



Teacher Training on the Revised Math Standards

Math Grades 6–8

The logo consists of a red square with the letters 'TN' in white, serif font. Below the red square is a dark blue horizontal bar.

TN

**Welcome &
Introductions**

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Agenda: Day 1

Time	Content
8–11:15 (includes break)	<p>Part 1: The Standards</p> <ul style="list-style-type: none">▪ M1: Standards Review Process▪ M2: TN Academic Standards▪ M3: Summary of Revisions
11:15–12:30	Lunch (on your own)
12:30–4 (includes break)	<p>Part 2: Diving into the Standards</p> <ul style="list-style-type: none">▪ M4: Know-Do-Understand <p>Part 3: Instructional Shifts</p> <ul style="list-style-type: none">▪ M5: Revisiting SMP's and Instructional Shifts▪ M6: Literacy Skills for Mathematical Proficiency

Agenda: Day 2

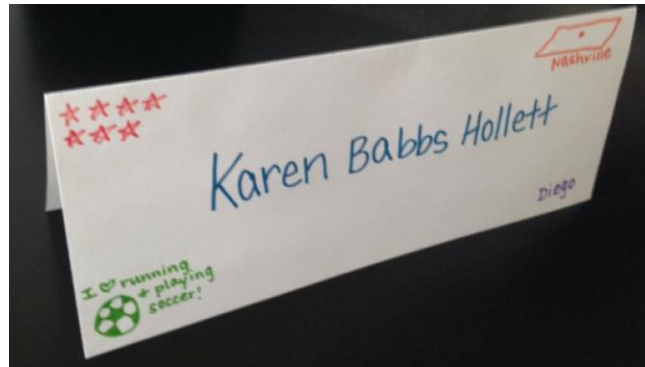
Time	Content
8–11:15 (includes break)	Part 4: Assessment <ul style="list-style-type: none">▪ M7: Connecting Standards and Assessment
11:15–12:30	Lunch (on your own)
12:30–4 (includes break)	<ul style="list-style-type: none">▪ M8: Evaluating Instructional Materials Part 5: Putting it All Together <ul style="list-style-type: none">▪ M9: Instructional Planning

Norms

- Keep students at the center.
- Be present and engaged.
- Be reflective and solutions oriented.
- Challenge ideas with respect.
- Monitor airtime.

Introductions

- Make a name tent
 - Top left corner: # of ★ = how many years you have taught
 - Top right corner: where you're from
 - Bottom left corner: your favorite hobby
 - Bottom right corner: the name of a student who inspires you to learn and improve

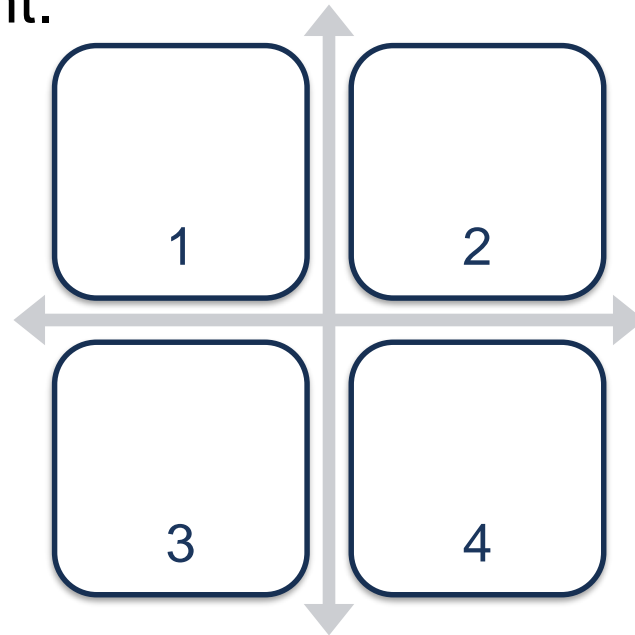


Today's Goals

- Review the standards revision process.
- Highlight changes/revisions to standards.
- Use a KUD exercise to deepen our understanding of the expectations of the standards.
- Discuss the instructional shifts and their relationship to the Standards for Mathematical Practice (SMPs).
- Explore the Literacy Skills for Mathematical Proficiency.

