Interim Report 2 Math Work Group

Senate Bill 812 charges the ASRC to propose modifications to the state mathematics standards that will

a) Increase students level of achievement
b) Meet and reflect North Carolina's priorities
c) Are age level and developmentally appropriate
d) Are understandable to parents and teachers
e) Are among the highest in the nation.

In addition, the ASRC would like to make standards that

f) allow for greater teacher flexibility.

Due to numerous parental complaints, we investigated

g) so called "models" are emphasized at the expense of standard (computational) algorithms.

In the DPI survey of k-8 teachers, there were numerous complaints of "too many standards" or "too much material to cover properly in the time allowed" so this was added to our list of questions. Due to numerous typos, overly complicated standards, errors and undefined terms we added questions relating to this.

The work group has had no input on item b) and will not study it. We will assume that item e) means that the North Carolina math standards meets the National Mathematics Advisory Panel's (NMAP) guidelines for the mastery of k-8 mathematics skills mastery. This panel was convened to study how to make the U.S. mathematics education world class and issued its final report in 2008. The guidelines are listed in the appendix. Common Core does not meet these guidelines so if North Carolina does meet them, it will be a leader. The only state which meets these guidelines appears to be Minnesota.

The work group decided to analyze k-8 and high school separately due to the vast differences in the respective standards. First we will give our analysis of k-8, then high school and finally compare CCSS (NC) with two non CCSS states Minnesota and Virginial.

I K-8 ANALYSIS

The work group made a questionnaire for evaluating the above issues for K-8 which is to be found in the appendix. From this questionnaire, the work group looked at which grades, on the whole, had problems. The results are:

Summary of grade by grade study for K-8

Items to be scored:

1, Need substantial improvement pedagogically.
2. Need substantial editing (too wordy, typos, math errors, etc.)
3. Are clear to parents.
4. Are age appropriate in skills and content.
5. The teacher has flexibility in choice of teaching methods
6. There is too much material to study in one term (too many standards).
7. Are too elaborate or complicated.
8. "Models" are over emphasized at the expense of standard algorithms.
9. Allow efficient conversion to instruction.

Scores 1= strongly disagree, 2= disagree, 3=neutral,, 4=agree, 5= strongly agree.
Results: There are 6 members in the work group. The scores were added and the largest score possible is 30 while the smallest is 6. If the result was at least 22, there is a "yes" (agree) below. If the result was 14 or less there is a "no" (disagree).

Table 1

Items	K	G1	G2	G3	G4	G5	G6	G7	G8
1					yes	yes	yes	yes	yes
2	yes		yes	yes	yes	yes	yes	yes	yes
3	no	no	no	no	no	no	no	no	no
4									no
5					no				
6	yes				yes		yes		
7				yes					
8				yes	yes			yes	yes
9	no								

From this questionnaire, and from the DPI survey of teachers, the work group selected the individual standards that seemed the most problematic. They are listed here.

Table 2

Kindergarten KCC4 1 KOA1 1, 2 KOA3 1, 2 KNBT1 1, 2 KMD2 1 KG4 1 KG6 1 **Grade 1** 1OA1 1 10A3 1 10A6 1 10A8 2 1NBT4 2 1MD2 1 1G1 1 1G2 1 **Grade 2** 2NBT7 1, 2 2MD5 1	**Grade 3** 3OA3 1 3OA5 2 30A8 1, 2 3MD2 1 3MD3 1 3MD5 1 3MD7 1, 2 3MD8 1 **Grade 4** 4OA2 1 4OA3 1, 2 4NBT5 1, 2 4NBT6 1 4NF3 2 4NF4 2 4NF5 1 4MD1 1, 2 4MD2 2 4MD4 2 4MD5 1 4MD7 1	**Grade 5** 50A2 1 5NBT6 2 5NBT7 1, 2 5NF1 1 5NF4 1 5NF5 1, 2 5NF6 1 5NF7 2 5MD4 1 5G1 1 **Grade 6** 6RP3 2 6NS1 1, 2 6EE2 1 6EE9 1, 2 6G2 1 6G4 1 6SP3 2 6SP5 1, 2	**Grade 7** 7RP2 1, 2 7NS1 1, 2 7NS2 1 7EE4 1 7SP3 1, 2 7SP4 1 7SP5 1 7SP6 1 7SP7 1 7SP8 1 **Grade 8** 8NS2 2 8EE8 2 8F4 1 8F5 1 8G4 1 8SP1 1 8SP2 1 8SP3 1 8SP4 1

Criteria 1, 2 mean the following:

1. At least 4 people on the work group had some problem with the standard.
2. The teacher ratings in the DPI survey were 1 sigma above the mean and at least 2 people on the work group had some problem with the standard.

