They are taught carefully and methodically, first breaking a whole into parts, moving from analysis to synthesis, and then introducing the concept of numerator and denominator, and methods for expanding and contracting fractions.

Problem-solving techniques/strategies are continued as are simple measurement and geometry.

GRADE FOUR

STANDARDS AND SKILLS

A. NUMBER SENSE

WHOLE NUMBERS

- 1. Reads, writes and orders numbers to 100,000
- 2. Has secure understanding of place value
- 3. Rounds a whole number to tens, hundreds, or thousands place
- 4. Can illustrate practical application or advantage for rounding
- 5. Writes numbers from least to greatest through 10,000
- 6. Can use notational symbols <>
- 7. Can recite times tables through 12, to the 12th multiple, forwards and backwards
- 8. Can identify a prime number
- 9. Recognizes factors and multiples of 1-12 through 144

FRACTIONS

- 10. Can represent fractions through the use of numerals, manipulatives and drawings
- 11. Can build one whole using fraction pieces to twelfths
- 12. Understands parts of a fraction numerator and denominator
- 13. Can read fractions
- 14. Can compare fractions and use "greater than" and "less than"
- 15. Knows the value equivalencies of simple fractions
- 16. Can identify a common denominator
- 17. Can identify a mixed number
- 18. Can identify an improper fraction

B. COMPUTATION AND PROCEDURES

- 1. Can access all math facts as a tool for problem solving
- 2. Uses a variety of problem-solving strategies:
 - Guess and check
 - Solve a simpler model
 - Work backwards
 - Make a table or graph
 - Make a model or drawing
 - Act it out
- 3. Can check one process by using the reverse process
- 4. Can select and use the appropriate method to solve a problem (mental math, estimation, paper and pencil) and choose the operation needed
- 5. Uses paper and pencil to solve: WHOLE NUMBERS
 - Addition and subtraction of 4-digit numbers with regrouping
 - Subtraction from zeroes
 - 3-digit multiplication problems with a 3-digit multiplier
 - Long division problems with 1-digit divisors with remainders
 - Shows clear alignment of long multiplication and division problems on a page

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ASSESSMENT

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GRADE FOVR

S	TANDARDS AND SKILLS	R	Uł	BRI	[C	ASSE	CSSI	MENT
	 FRACTIONS Addition and subtraction of fractions with common denominators Establishes a simple common denominator Can mentally solve problems involving all math facts Uses mental estimation 	1 □ □	2 0 0	3 0 0 0	4 0 0 0		LB	AT
С.	PATTERNS AND ALGEBRA							
1. 2. 3. 4.	Explains how a change in one quantity can produce change in another							
D.	DATA ANALYSIS, STATISTICS, AND PROBABILITY							
	Can collect data and construct displays (including graphs, tables, charts) to represent it Can analyze data displays by making comparisons, inferences, and predictions							
E . (GEOMETRY							
	Develops concepts of shape, size, symmetry, congruence, and similarity with two and three-dimensional shapes, using form drawing where appropriate Determines the area and perimeter of right angled polygons using physical models, pictures or arithmetic							
F. 1	MEASUREMENT							
1. 2.	Measures objects to nearest ¹ / ₂ inch Uses a ruler to convert units of measurement: inches to feet, feet to yards, centimeters to meters			_				
3. 4. 5. 6.	Selects and uses appropriate units of measurement for problem-solving Converts time measurements: seconds to minutes to hours to days							
7.	Uses money in real life situations up to \$100 to compute change Describes the fractional equivalencies of a dollar							

GRADE FIVE

Fifth grade is the great period of review and consolidation. The curriculum includes all the skills gained so far. The student needs to have all times tables in place and be comfortable doing mental math using simple facts. They must be proficient in all operations with whole numbers and, by the end of the year, with fractions. Similarly, the students in need of ongoing remediation must have a firm sense that they can handle the challenges of work presented to them.