Appointment with Peers

- Create an appointment with four fellow participants by having them sign your manual.
- Participant partners will meet together during the training to discuss content.



Key Ideas



Key Ideas



Strong Standards

Standards are the bricks that should be masterfully laid through quality instruction to ensure that all students reach the expectation of the standards.

High Expectations

We have a continued goal to prepare students to be college and career ready.

Key Ideas



Instructional Shifts

The instructional shifts are an essential component of the standards and provide guidance for how the standards should be taught and implemented.

Aligned Materials and Assessments

Educators play a key role in ensuring that our standards, classroom instructional materials, and assessments are aligned.



Part 1: The Standards

Key Idea



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Module 1: Standards Review Process

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Standards Review Process

Public Comment Period – November 2014



Educator Advisory Teams Review – April 2015



Standards Review and Development Committee – Fall 2015



Revised Standards Released for Public Comment – October 2015



Standards Recommendation Committee – January 2016

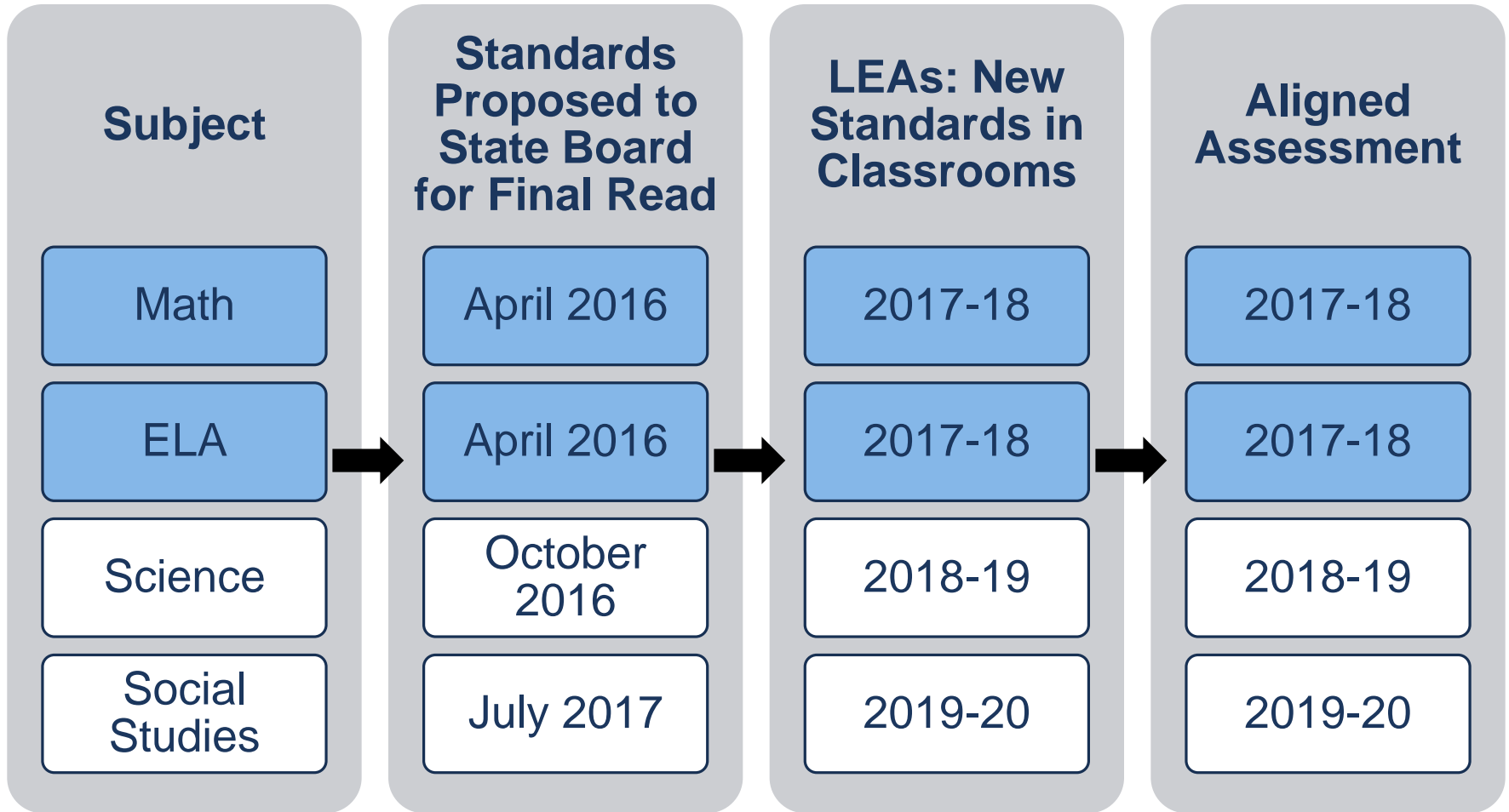


State Board of Education Approval – April 2016

Educator Advisory Team Members



Standards and Assessment Timeline



Standards Revision Key Points

- The instructional shifts remain the same and are still the focus of the standards.
- The revised standards represent a stronger foundation that will support the progression of rigorous standards throughout the grade levels.
- The revised standards improve connections:
 - Within a single grade level, and
 - Between multiple grade levels.

Excellence and Equity

- “Districts and schools in Tennessee will exemplify excellence and equity such that all students are equipped with the knowledge and skills to successfully embark upon their chosen path in life.”
- **Comment: Please insert graphic as a background on page 19. It has the arrows going up.**
- What is your role in ensuring that all students are college and career ready?



**Module 2:
Tennessee Academic
Standards for
Mathematics**

Goals

