OKLAHOMA STANDARDS
DEVELOPMENT COMMITTEE

Overview for Draft #3 of Oklahoma Academic Standards

Mathematics

September – October, 2015

Oklahoma State Department of Education

Agenda

- The Law
- The Process
- The Standards
- Feedback

The Law

- HB 3399 requires that Oklahoma create new Oklahoma Academic Standards in English language arts and math by 2016.

- The Oklahoma Academic Standards will ensure students are prepared for higher education and the workforce and reflect Oklahoma values.

OKLAHOMA STANDARDS DEVELOPMENT COMMITTEE

Oklahoma Mathematics Standards Writing Team

Member	Title	Work Affiliation
Dr. Stacy Reeder	Associate Professor, Mathematics Education and Chair, Department Instructional Leadership and Academic Curriculum	The University of Oklahoma
Stacy Weinand	High School Mathematics Teacher	Norman Public Schools
Dr. Darlinda Cassel	Associate Professor	University of Central Oklahoma
Dee Atkins	Teacher	Stillwater Public Schools
Paige Bergin, M. Ed.	5th Grade Teacher	Union Public Schools
Sara Snodgrass, M. Ed./NBCT	Adjunct Professor	The University of Oklahoma
Dr. Juliana Utley	Associate Professor, Mathematics Education and Interim Associate Dean, OSU College of Education	Oklahoma State University
George Abshire, M. Ed.	Teacher	Jenks Public Schools
Andrea Brock, M. Ed.	Curriculum Coordinator	Moore Public Schools
Nicole Shobert, M. Ed.	Clinician Instructor	Oklahoma State University - Tulsa
Dr. Carol Lucas	Associate Professor Department of Mathematics	University of Central Oklahoma
Linda Hall	Mathematics Consultant	Edmond Public Schools
Shari Gierhart	High School Teacher	Tuttle Public Schools
Toni Slagle Herriman, M. Ed.	High School Teacher	Collinsville Public Schools
Dr. Shannan Bittle, Ed. D.	Mathematics Curriculum Specialist	Union Public Schools
Julie Owens, M. Ed.	Curriculum Director	El Reno Public Schools
Dr. Courtney Lockridge	Curriculum Director	Piedmont Public Schools
Alana McAnally, M. Ed.	Director of Developmental Mathematics	University of Central Oklahoma
Levi Patrick, M. Ed.	Director of Secondary Mathematics Education	Oklahoma State Department of Education
Robbyn Glinsmann, M. Ed.	Director of Elementary Mathematics Education	Oklahoma State Department of Education

Oklahoma Academic Standards for Mathematics 2015 Writing Process

OKLAHOMA STANDARDS DEVELOPMENT COMMITTEE

Imagine a classroom, a school, or a school district where all students have access to high-quality, engaging mathematics instruction.

NCTM, 2000

The Math Team's Process

Goal

Develop exemplary mathematics standards for Oklahoma students that prepare them to be college and career ready.

May (Initial Development)

- Kick off meeting was held May 1st & 2nd with entire team to set goals and begin writing process
- Writing team discussed and developed process skills and format for the new standards document
- Grade band teams worked either online or in person to create their part using a variety of resources (NCTM, Minnesota, ACT, etc.)
- Co-Chairs compiled the work from the grade band teams to create the 1st draft
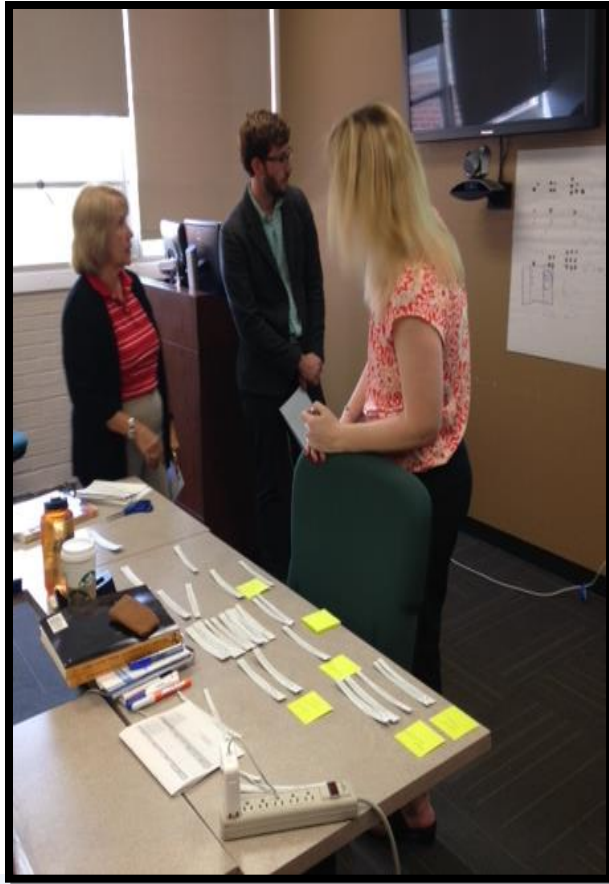- 1st draft was submitted to the Steering Committee on June 2nd