The general theme in fifth grade is fractions. The goal is that a student is able to move among whole numbers, common fractions, and decimal fractions, percents, ratios, and proportions, and to understand their relationship. All calculations involving both common and decimal fractions should be able to be done freely and easily. Calculations with inverse operations and reciprocals, brain twisters, humorous stories, and tough problems to crack, all arouse an appetite for discovery and train active forces of thinking.

In addition to reviewing all phases of mathematics introduced heretofore, extensive mental math, using sets and distribution will be worked with. A high degree of mastery with all types of computation is the goal. The communicative and associative properties can be brought as well as estimation as a tool.

The study of geometry is based on observation and imagination. The relationships of various elements of geometric form are rendered freely, without the use of instruments. Pictures of ancient Egypt/Chaldean geometry, and then Greek, are brought, as well as the relationship of area and perimeter (i.e., the square being the most efficient area/perimeter). The four-, six-, and eightfold divisions of the circle are made imaginatively, though tools may be introduced via the ancient compass (string and stick) on sand. The basic language of geometry—line, point, segment, angle, intersection, parallel, circle, polygon, etc.—is introduced. Radius, diameter, and circumference are defined. The Pythagorean theorem is introduced with the example of the equilateral right triangle. This study proceeds in a vivid manner by having students cut the proper triangles out of paper and prove by observation. The biography of Pythagoras and other Greek geometers may be told.

GRADE FIVE

STANDARDS and SKILLS

RUBRIC ASSESSMENT

A.	NUMBER SENSE	1	2	3	4	OB	LB	AT
W	HOLE NUMBERS							
	Reads, writes and orders numbers through the billions							
2.	Can round or estimate any whole number to a specific place							
3.	Can illustrate practical application or advantage for rounding							
	Can use notational symbols <>							
	Can recite times tables through 12, to the 12th multiple,							
	forwards and backwards							
6.	Recognizes and knows factors and multiples of 1-12 through 144							
	Knows prime and square numbers through 50							
	ACTIONS							
	Understands tenths and hundredths place of fractions							
	Can place common fractions in sequential order							
	Knows the value equivalencies of fractions							
	Can reduce and expand fractions using manipulatives and numerals							
	Can establish common denominators							
13.	Can change mixed numbers to improper fractions							
	Can change improper fractions to mixed numbers							
	CIMALS							
15.	Can identify decimal place value to tenths, hundredths, thousandths							
	Can order decimals							
17.	Can change fractions to decimals and back							
	Can change decimals to fractions and back							
В.	COMPUTATION AND PROCEDURES							
1	Can access all math facts previously memorized							
2.	Can use a variety of problem-solving strategies:	_	_	_	_	_	_	_
	• Guess and check							
	• Solve a simpler model							
	Work backwards							
	• Make a table or graph							
	• Make a model or drawing							
3.	Can check one process by using the reverse process							
	Can select and use the appropriate method to solve a problem (mental math,							
	estimation, paper and pencil) and choose the operation needed							
5.	Uses paper and pencil to solve:							
	WHOLE NUMBERS							
	• Addition and subtraction of 4-digit numbers with regrouping							
	Subtraction from zeroes							
	• 3-digit multiplication problems with 3-digit multiplier							
	• Long division problems with two-digit divisors with remainders							
	• Show clear alignment of long division problems on a page							
	FRACTIONS							
	• Addition and subtraction of simple fractions and mixed numbers							
	Regrouping with fractions and mixed numbers							
	• Multiplication and division of simple fractions and mixed numbers							
	Reducing a fraction to lowest terms							

GRADE FIVE

RUBRIC

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ASSESSMENT

OB LB AT

STANDARDS AND SKILLS

- Problems involving all four processes with decimal fractions
- 6. Can mentally solve problems involving learned math facts and squares
- 7. Uses mental estimation