Next, the 4 people with considerable experience in teaching k-12 were asked to identify what the problems were for each of the problematic standards. A summary of the results is in the next table.

Problematic standards and their issues.

1. needs editing
2. not clear to parents
3. not age appropriate
4. no teacher flexibility
5. elaborate or complicated
6. models overemphasized
7. no efficient conversion to instruction

Table 3

identified standard	issues	identified standard	issues	identified standard	issues	identified standard	issues
KCC4	1,2	3OA3	1,5,7	5OA2	1,2,5	7RP2	1,2,3,5,6
KOA1	1,2,5,7	3OA5	1,2,3,5,7	5NBT6	1,2,4,5,6,7	7NS1	1,2,3,4,5
KOA3	1,2	3OA8	1,2,3	5NBT7	1,2,4,5	7NS2	1,2,5
KNBT1	1,2	3MD2	1,2,3,4,5	5NF1	1,2,5,6,7	7EE4	1,2,3,5
KMD2	1,2	3MD3	1,2,5	5NF4	1,2,3,4,5,6,7	7SP3	1,2,3,5
KG4	1,3,5	3MD5	1,2,5	5NF5	1,2,3,5,6	7SP4	1,2,5
KG6	1,2,3,6	3MD7	1,2,3,5,6,7	5NF6	1,6	7SP5	2
		3MD8	1,2	5NF7	1,2,5	7SP6	1,2
1OA1	1,2,3,5			5MD4	1,2,3,5	7SP7	1,2,5
1OA3	1,2,3,5	4OA2	1,2,5	5G1	1,2,4,5,7	7SP8	1,2,5
1OA6	1,2,3,5	40A3	1,2,5				
10A8	3	4NBT5	1,2,5,6	6RP3	1,2,5	8NS2	1,2,5
1NBT4	1,2,5	4NBT6	1,2,3,5,6,7	6NS1	1,2,5,6	8EE8	1,2,3,5
1MD2	1,2,5	4NF3	1,2,5,7	6EE2	1,2,5	8F4	1,2,3,5
1G1	1,2,3,5	4NF4	1,2,5,7	6EE9	1,2,3,5,6	8F5	1,2,3,5
1G2	1,2,3,4,5,6,7	4NF5	1,2,4,5	6G2	1,2,3,5	8G4	1,2,5
		4MD1	1,2,5	6G4	1,2,3,5	8SP1	1,2,3,5
2NBT7	1,2,3,4,5,,67	4MD2	1,2,5,7	6SP3	1,2,3,5	8SP2	1,2,3
2MD5	1,2,5,6	4MD4	1,2,5	6SP5	1,2,3,5,6	8SP3	1,2,3,5
		4MD5	1,2,3,5,6			8SP4	1,2,3,5
		4MD7	1,2,3				

The work group accumulated a set of topics omitted by CCSS (math), We do not specify here when they should be added. Details for this and additional topics for addition are available upon request. There are also more suggestions for topics that need more time in the classroom.

Topics omitted by Common Core

tally marks
Roman numerals
calendar, days of the week, months, seasons
ordinal numbers
Actual measurements: length, weight/mass, volume, temperature
pie charts

prime factorization
perfect squares
geometric sequences.
Venn diagrams, basic set operations
Odds (in probability)
understanding of calculator output in the grade in which they are first allowed.

More work should be included on the following topics

money counting and making change
measurements and conversions in U.S. standard units.
elapsed time
reading and writing numbers in words
multiplication and division of larger numbers

There are numerous typos, undefined terms and some mathematical errors in CCSS.