OKLAHOMA
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Elementary Grade Band Team Planning & Brainstorming

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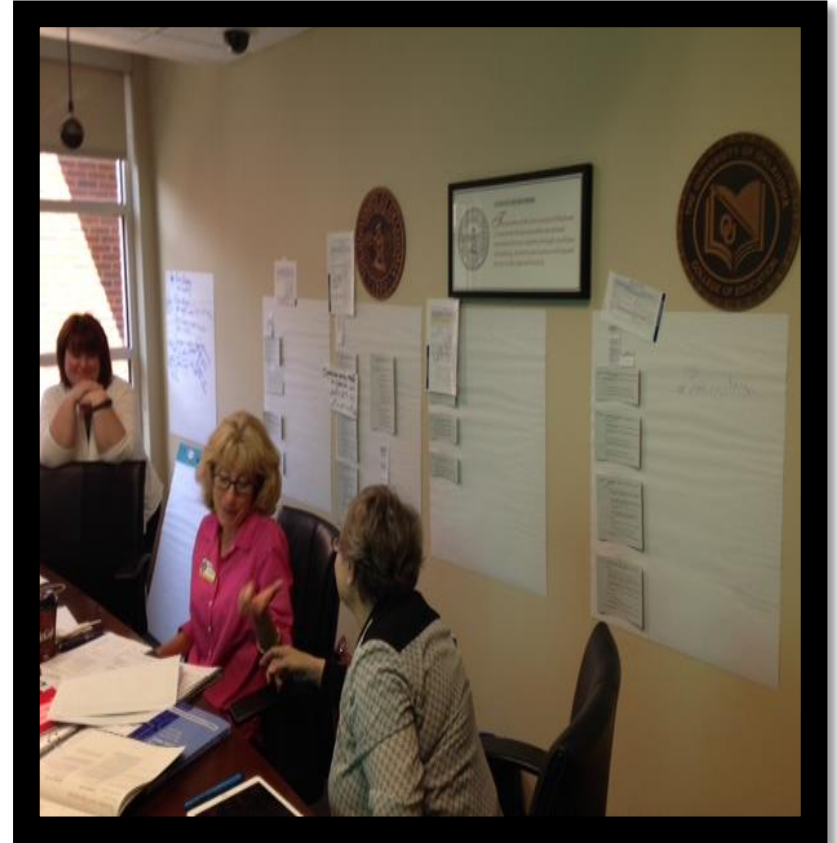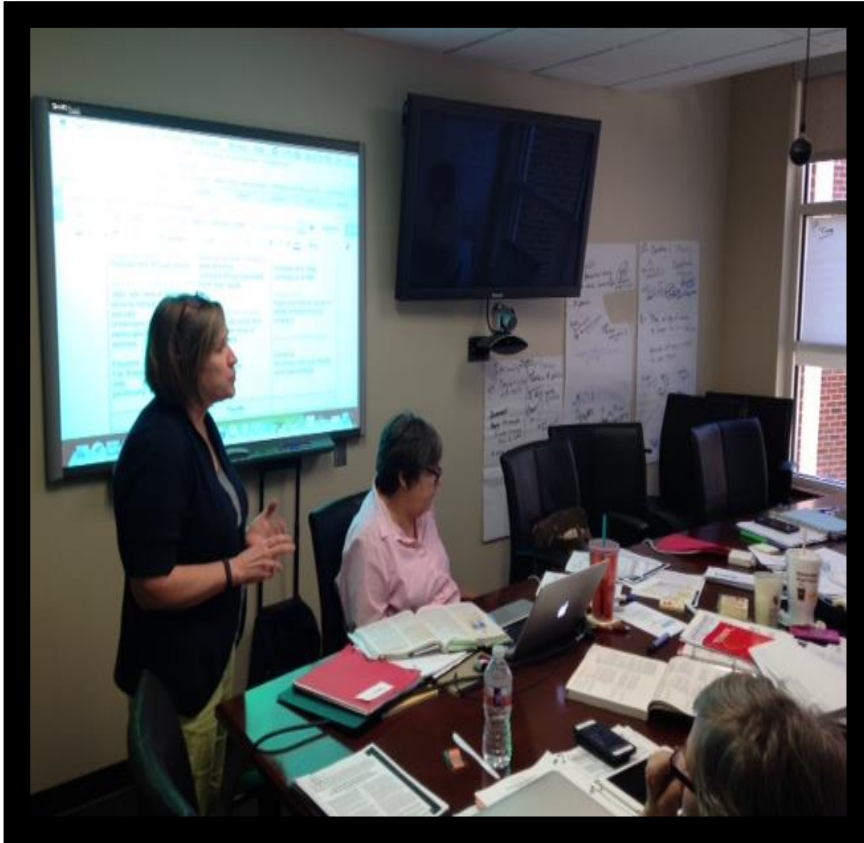
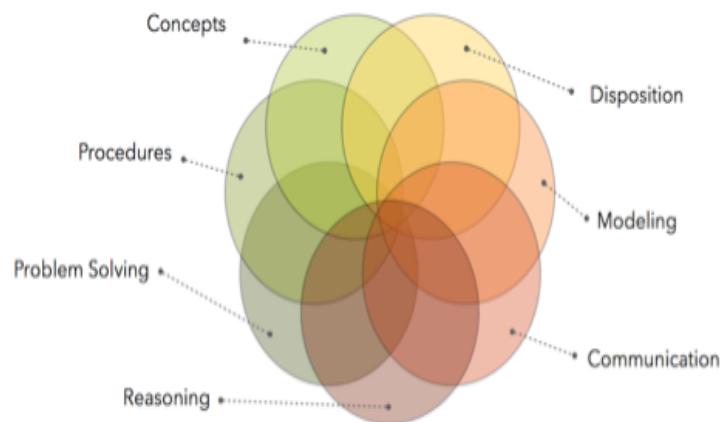# Middle School Grade Band Team Hard at Work!
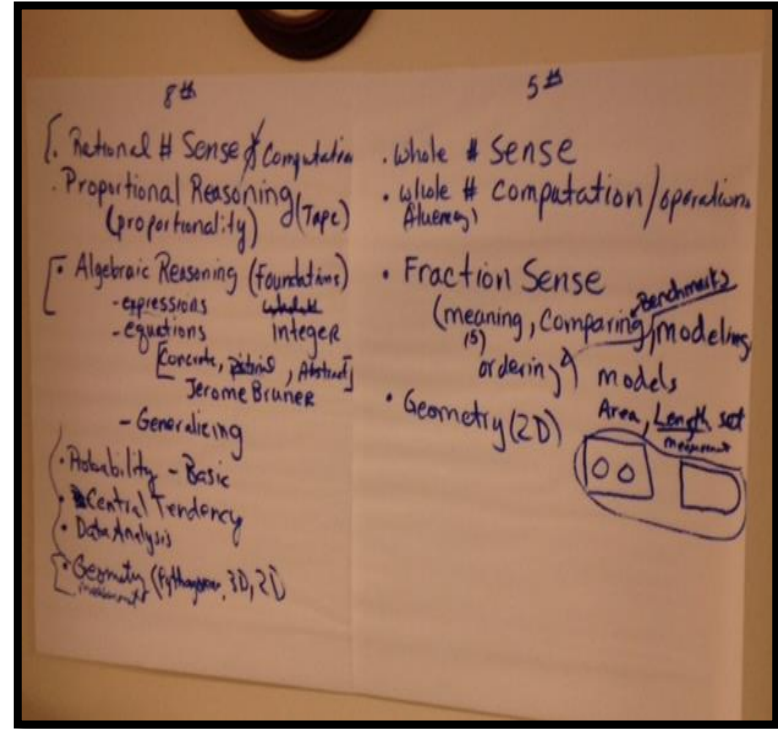
Main Content Strands

- Algebraic Reasoning and Algebra

- Number and Operations

- Geometry and Measurement

- Data and Probability

High School Grade Band Writing Team

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Mathematical Actions & Processes

Throughout their Pk-12 education experience, mathematically literate students will:

Develop a Deep and Flexible *Conceptual* Understanding

Pursue a deep and flexible conceptual understanding of mathematical concepts, operations, and relations while making mathematical and real-world connections.