C. PATTERNS AND ALGEBRA

- 1. Interprets, extends, and creates number patterns
- 2. Describes and constructs a math pattern using previously learned math facts
- 3. Explains how a change in one quantity can produce change in another
- 4. Can identify the rule when given pairs of numbers with a common function
- 5. Can find a missing number in an algorithm involving any of the four processes

D. DATA ANALYSIS, STATISTICS, AND PROBABILITY

1.	Can collect data and construct displays (including graphs, tables, charts and	_	_	_	_	_	_	_
2.	diagrams) to represent it Can analyze data displays by making comparisons, inferences, and predictions							
3. 4.	Can define and calculate averages Uses sampling to make probability decisions and to predict possible outcome							
E. (GEOMETRY							
1. 2.	Draws geometric shapes freehand Imaginatively divides a circle (1/4s, 1/6s, 1/8s)							
4.	Recognizes different orientations of shapes in relationship to each other (symmetry and congruence) Calculates perimeter of any polygon using whole numbers and "like" fractions							
	Calculates the area of any rectangle or triangle using standard and nonstandard measurement Can apply the relationship of area/perimeter							
F. 1	MEASUREMENT							
	Uses ruler and yardstick to measure classroom objects to the nearest ¹ / ₄ inch							
2.	Comprehends (and problem solves) simple standard length measurements, including conversions (inches, feet, yards, miles)							
3.	Comprehends (and problem solves) simple standard weight measurements,	_	_	_	_	_	_	_
4.	including conversions (ounces, pounds, tons) Comprehends (and problem solves) simple standard capacity measurements,							
	including conversions (ounces, cups, pints, quarts, gallons)							
5.	Comprehends (and problem solves) simple standard units of time, including conversions (seconds, minutes, hours, days, months, years)							
6.	Comprehends definitions of basic metric length, mass, and capacity terms	_	_	_	_	_	_	_
7.	(mm, cm, m, km; mg, g, kg; l, ml) Proficiently adds and subtracts time							
8.	Uses money in real life situations to compute change and describe equivalencies							

The instinctual sense of gain and profiteering is strong in the 11/12-yearold; to this can be added powers of discernment and judgment. Through the introduction of practical business operations that govern the flow of monies and commodities. This, of course, requires the student to move freely about in all arithmetic operations and that percentages and their practical application in business math have been mastered.

Review of previous skills continue: counting and rhythmic work; computations with fractions, decimals and primes; extensive mental math using sets; and all other mathematics previously introduced.

Students work very consciously with geometry, developing skill with the classic tools and building up concepts through orderly and pictorial proofs. The history of geometry as earth measure is reviewed, along with the biographies of famous geometers. Students will be able to recognize, name, and construct basic geometric polygons as well as be able to compute their perimeters and most of their areas, both pictorially and arithmetically. The modern tools—compass, straightedge, and protractor—can be introduced and used to divide circles (1/4s, 1/6s, 1/8s) and to learn the number of degrees in various plane figures. Students will learn to copy and bisect an angle as well as construct parallel and perpendicular lines. Finally, the concept of pi is brought pictorially and arithmetically.

Introductory algebraic manipulations are gradually be introduced so that, by year-end, students exhibit a readiness for the subject when it is introduced in seventh grade. Such algebraic concepts might include: balance, equations, order of operations, negative numbers, roots, and exponents, as well as the communative, associative, and distributive properties of addition and multiplication.