Typos (T), Undefined Terms (U) and Math Errors (M)

2G1 U angle
3NF3d M (see also 4NF2,4NF7, 5NF2) "Recognize that comparisons are valid only when the two fractions refer to same whole" Fractions are rational numbers which are derived form Peano Axioms, no "whole" is involved. The authors confuse "a fraction a/b of the whole (= x)", which is (a/b)*x with the fraction a/b. Thus the sentence is mathematically incorrect. It is especially ironic since 3NF2a makes a point of saying that a fraction is a number. Use mathematically correct terminology.
3MD2 U standard units (the metric system is not standard in the U.S.)
3G2 U unit fraction
4OA3 U remainder
5OA3 U coordinate plane
5NBT7 U written method (also in later standards)
5NF4b M unit squares don't have fractional side lengths
6RP1 U ratio; the notation is also omitted
6RP2 U unit rate
6RP3 U equivalent ratios
6NS4 U rational number
6EE2 T V = s3, A = 6s2
6EE6 U variable
6EE9 T d = 65t, what is the speed? what are the units?
6G2 M unit cubes don't have fractional side lengths
T V=b, h on next line, not V=bh
6G4 U nets
7RF1 M (1/2)/(1/4) is not a complex number a + bi. (this is in several others too)
7NS1a M opposite and equal charge
7SP2 U simulated sample
7SP8 U simulate
7SP8 U sample space
8EE4 U scientific notation
8EE6 U similar triangle
8NS2 T π2

Topics that are poorly done

Fractions.

The basic algebraic laws for adding, subtracting, multiplying and dividing fractions are not taught. Rather "visual models" are used throughout for computations. Only after the answer has been obtained by a visual model is an equation written. The brightest students who discover the rules are theoretically allowed to use them on a test, but many teachers do not obey this DPI rule. There is no good reason not to teach all students the rules for computing with fractions so that they may be used. The ultimate goal should be that all calculations with fractions should be done using the algebraic rules.

Use of "models" (visual representations of mathematics) is overdone.

The focus of k-8 instruction should be to develop the basic math skills needed for high school and college. It is good to understand concepts, but the goal should be rapid and accurate computation not only of working with arithmetic, fractions and exponents, but in manipulating expressions and equations properly. Math proceeds by stages and one cannot do a later stage without a firm grasp of the earlier stages.

Excessive use of so called models or visual methods of calculation is detrimental to the attainment of speed and accuracy in standard calculations since they are inherently inefficient. They are useful to get the concepts across or for easy mental calculations. It appears from numerous published examples and complaints from parents that some teachers are making the computations with models into monstrously complex exercises.

No test should require the use of these visual artifacts since the goal is mastery of the standard algorithms and arithmetic rules.

Functions in 8th grade

Students are asked to understand functions on a very technical level. This should be moved to high school when students are more able to handle abstractions and technicalities. In 8th grade it is enough to teach kids the idea of independent and dependent variables. If the idea of a function is to be kept, it should be simplified to "each input leads to one output" That is all that is need at this point.

Probability and Statistics are extremely poorly done in grades 6-8.

The authors make the work too complicated, technical and obscure. It is often hard to see what the students are supposed to learn, and the authors gloss over many nuances and important ideas.

The work done in grades 6-8 should be kept simple and comprehensible and the more detailed work moved to high school.

A large problem is that statistics and probability contain many subtleties, many possible situations, and many ramifications. For example, what kinds of distributions of data or probability functions are there in practice and in theory? When is the median a better measure of the "center" of data that the mean? When is a random sample not appropriate? How does one insure that one is making a random sample? How many samples are needed to get an accurate picture of a large population or a probability function? Can statistics be used to mislead others?

It is not clear how much students can absorb at such an early age. It is worthwhile for k-8 students to learn some ideas, **but the presentation must be kept simple and accurate**.

This means the topics " Mean Average Deviation" (MAD), Interquartile Range (IQR) and Box plots should be omitted. "Mean Average Deviation" is hard to calculate and is nowhere used in outside of CCSS (it has no statistical meaning whereas the standard deviation does). IQR requires students to learn four cases for computing it and box plots depend on IQR. As a measure of the "variation" of the data, min and max (range) and plots such as dot plots, pie charts or histograms tell the story well.