Develop Accurate and Appropriate *Procedural* Fluency

Pursue efficient procedures for various computations and repeated processes based on a strong sense of numbers. They will develop a sophisticated understanding of the development and application of algorithms and procedures.

Develop Strategies for *Problem Solving*

Analyze the parts of complex mathematical tasks and identify entry points to begin the search for a solution. They will select from a variety of problem solving strategies and use corresponding multiple representations (verbal, physical, symbolic, pictorial, graphical, tabular) when appropriate. They will pursue solutions to various tasks from real-world situations and applications that are often interdisciplinary in nature. They will find methods to verify their answers in context and will always question the reasonableness of solutions.

Develop Mathematical *Reasoning*

Explore and communicate a variety of reasoning strategies to think through problems. They will apply their logic to critique the thinking and strategies of others to develop and evaluate mathematical arguments, including making arguments and counterarguments and making connections to other contexts.

Develop a Productive Mathematical *Disposition*

Hold the belief that mathematics is sensible, useful and worthwhile. They will develop the habit of looking for and making use of patterns and mathematical structures. They will persevere and become resilient, effective problem solvers.

Develop the Ability to Make Conjectures, *Model*, and Generalize

Make predictions and conjectures and draw conclusions throughout the problem solving process based on patterns and the repeated structures in mathematics. They will create, identify, and extend patterns as a strategy for solving and making sense of problems.

Develop the Ability to *Communicate* Mathematically

Develop the ability to communicate mathematically. They will discuss, write, read, interpret and translate ideas and concepts mathematically. As they progress, students' ability to communicate mathematically will include their increased use of mathematical language and terms and analysis of mathematical definitions.

Geometry and Measurement

4.GM.1. Apply mathematical actions and processes to name, describe, classify and construct polygons.

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**4.GM.1.1** Describe, classify and construct triangles, including equilateral, right, obtuse and acute triangles. Recognize triangles in various contexts. **4.GM.1.2** Describe, classify and construct quadrilaterals, including squares, rectangles, trapezoids, rhombuses, parallelograms and kites. Recognize quadrilaterals in various contexts.

Sample Problems or Classroom Activities

FORTHCOMING

Algebraic Reasoning and Algebra

6.A.3 Apply mathematical actions and processes to understand and interpret equations and inequalities involving variables and positive rational numbers. Use equations and inequalities to represent real-world and mathematical problems; use the idea of maintaining equality to solve equations. Interpret solutions in the original context.
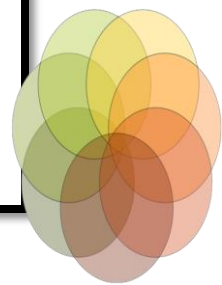
Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**6.A.3.1** Represent real-world or mathematical situations using equations and inequalities involving variables and positive rational numbers. **6.A.3.2** Solve equations involving positive rational numbers using number sense, properties of arithmetic and the idea of maintaining equality on both sides of the equation. Interpret a solution in the original context and assess the reasonableness of results. **6.A.3.3** Model, write, solve, and graph one-step equations with one variable using number sense, the properties of operations, and the properties of equality (e.g., $1/3x = 9$).

Sample Problems or Classroom Activities

Resource note for 6.A.3.2: Use a balance to model an equation and show how subtracting a number from one side requires subtracting the same amount from the other side. Hands on equations and balance tasks can help students move from the concrete to the pictorial to the abstract.

The app "Solve Me Mobiles" for tablet and the Balance Task app found on the NCTM Illuminations website will be helpful for students working to understand solving equations.

MORE FORTHCOMING

Functions

A2.F.1 Apply mathematical actions and processes to understand functions as descriptions of how related quantities vary together (covariation).