RUBRIC ASSESSMENT

STANDARDS AND SKILLS

NIIMBED CENCE

А.	NUMBER SENSE	1	Z	3	4	Ο	B LE	3 /	AT
	HOLE NUMBERS								
1.	Expresses and uses math terminology $(<, >, =)$ to the billions in identifying patterns and relationships in the place value system							1	
2.	Names and writes numbers								
3.	Rounds numbers and decimals to any place]	
	Knows Roman numerals 1-100								
	Recognizes prime and composite numbers, factors and multiples through 144								
6.	Knows square numbers, roots of perfect squares, and exponents to 144							J	
	ACTIONS	_	_	_	_	_	_		_
	Names and writes decimals to the 4th place Rounds any decimal to a specific place								
	Can identify and use the patterns among a series of equivalent fractions								Ч
2.	to predict the next fraction in the series]	
10.	Can expand/reduce common fractions								
	Can change mixed numbers to improper fractions and vice versa								
12.	Can change a fraction to a decimal and vice versa]	
	TIO and PROPORTION — PERCENTAGE								
	Has sense of ratio and simple proportion								
	Can define the terms of a ratio statement								
13.	Has sense of percentage out of decimal fraction and ratio						L	1	Ш
	SINESS MATH	_	_	_	_	_	_	_	_
	Has sense of budgets: income = expenditure								
17.	Can identify the terms selling price (cost and margin), margin (overhead and profit), loss, profit, discount	П						1	
18	Can apply percentage formula $P = BR$								
	Can apply principles of banking: interest, dividends and principle								
B.	COMPUTATION AND PROCEDURES								
1.	Can access all math facts as a tool for problem solving]	
	Can use a variety of problem-solving strategies:								
	Guess and check							-	
	• Solve a simpler model								
	Work backwards								
	Make a table or graphDraw a diagram								
	 Draw a diagram Eliminate possibilities 								
3.	Can select and use the appropriate method to solve a problem (mental math,		-	-			-	•	-
	estimation, paper and pencil) and choose the operation needed]	

4. Can solve a problem in more than one way

STANDARDS AND SKILLS

RUBRIC ASSESSMENT

12. 13. 14. 15. 16.	 Uses paper and pencil to solve: 3-digit multiplication problems with a 3-digit multiplier Division with two-digit divisor, with remainders as fractions and decimals Fraction problems involving all four processes and carrying and borrowing Mixed numbers problems involving all four processes Decimal problems involving all four processes Can mentally solve problems involving all math facts and squares Can develop ratio out of common fractions Can develop percentage out of decimals, fractions and ratio Can convert fractions to decimals, fractions to percentage and do the reverse Has memorized most common equivalencies Can work problems using interest, principle, and rate Can compute problems involving discount Can use number sense to justify reasonableness of solutions to problems involving discount Can use a calculator to add, subtract, multiply, divide accurately 	1	3	4		
С.	PATTERNS AND ALGEBRA					
2. 3. 4. 5. 6. 7.	Interprets, extends, and creates number patterns Describes and constructs patterns that show relationships among all math facts Can identify the rule for a given pair of numbers that have a common function Uses inverse operations to solve simple equations Can work formulas as the basis of equations Can perform four processes algebraically Can work problems with the correct order of operation					
8. 9.	Demonstrates understanding of communicative, associative, and distributive properties with addition and multiplication Can work with exponents					
D.	DATA ANALYSIS, STATISTICS, AND PROBABILITY					
1. 2. 3.	Can collect data and construct displays including graphs, charts and diagrams to represent them Can analyze data displays by making comparisons, inferences, and predictions Can calculate averages Can predict and analyze outcomes					

STANDARDS AND SKILLS

E. GEOMETRY

- 1. Draws geometric shapes using a straight edge and a compass
- 2. Delineates circles into various divisions (1/4s, 1/6s, 1/8s) with tools
- 3. Constructs parallel and perpendicular lines
- 4. Copies and bisects an angle
- 5. Recognizes, names and constructs basic geometric polygons: square, rectangle, triangle, parallelogram, pentagon, hexagon, octagon
- 6. Identifies and describes parts of a circle: radius, diameter, circumference
- 7. Calculates the perimeter of any polygon and the circumference of a circle
- 8. Calculates the area of a rectangle or triangle using formulas
- 9. Knows the geometric terms: point, line, segment, cord, arc, quadrilateral, prism, etc.
- 10. Knows the number of degrees in various plane figures
- 11. Can use pi arithmetically and compute the area of a circle