Sampling a large population to get an idea of its statistical or probabilistic features is often required in grade 7. There no discussion at all on the number of samples needed. Perhaps the authors intended that the students find this out by experiment, but if so, the experiments used are very inadequate. The authors don't seem to realize that it usually takes a large number of sample points and probably have not heard of confidence intervals.

"Simulation" is often mentioned and it is never described but it should be. Usually it is done on a computer, and it is completely obscure what the authors have in mind.

7.SP.8 appears to be completely useless. There is no work with probabilities for compound data which require conditional probabilities. The authors don't know that simple counting techniques can fail to give the right answer for the number of outcomes in a sample space of a compound event. At this level, there is no need for more than tree diagrams to represent compound events. Part c) is unrelated to parts a), b). Discard it standard.

The statistics in grade 8 are much simpler and easier,, not on the same level of difficulty..

Congruence and similarity

These should be done the old way, and not through rigid motions (translations, rotations, reflections) and dilations. This approach is college level work, and while amusing and instructive, cannot be used for proof at this level. They use up too much time and cannot be made rigorous at this level.

Equivalence of expressions

The definition used in CCSSM (6EE4) is "when the two expressions name the same number regardless of which value is substituted into them". The authors are essentially defining equality of functions. The definition should be "two expressions are equivalent when one can be derived from the other by valid mathematical operations. This is a true equivalence relation and it immediately follows that the expressions must yield the same values when numbers are plugged in for variables.

Comparison of North Carolina, Minnesota and Virginia k-8 Math standards

The work group looked at math standards from all states not currently using CCSSM: Virginia, Minnesota, Texas, and Nebraska. We selected Virginia (copyright 2/2/2009) because it was specifically written to allow teacher flexibility in teaching and Minnesota (2007 no copyright) because it met the NMAP guidelines for mastery of basic topics. We note that on the 2013 National Assessment of Educational Progress (NAEP) tests, Minnesota ranked first in 4th grade and 3rd in 8th grade scores. NAEP tests a sample of students nationwide in 4th, 8th and 12th grades every two years to find out how well the students in each state perform in math and other subjects. All states participate, so that one can compare educational outcomes.

There are common attributes to both sets of standards which contrast sharply with CCSSM. These are:

1. They are concise and to the point,
2. Patterns are more consistently taught through all the grades,
3. Statistics and probability are done in a sensible way,
4. Prime factorization is included.
5. There is emphasis on number facts and measurable (testable) mastery of them
6. Both allow the teacher considerable flexibility in teaching.

Yet there are differences. The Minnesota standards are clear and provide examples of what is to be taught and so require no "Curriculum Frameworks" (a.k.a "unpacking") Virginia's standards are stated in a more general way and so Virginia provides lengthy "Curriculum Frameworks" for each grade k-8. These clarify what is to be done in the classroom, give examples and provide definitions for teachers.

Minnesota meets the NMAP guidelines and CCSSM does not. Because Virginia's standards are so general and vague, it is not possible at this time to determine whether or not Virginia meets the NMAP guidelines.

The vagueness of the Virginia standards and lack of examples also means that parents do not have knowledge of exactly what happens in the classroom. Parents are prohibited from looking at the Curriculum Frameworks which do explain what is happening in the classroom.

Minnesota seems to use fewer "models" (visual representations of math) than CCSSM and identifies them so that a teacher is not encouraged to use a large number of complicated "models".

Minnesota's standards are clear, whereas CCSSM (North Carolina version), contains many typos, undefined terms, confusing terms, some verbose and elaborately worded standards and a few very poorly done standards. See our initial analysis and discussion of the statistics standards.

k-8 Recommendations

CCSSM is touted as being "better that what most states had previously," and have been adopted by many states. However, they need considerable repair as we have shown in the first part of this report. In order for North Carolina to be "best in the nation and world class" its standards must satisfy the NMAP guidelines. .

There are two possible ways to improve North Carolina's k-8 math standards. One option is to adopt the Minnesota standards, with perhaps some editing to fit North Carolina's needs. This option is supported by the performance of Minnesota's students on the NAEP tests. Additionally, Minnesota's standards satisfy the NMAP guidelines and are clear to parents. We are recognize that NC teachers do not want to create all lesson plans. Converting from Common Core to Minnesota's standards should be smooth as many standards are similar. Efforts to find text books are encouraged as NC teachers have made that request. Virginia has found k-8 texts.