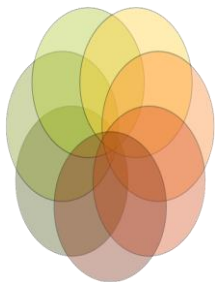| Mathematical Actions and Processes	Mathematical Standard
- Develop a Deep and Flexible Conceptual Understanding - Develop Accurate and Appropriate Procedural Fluency - Develop Strategies for Problem Solving - Develop Mathematical Reasoning - Develop a Productive Mathematical Disposition - Develop the Ability to Make Conjectures, Model, and Generalize - Develop the Ability to Communicate Mathematically	**A2.F.1.1** Use algebraic, interval, and set notations to specify the domain and range of functions of various types. **A2.F.1.2** Graph a quadratic function and identify the x- and y- intercepts, maximum or minimum value, axis of symmetry, and vertex using various methods and tools which may include a graphing calculator. **A2.F.1.3** Model a situation that can be described by a quadratic function and use the model to answer questions about the situation. **A2.F.1.4** Graph exponential and logarithmic functions and identify asymptotes and x- and y- intercepts using various methods and tools which may include graphing calculators. Recognize exponential decay and growth graphically and symbolically. **A2.F.1.5** Model a situation that can be described by an exponential or logarithmic function and use the model to answer questions about the situation. **A2.F.1.6** Graph a polynomial function and identify the x- and y- intercepts, relative maximums and relative minimums, using various methods and tools which may include a graphing calculator. **A2.F.1.7** Model a situation that can be described by a polynomial function and use the model to answer questions about the situation.
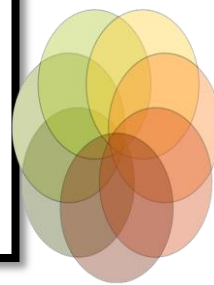
June (Vertical Alignment)

- 1st draft reviewed by Review Team defined by legislation consisting of representatives from the following groups:
  - Higher Education (OSRHE);
  - Career Tech; and
  - Department of Commerce

  Note: Representatives from the ROPE Commission also reviewed the first draft.

- 1st draft edited to reflect comments from the Review Team

- Vertical alignment document created

- 2nd draft submitted on June 29

Appendix C -- Vertical Alignment Charts

| Number and Operations			
Grade 5	**Grade 6**	**Grade 7**	**Pre-Algebra**
5.N.1 Apply mathematical actions and processes to divide multi-digit numbers and solve real-world and mathematical problems using arithmetic. **5.N.1.1** Estimate solutions to division problems in order to assess the reasonableness of results. **5.N.1.2** Divide multi-digit numbers, using efficient and generalizable procedures, based on knowledge of place value, including standard algorithms. Recognize that quotients can be represented in a variety of ways, including a whole number with a remainder, a fraction or mixed number, or a decimal and consider the context in which a problem is situated to select and interpret the	**6.N.1** Apply mathematical actions and processes to read, write, represent and compare positive rational numbers expressed as fractions, decimals, percents and ratios; write positive integers as products of factors; use these representations in real-world and mathematical situations. **6.N.1.1** Locate positive rational numbers on a number line. **6.N.1.2** Compare positive rational numbers represented in various forms using the symbols <, >, and =. **6.N.1.3** Explain that a percent represents parts out of 100 and ratios to 100 (e.g., 75% corresponds to the ratio 75 to 100 which is equivalent to a ratio of 3	**7.N.1** Apply mathematical actions and processes to read, write, represent and compare positive and negative rational numbers, expressed as integers, fractions and decimals. **7.N.1.1** Know that every rational number can be written as the ratio of two integers or as a terminating or repeating decimal. Recognize that π is not rational, but that it can be approximated by rational numbers such as $\frac{22}{7}$ and 3.14. **7. N.1.2** Locate positive and negative rational numbers on a number line and understand the concept of opposites. **7.N.1.3** Compare and order positive and negative rational numbers expressed in various forms using the symbols <, >, =, $\leq$, and $\geq$.	**PA.N.1** Apply mathematical actions and processes to read, write, compare, classify and represent real numbers, and use them to solve problems in various contexts. **PA.N.1.1** Develop and apply the properties of positive and negative integer exponents to generate equivalent numerical expressions, including $a^0 = 1$. **PA.N.1.2** Express approximations of very large and very small numbers using scientific notation; understand how calculators display numbers in scientific notation. Multiply and divide numbers expressed in scientific