F. MEASUREMENT

- 1. Measures with U.S. and metric rulers
- 2. Selects and uses appropriate units of measurement in problem-solving
- 3. Can problem solve with conversions: inches to feet to yards, quarts to gallon, millimeters to centimeters to meters, seconds to minutes to hours, days to weeks to years
- 4. Estimates and measures distance and area in standard and metric units
- 5. Comprehends definitions of basic metric length, mass, and capacity terms (mm, cm, m, km; mg, g, kg; l, ml)
- 6. Proficiently adds and subtracts time
- 7. Uses money in real life situations to compute change and describe equivalencies

R	UE	BRI	С	AS	SSE	SSN	AEN	
1	2	3	4		OB	LB	AT	

The general application and transformation of formulas and equations in practical life situations forms a central part of the seventh grade math curriculum. The students are beginning to encounter the practical laws of cause and effect, and with this, they can start working strongly with estimation in their computation. However, computational skills must be firmly established, or work with estimation will be difficult to verify. Extensive mental arithmetic, using sets and distribution as in 3(3+4), are used to challenge the students. Continued mastery of the four processes using whole numbers, fractions, decimals, measurements, and word problems are reinforced.

Work also continues in business math, solving budget, percentage, and discount problems. Ratio and simple proportion problems continue, as do problems with simple formulae (P = BR; P = RT; A = lw; etc.) Facility with simple algebraic equations and work with prime and square numbers is furthered. Absolute value, signed numbers, powers, and roots are introduced.

Conscious work with geometric proofs continues, building up through triangles and parallelograms to deductive proofs of the Pythagorean theorem. Familiarity and precision are developed with all basic geometric constructions.

During this time when thinking skills are active, word problems are worked with extensively. Appropriate discriminatory strategies and skills in analyzing word problems are further developed.

STANDARDS AND SKILLS RUBRIC ASSESSMENT A. NUMBER SENSE 2 3 1 **OB LB AT** WHOLE NUMBERS — FRACTIONS 1. Can round any whole numbers or decimals to a specific place 2. Can show the meaning of and write an exponential number in standard form 3. Can write exponential notations converting 10^{n} to standard form ($10^{3} = 1,000$) 4. Writes numbers in expanded notation (356 = 300 + 50 + 6)5. Recognizes prime and composite numbers, factors, and multiples through 144 6. Can work with square numbers and roots 7. Can use and explain the relationship among fractions, decimals, and percents and make conversions with numerals, manipulatives, or drawings П 8. Identifies and plots positive and negative numbers 9. Has a sense of ratio and percentage 10. Can define the terms of a ratio and set up a proportion BUSINESS MATH — PERCENTAGE 11. Can apply these formulas: Percentage = rate x base; Interest = principle x rate; Discount = rate of discount x list price; Commission = amount of sales x rate of commission; Distance = rate x time 12. Has knowledge of banking including: mortgage, lenders, insurance, taxes, stocks, compound interest, monopoly, charge accounts, installment purchasing 13. Can apply concepts of percentage through interest, commission, salary **COMPUTATION AND PROCEDURES** Β. 1. Can quickly and accurately access all math facts as a tool for problem solving 2. Can use a variety of problem-solving strategies: • Guess and check • Solve a simpler model Work backwards • Draw diagram or Venn diagram • Systematic lists • Eliminate possibilities 3. Can select and use the appropriate method to solve a problem (mental math, estimation, paper and pencil) and choose the operation needed 4. Can solve a problem in more than one way 5. Uses paper and pencil to solve: • 3-digit multiplication problems with a 3-digit multiplier · Division with two-digit divisor, with remainders as fractions and decimals · Fraction problems involving all four processes and carrying and borrowing · Mixed numbers problems involving all four processes • Decimal problems involving all four processes · Addition and multiplication of positive and negative integers · Conversion among mixed numbers, fractions, decimals and percents · Has memorized equivalencies of fractions, decimals, percents · Calculation of fractions, decimals, and percent in real life situations

П

П

• Scientific order of operations (P-E-M-D-A-S: parenthesis, exponent, multiply, divide, add, and subtract)