The second possibility is to rewrite and edit North Carolina's current standards, bringing them into line with the NMAP guidelines, simplifying language for teachers and parents, and correcting the flaws documented above. However, we do not recommend this course of action since it will not be easy to correct poor standards.

In either case, we recommend that the group making the new standards have a developmental child psychologist, one or two university faculty, and a number of experienced teachers from North Carolina schools who have good reputations. This committee should be chosen by the State Board of Education rather than the DPI because some members of the DPI have extensive connections with the national common core group.

II HIGH SCHOOL ANALYSIS

As we researched the high school standards, we concluded they are seriously deficient and flawed. For example, standards appear multiple times in Math I, II and III. In Math I and II, there are 8 repeated categories of standards which contain 23 common standards. In Math I an III there are 8 repeated categories which contain 24 common standards. In Math II and III there are 10 repeated categories which contain 29 common standards. The common standards are identical, except for about 3-5 which have different subsections A table is given in the Appendix.

This repetition of standards creates confusion about specific content and in level of difficulty from course to course. This confusion applies equally to parents and teachers. It is hard to see how the high school Common Core standards are actually workable standards.

Contributing to the difficulty for a teacher in making a lesson plan and for parents to understand the standards, the high school standards are often general and vague. For example, A-IC.6 is "Evaluate reports based on data." There are extremely few examples to guide the teacher as to the level and nature of the instruction. The writing style is starkly different than that used in K-8. In Education Week 2/25/15, Prof. William G. McCallum, a math professor and one of the lead writers of Common Core said of the writing of the high school math standards: "Everybody had their pet topic. But all those topics, they're all good things to learn. High school was hard. The whole exercise was trying to bring people together to agree on things." In the same article, math professor Hung-Hsi Wu, who served on the development team said "The amount of time given to the high school standards was definitely inadequate. We were so busy with K-8."

A glaring defect is the nearly complete absence of examples, which are used to indicate the topic content and the skill level being taught. In stark contrast with K-8, there are no examples of application to real world problems. There is no clear statement of what skills the students should have after completing the courses.

These facts about Math I, II, III support the conjecture that the standards were written in some kind of outline form and then chopped up into pieces to fill out three courses. It is not clear from the standards that they are integrated in the usual sense of the word, which means to combine and unify. The synergy between the topics is hard to detect.

A consequence of the fragmentation is the sense that teachers hop from one topic to another. Teachers, parents and students notice this. Some parents complain that their child has not mastered a topic before the topic changes. Some teachers say that they have to devote extra time to a review of a topic when they come back to it, which is a waste of time in an already crowded schedule. Others express frustration in being unable to connect ideas from one unit to the next as they complete a study of probability and jump to quadratic equations for example. The building of concepts is difficult with a curriculum composed of disjoint “pet topics.”

A lack of textbooks for CCSS creates additional confusion as to what is expected from students as well as a tremendous variance in what teachers are teaching. Parents complain to teachers and administrators about this because they cannot help their children at home.

The DPI made a voluntary anonymous survey of the teachers in North Carolina. About 5% of them responded. The responders are not a random sample carefully selected across experience groups, but we think the results should not be ignored. They show a strikingly high number of high school teachers who think many standards should be revised.

The Common Core math high school standards omit topics suggested by the NMAP report, whereas the old Algebra 1, Geometry and Algebra 2 do not. A copy of the NMAP requirements for high school is in the appendix.

Of additional concern is the slighting of geometry. Geometry in CC has been reduced to algebraic formulae for geometric theorems involving missing sides or missing angles. Logic, deductive reasoning and formal proof have been eliminated is all forms. Omitting theses topics creates a gap in learning that students will need for higher level courses and college level mathematics. Additionally, many standardized tests such as the OAT, LSAT and MedCats have large sections on deductive reasoning. Of equal importance is the many applications of deductive and indirect reasoning that adults apply daily. With the national emphasis on critical thinking, it is difficult to discern why CC has omitted logic and formal proof in geometry. Furthermore, exact solutions for the trig functions for the standard 30-60-90 and 45-45-90 triangles are omitted.