Money

Kindergarten	1st Grade	2nd Grade	3rd Grade
Identify U.S. coins by name, including pennies, nickels, dimes, and quarters.	Identify U.S. coins, including pennies, nickels, dimes, and quarters, by value and describe the relationships among them. Write a number with the cent symbol to describe the value of a coin. Use relationships to count by ones, fives, and tens to determine the value of a collection of pennies, nickels, and/or dimes.	Determine the value of a collection(s) of coins up to one dollar (e.g. given 2 dimes and 1 quarter, recognize you have 45¢, person 1 has 15¢ and person 2 has 25¢, together they have 40¢) Limited to: whole numbers. Select a combination of coins to represent a given amount of money up to one dollar.	Use addition to determine the value of a collection of coins or bills up to $20. (e.g. 45¢ + 30¢= 75¢, $11 + $9=$20). Limited to: whole numbers Select the fewest amount of coins for a given amount of money up to one dollar.
4th Grade	**5th Grade**	**6th Grade**	**7th Grade**
Model, read and write decimals up to at least the hundredths place in a variety of context including money. Given a total cost and amount paid, find the change required in a variety of ways.	Add and subtract fractions and decimals, using efficient and generalizable procedures, including standard algorithms in order to solve real world and mathematical problems including those involving money, measurement, geometry, and data.	Solve real-world and mathematical problems including those involving money, measurement, geometry, and data requiring arithmetic with decimals, fractions and mixed numbers.	Calculate the percent of a number and determine what percent one number is of another number to solve problems in various contexts (e.g., sales tax, markup, discount, percent error, tip).

Kindergarten	1st Grade	2nd Grade	3rd Grade
None	Partition a regular polygon into equal pieces (e.g., halves, thirds, fourths).	Identify the parts of a set and/or area that represent fractions for halves, thirds and fourths. Construct equal sized portions through fair sharing including length and set area models for halves, thirds, and fourths.	Read and write fractions with words and symbols. Order and compare, including equivalent unit fractions and fractions with like denominators by using models, reasoning about their size and an understanding of the concept of numerator and denominator.

| 4th Grade	5th Grade	6th Grade	7th Grade
Represent equivalent fractions using fraction models (e.g. parts of a set, fraction circles, fraction strips, number lines and other manipulatives). Decompose a fraction in more than one way into a sum of fractions with the same denominator using concrete and pictorial models and recording results with symbolic representations (e.g. 3/4 = 1/4 + 1/4 + 1/4). Use fraction models to add and subtract fractions with like denominators in real world and mathematical situations. Develop a rule for addition and subtraction of fractions with like denominators.	Estimate sums and differences of fractions and decimals to assess the reasonableness of the results. Model addition and subtraction of fractions and decimals using a variety of representations (e.g., fraction strips, area models, number lines, Cuisenaire rods). Add and subtract fractions and decimals, using efficient and generalizable procedures, including standard algorithms in order to solve real world and mathematical problems including those involving money, measurement, geometry, and data.	Estimate solutions to problems with whole numbers, decimals, fractions, and mixed numbers and use the estimates to assess the reasonableness of results in the context of the problem. Model multiplication and division of fractions and decimals using a variety of representations (e.g., fraction strips, area models, number lines, Cuisenaire rods). Multiply and divide fractions and decimals, using efficient and generalizable procedures, including standard algorithms.	Add, subtract, multiply and divide positive and negative rational numbers that are integers, fractions and terminating decimals; use efficient and generalizable procedures, including standard algorithms.

Fractions
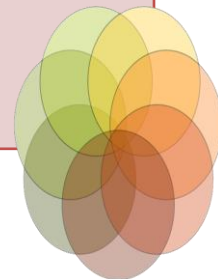
July (Public input)

- July 1st meeting of representatives from Oklahoma Council of Teachers of Mathematics (OCTM), Central Math Consortia, Southeastern Math Consortia, and Northeastern Math Consortia.