STANDARDS AND SKILLS

- 6. Mentally solves problems involving four processes, sets, and distribution
- 7. Can use mental estimation
- 8. Can develop ratio out of common fractions and derive proportion from ratio
- 9. Can use formulas to solve problems (P = BR; P = RT; $\hat{I} = PRT$; A = Iw; etc.)
- 10. Can use number sense to justify the reasonableness of solutions to problems involving whole numbers, fractions, decimals, and percents
- 11. Can use a calculator to add, subtract, multiply, divide accurately

C. PATTERNS AND ALGEBRA

- 1. Interprets, extends, and creates complex number patterns
- 2. Describes and analyzes patterns to generalize relationships between values by using tables and simple rules
- 3. Can identify the rule when a pair of numbers have a common function
- 4. Uses variables in an expression or equation with positive and negative numbers \Box
- 5. Predicts and graphs ordered pairs and simple equations
- 6. Uses inverse operations to solve simple equations
- 7. Can work formulas as the basis of equations
- 8. Can perform four processes algebraically
- 9. Can work problems with the correct order of operation
- 10. Demonstrates understanding of communicative, associative, and distributive properties with addition and multiplication
- 11. Can work with exponents

D. DATA ANALYSIS, STATISTICS, AND PROBABILITY

1.	Generates and organizes data and reports in a variety of ways (tables, charts, graphs) including pictobar, line, and circle				
2. 3.	Analyzes data as fractions, decimals, and percents. Finds the average. Draws conclusions Predicts outcomes as fractions, decimals, ratios, and percents				
E. (GEOMETRY				
1. 2. 3. 4.	Can draw geometric constructions of simple and irregular polygons Divides circles into (5, 7) with tools Can draw various triangles: scalene, right, isosceles, equilateral, obtuse, acute Understands concepts of similarity and congruence in triangles, squares,				
5. 6. 7. 8. 9.	and rectangles Can compute areas and perimeters of basic polygons including a circle Can compute areas of surfaces of solids Can calculate volume of rectangular solids using formulas Can measure and construct angles using a protractor				

RUBRIC A

ASSESSMENT

1	2	3	4	OB	LB	AT

STANDARDS AND SKILLS

F. MEASUREMENT

- 1. Can select, estimate, and measure using appropriate units, tools, and formulas
- 2. Estimates and measures using all standard and metric units
- 3. Selects and uses appropriate units of measurement in problem-solving
- 4. Can problem solve using conversions of units of measurement
- 5. Uses money in real life situations to compute change, describe equivalencies, and determine percentages

	1	2	3	4	OB LB AT
5					

RUBRIC ASSESSMENT

GRADE EIGHT

Eighth graders, 13/14-year-olds, are looking towards the future; some will be very sophisticated in their thinking skills, while others still will not have matured enough to handle multiple-step operations. Idealistic concerns are very real for this age, and as much of the beauty of mathematical operations as possible is brought to the students. A review of the numerical relations they explored in the early grades can be brought back to them as aesthetic exercises. For example, the Fibonacci series, introduced earlier, now can be traced to seashells and pinecones or represented visually in a geometric drawing.

The impending demands of high school must, however, be very real for all students, and course work should take these demands into account. Every student should graduate with a firm grasp of all arithmetic operations and their applications in the areas of percentage, business problems, computations with time, estimations, practical measurements of geometric figures, 3-part formulas, and algebra. If proportionate reasoning has not been firmly established in grades 5 and 6, problems will arise in algebra comprehension. A high level of mathematical aptitude is the goal.

Geometry continues with the construction of more complex polygons as well as the platonic solids. Computation of areas and volumes of planes and solids is developed as the concept of similarity and congruence in triangles and rectangles is furthered. Continued work with proofs of the Pythagorean theory can also be done.