Laws of exponents are not taught per se, but they are supposed to be used in R-RN.1. Logarithms are not anywhere defined and their properties and not developed. Consequently the connection between exponents and logarithms is lost.

Too many common functions, such as logarithms, trig functions, exponential functions, are plotted with a calculator with no proper definition or discussion of them. This reduces the study of them to mere button pushing on a calculator, the antithesis of education. For example, in Math I, F-IF.7 students are required to plot trigonometric functions and logarithms. Neither has been defined or studied yet. Trigonometric functions on the whole real line are not defined until Math III. Trigonometric ratios for right triangles are defined in Math II.

Factoring is slighted. Little emphasis is given to basic multiplication and factoring patterns. Factoring is reduced to the simplest examples, which means that students will not be prepared for college level work. As a further consequence, rational expressions are given little attention as factoring skills are needed to add and subtract rational expressions as well as to reduce those expressions.

Of additional concern is the complete absence of matrices anywhere in the curriculum. Matrices are widely regarded for their use in application problems as well as ties to science curricula, particularly genetics.

Probability is poorly done. There is no explicit instruction for counting principles for sampling with and without replacement and the related calculations, which are crucial at the beginning level. The authors do not know that counting principles will not always give the right probability for compound events.

Standards S-CP.1 to S-CP.9 in Math II are all theoretical but one. It is not clear what kinds of problems that students are expected to master or whether they are expected to memorize the probability rules. Set theory is slighted and Venn diagrams are not taught. One cannot study the general laws of probability satisfactorily without these. Conditional probability is difficult and Bayes Theorem, a very important part of conditional probability in its application, is not taught. The authors don't realize that the probability rules are not restricted to uniform probability models. These standards will take up a lot of teaching time since the teacher has to augment and clarify the material.

Recommendations.

After careful examination and discussion of the high school standards, we find truth in Prof. McCallum and Prof. Wu’s statements and concerns of an inadequate curriculum. While the proponents of CCSSM proclaim greater "understanding", we find that CCSSM is "a mile wide and an inch deep" due to the repeating the same standards from Math I to Math III. This vague repetition projects confusion in what the standards really mean or if there are any standards for a particular course at all. . There are simply too many unidentified prerequisite skills to be covered in the allotted class time. The obvious ripple effect is less critical thinking and a weaker command of the basic skills needed to succeed. Our recommendation is that NC should return to the sequence of study Algebra I, Geometry and Algebra II. Algebra I should be a course in which students master algebraic skills that they can apply in later courses and use that vessel of knowledge to think critically. We believe that you have to know something in order to think critically about it. Geometry should return with an emphasis on traditional Euclidean geometry and proof; however, all of the common core algebraic applications should be included. Algebra II should build on Algebra I and Geometry, including critical thinking, algebraic proof, applications of skills acquired in the two previous courses, conic sections, and more in-depth study of factoring, graphing, matrices, functions and logarithms. North Carolina's students deserve a strong curriculum that builds on skills to develop the knowledge to think critically about mathematics.

Appendix

Questionnaire 1

Questions regarding CCSS.
These questions relate to the requirements of SB812 and other issues. Give a score for the whole grade in general. We will do one grade at a time.
Score as follows: 1=strongly disagree, 2=disagree, 3=neutral, 4=agree, 5=strongly agree.
In the space below the question, list the standards by number that are problematical.

Grade:

Statement	Score
Need substantial improvement pedagogically. List the ones that need improvement.	
Need substantial editing (too wordy, typos, math errors, etc.) List the ones needing editing.	
Are clear to parents. List the ones that need clarification.	
Are age appropriate in skills and contant. List the ones which are not.	
The teacher has flexibility in choice of teaching methods List the ones that constrain the teacher too much.	
There is too much material to study in one term (too many standards). List the standards which could be deleted or downplayed.	
Are too elaborate or complicated. List those that are.	
"Models" are over emphasized at the expense of standard algorithms. List the standards that do this.	
Allow efficient conversion to instruction. List the ones that do not.	

List other problems you have with the standards as written. What improvements can be made?