- Development of a survey to solicit input from all stakeholders in Oklahoma (http://bit.ly/OklahomaMathStandardsFeedback)

- Town hall meeting and sessions at the ENGAGEOK conference July 7-9

- Use the comments/suggestions from the public review to revise the 2nd draft

- Submit the 3rd draft in August

OKLAHOMA STANDARDS DEVELOPMENT COMMITTEE

July 1 Review

- 40 teachers from 27 different schools from Freedom, Ada, Tahlequah, Claremore, Tishomingo, Elgin, and many more.
- SIMPLE TO UNDERSTAND // OPPORTUNITIES FOR DEPTH // STRONG PROGRESSION
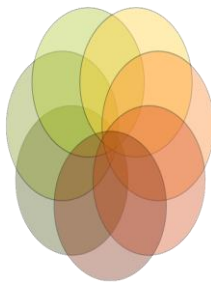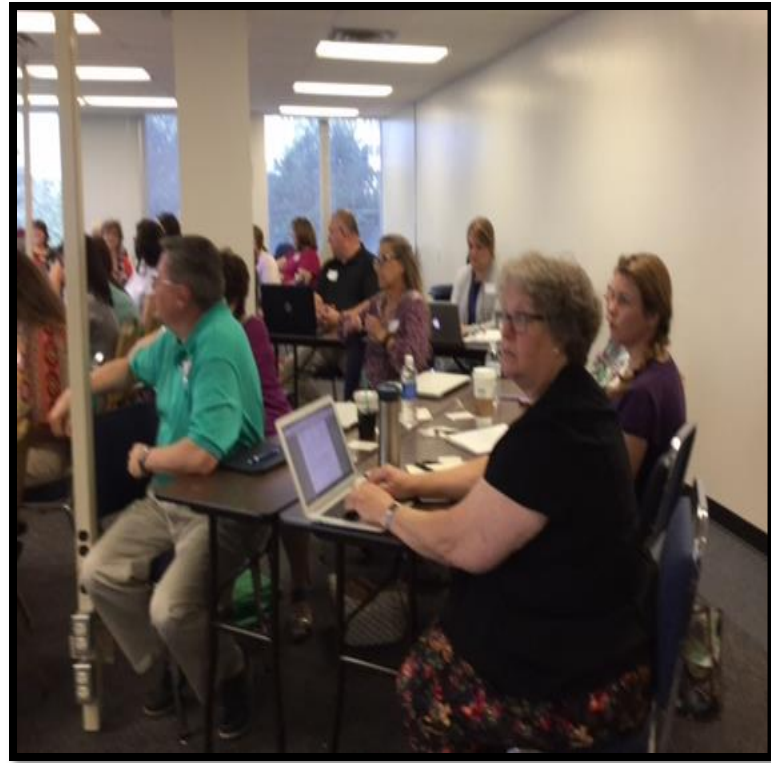
Mathematics Writing Team Request To Steering Committee:

We would like to add an additional set of standards at the high school level at a later date. We have discussed creating standards for a **Statistics** course, **Pre-Calculus** course or some type of **senior year mathematics course** for students not interested in taking any high school mathematics beyond Algebra II. Such a course might support a reduction in the number of students who require mathematics remediation beyond high school.

The Process

INCLUSIVE

INTERACTIVE

INTENSIVE

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Stakeholder Feedback

INCLUSIVE

Multiple opportunities existed (and still exist) through multiple venues (town halls, focus groups, surveys, expert reviews) for Stakeholder Feedback as described in *Oklahoma Academic Standards – Stakeholder Input Fact Sheet*.

Stakeholder Feedback

Writing committee members read all comments; thoroughly discuss and consider issues raised; and incorporate research-based recommendations into the current iteration of the Oklahoma Academic Standards.

OKLAHOMA STANDARDS DEVELOPMENT COMMITTEE

External Reviews – Content Experts For Draft #2

- Oklahoma State Department of Education Town Hall at EngageOK

- Southern Regional Education Board (SREB)

- Partnership for 21st Century (P21)

- South Central Comprehensive Center (SC3) at University of Oklahoma

OKLAHOMA STANDARDS DEVELOPMENT COMMITTEE

Publishing

- Draft #3 available for review at:

  http://ok.gov/sde/newstandards

INTENSIVE

External Reviews – Content Experts
For Draft #3

= YOU!

Please complete Feedback Form
provided by your facilitator.

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The Process Continues . . .

YOUR QUESTIONS?

OKLAHOMA
STANDARDS
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Oklahoma State Department of Education