In algebra, more complex aspects of algebraic equations are brought. A variety of techniques for solving linear equations, inequalities, and systems of equations in applied contexts are developed. Geometrical connections to algebraic and numerical situations are explored. Graphs and the graphing of functions are taught as well as proportional reasoning to solve practical and scale figure situations.

Word problems continue to be important—especially ones that test thinking against multistep problems and utilize analytical skills and strategies. Where possible, they involve real life situations.

Ideally, the curriculum strives towards teaching an Algebra I course as preparation for a high school level algebra course.

GRADE EIGHT

RUBRIC ASSESSMENT

STANDARDS AND SKILLS

Α.	NUMBER SENSE	1	2	3	4	OB	LB	АТ
	Represents the value of a number in a variety of forms (standard, expanded, exponential, scientific notation)							
2.	Uses and explains the relationships among fractions, decimals, and percents and make conversions							
3.	Identifies and plots positive and negative numbers							
4.	Understands square numbers and roots							
5. 6.	Has a sense of ratio and percentage Can set up a proportion							
Β.	COMPUTATION AND PROCEDURES							
1. 2.	Can quickly and accurately access all math facts as a tool for problem solving Can use a variety of problem-solving strategies:							
	• Guess and check							
	Solve a simpler modelWork backwards							
	Make a table or graph							
	Make a model or drawing							
3.	Can select and use the appropriate method to solve a problem (mental math,	_	_	_	_	_	_	_
1	estimation, paper and pencil, calculator) and choose the operation needed Can solve a problem in more than one way							
	Uses paper and pencil to solve:			Ц				
0.	• Calculation of scientific order of operations (P-E-MD-AS: Parenthesis,							
	exponent, multiply, divide, add, and subtract)							
	• Addition, subtraction, multiplication, and division of whole numbers,	_	_	_	_	_	_	_
	decimals, fractions, mixed numbers, and integers							
	Calculating positive and negative integers using four processesCalculation of fractions, decimals, and percents in real life							
	situations/problems							
	Application of estimation							
6.	Can mentally solve problems involving all four processes, squares, estimation,	_	_	_	_	_	_	_
7	sets, and distribution							
7. 8.	Works extensively with proportion problems Can work problems using formulas to solve problems							
	Can use number sense to justify the reasonableness of solutions to problems			Ч				
2.	involving whole numbers, fractions, decimals, and percents							
10.	Uses calculator to add, subtract, multiply, and divide accurately							
С.	PATTERNS AND ALGEBRA							
1.	Interprets, extends, and creates complex number patterns							
2.	Describes and analyzes patterns and relationships using tables, coordinate							
~	graphs, verbal rules, and standard algebraic notation							
	Solves linear equations and formulas in problem-solving situations Solves and graphs simple linear equations and ordered pairs of numbers							
т.	Sorres and Eraphs simple mean equations and stated pairs of numbers							

GRADE EIGHT

STANDARDS AND SKILLS

RUBRIC

2

1

34

ASS	ESSM	ENT

OR IR AT

6. 7.	 Can solve formulas as the basis of equations Can apply equations with correct order of operations Works extensively with least common multiples and factors Understands distributive property of multiplication with respect to addition and multiplication 				
D.	DATA ANALYSIS, STATISTICS, AND PROBABILITY				
	Generates and organizes data and reports in a variety of ways (tables, charts, graphs) including pictobar, line, and circle Analyzes data as fractions, decimals, and percents. Finds the average. Draws conclusions Predicts outcomes as fractions, decimals, ratios, and percents				
E.	GEOMETRY				
	Displays deeper understanding of concepts of similarity and congruency in triangles, rectangles, etc. Compute ratio and proportion of polygons Computes area and perimeter of parallelograms, trapezoids, circles, and regular polygons Computes surface area of regular solids Computes volumes of regular polyhedrons (cylinders, pyramids, cones, spheres) Can construct platonic solids: cube, tetrahedron, dodecahedron, octahedron, icosahedron				
3.					
5. 6.					
F.	MEASUREMENT				
2. 3. 4.					