- Reinforce the continued expectations of the Tennessee Math Academic Standards.
- Revisit the three instructional shifts and their continued *and* connected role in the current standards.
- Review the overarching changes to the current Tennessee Math Academic Standards.

Setting the Stage

- Read and annotate the General Introduction to the TN Math Standards (page 1–2).
- After reading and annotating the two parts, write the sentence or phrase you felt was the most important in your participant manual on page.
- Be prepared to share with your colleagues.



What Has NOT Changed

Overview of Similarities

- Students **prepared** for college and career

Overview of Similarities

- Students prepared for college and career
- **K–12 learning progressions**

The Learning Progressions

K	1	2	3	4	5	6	7	8	HS
Counting & Cardinality									
Number and Operations in Base Ten						Ratios and Proportional Relationships		Number & Quantity	
			Number and Operations – Fractions		The Number System			Number & Quantity	
Operations and Algebraic Thinking						Expressions and Equations		Algebra	
								Functions	Functions
Geometry									Geometry
Measurement and Data						Statistics and Probability		Statistics & Probability	

Overview of Similarities

- Students **prepared** for college and career
- K–12 **Learning Progressions**
- Traditional and integrated **pathways** (for high school)

Overview of Similarities

- Students prepared for college and career
- K–12 Learning Progressions
- Traditional and Integrated pathways
- Standards for **Mathematical Practice**

Standards for Mathematical Practice

Standards for Mathematical Practice

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

Overview of Similarities

- Students prepared for college and career
- K–12 Learning Progressions
- Traditional and Integrated pathway
- Standards for Mathematical Practices
- **Instructional shifts**

Instructional Shifts

- **Focus**

- The standards are focused on fewer topics so that students can dig deeper within the mathematics.

- **Coherence**

- Topics within a grade are connected to support focus. Additionally, standards are linked across grades to ensure vertical coherence.

- **Rigor**

- The standards set expectations for a balanced approach to pursuing conceptual understanding, procedural fluency, application, and modeling.