NMAP guidelines for K-8
(page 20 of their final report)

Fluency with whole numbers
1. By the end of grade 3, students should be proficient with addition and subtraction of whole numbers.
2. By the end of grade 5, students should be proficient with multiplication and division of whole numbers.

Fluency with fractions
1. By the end of grade 4, students should be able to identify and represent fractions and decimals, and compare them on a number line or with other common representations of fractions and decimals.
2. by the end of grade 5, students should be proficient with comparing fractions, decimals and common percent, and with the addition and subtraction of fractions and decimals.
3. By the end of grade 6, students should be proficient with multiplication and division of fractions and decimals.
4. By the end of grade 6, students should be proficient with multiplication and division of fractions and decimals.
5. By the end of grade 7, students should be proficient with all operations involving positive and negative fractions.
6. By the end of grade 7, students should be able to solve problems involving percent, ratio and rate and extend this work to proportionality.

Geometry and Measurement
1. by the end of grade 5, students should be able to solve problems involving perimeter and area of triangles and all quadrilaterals having at least one pair of parallel sides (i.e. trapezoids).
2. By the end of grade 6, students should be able to analyze the properties of two dimensional shapes and solve problems involving perimeter and area, and analyze properties of three dimensional shapes, and solve problems involving surface area and volume.
3. By the end of grade 7, students should be familiar with the relationships between similar triangles and the concept of the slope of a line.

NMAP: The major topics of school algebra (to be completed by grade 11)
Symbols and Expression

Polynomial expressions
Rational expressions
Arithmetic and finite geometric series

Linear Equations

Real numbers as points on the number line
Linear equations and their graphs
Solving problems with linear equations
Linear inequalities and their graphs
Graphing and solving systems of simultaneous linear equations

Quadratic Equations

Factors and factoring of quadratic polynomials with integer coefficients
Completing the square in quadratic experessions
Quadratic formula and factoring of general quadratic polynomials
Using the quadratic formula to solve equations

Functions

Linear functions
Quadratic functions - word problems involving quadratic functions
Graphs of quadratic functions and completing the square
Polynomial functions (including graphs of basic functions)
Rational exponents, radical expressions and exponential functions
Logarithmic functions
Trigonometric functions
Fitting simple mathematical models to data

Algebra of Polynomials

Roots and factorization of polynomials
Complex numbers and operatios
Fundamental theorem of algebra
Binomial coefficients (Pascal's Triangle)
Mathematical induction and the binomial theorem

Combinatorics and Finite Probability

Combinations, permutations, as applications of the binomial theorem and Pascal's Triangle.

There are no comments about what should be in high school geometry.

High School standards by category and number by grade and overlap

					Overlap	
Group	Math I standards	Math 2 standards	Math III standards	I, II	I, III	II, III
NRN	1 2	2	3	1	0	0
NQ	1 2 3	1 2 3	1 2 3	3	3	3
ASSE	1 2 3	1 2 3	1 2 3 4	3	2	3
AAPR	1	1 5	1 2 3 4 6	1	1	2
ACED	1 2 3 4	1 2 3 4	1 2 3 4	4	4	4
AREI	1 3 5 6 10 11 12	1 2 4 7 10 11	1 2 4 10 11	3	3	5
FIF	1 2 3 4 5 6 7 8 9	2 4 5 7 8 9	2 4 5 7 8 9	5	6	6
FBF	1 2 3	1 3	1 2 3 4	2	3	2
FLE	1 2 3 5		3 4	0	1	0
GCO	1	2 3 4 5 6 7 8 10 13	1 9 10 11 12	0	1	1
GGPE	4 5 6 7	1 6	1 2	1	0	1
GGMD	1 3	4		0	0	0
SID	1 2 3 5 6 7 8 9		4	0	0	0
GSRT		1 6 7 8 9 11	2 3 4 5	0	0	0
GMG		1 2 3	3	0	0	1
SIC		2 6	1 3 4 5 6	0	0	1
SCP		1 2 3 4 5 6 7 8 9		0	0	0
GC			1 2 3 5	0	0	0
SMD			6 7	0	0	0
NCN			1 2 7 9	0	0	0
FTF			1 2 5 8	0	0	0
			Sums	23	24	29

About 3-5 standards have different parts.

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