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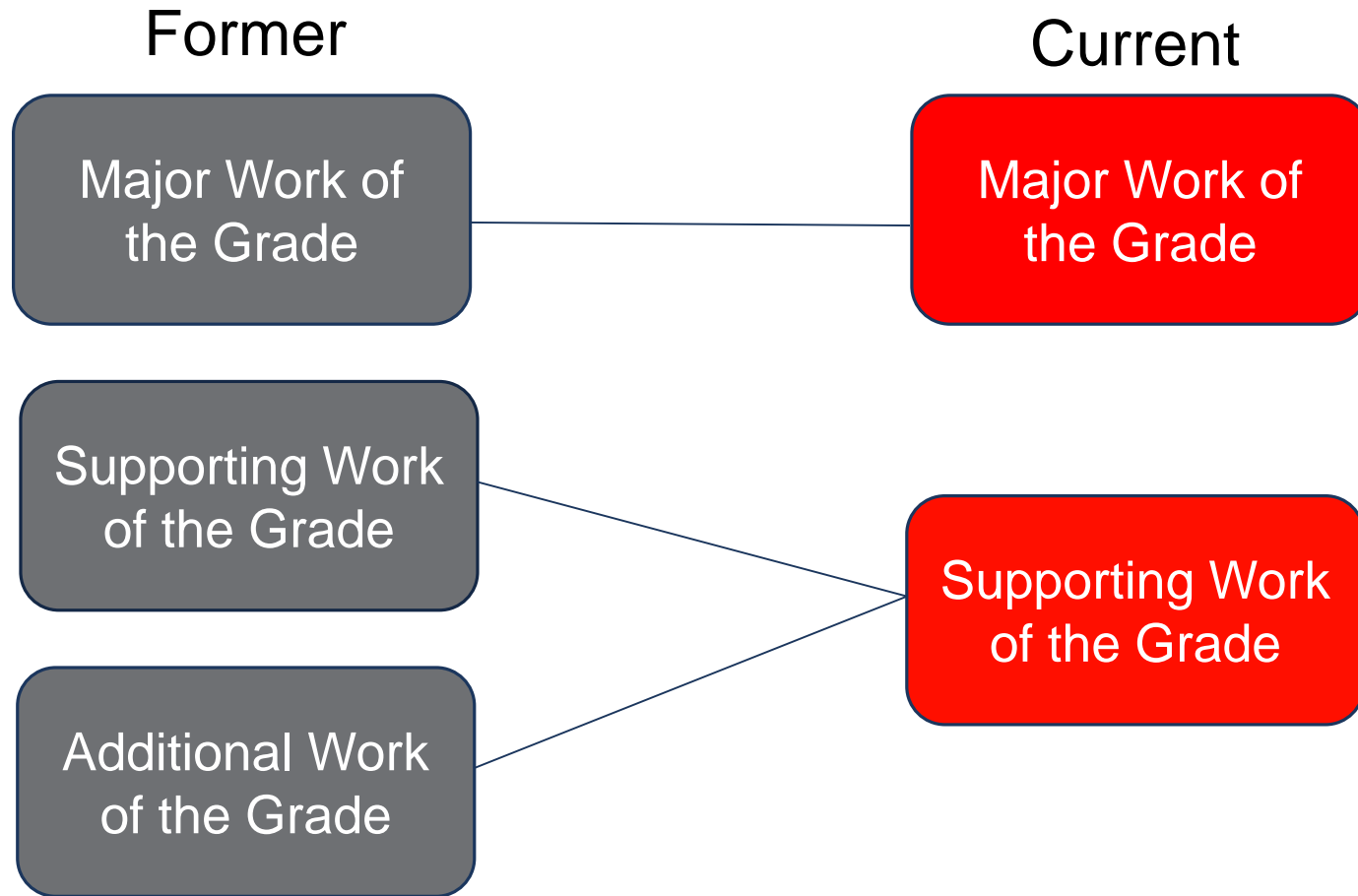
What Has Changed

Overarching Revisions K–12

K–12

- Revised structure
- Literacy Skills for Mathematical Proficiency

Category Change



Revised Structure

		Operations and Algebraic Thinking (OA)	
		Cluster Headings	Content Standards
Operations and Algebraic Thinking	Use the four operations with whole numbers to solve problems.	<p>A. Use the four operations with whole numbers to solve problems.</p> <p>(See Table 1 - Addition and Subtraction Situations and Table 2 - Multiplication and Division Situations)</p>	<p>4.OA.A.1 Interpret a multiplication equation as a comparison (e.g., interpret $35 = 5 \times 7$ as a statement that 35 is 5 times as many as 7 and 7 times as many as 5). Represent verbal statements of multiplicative comparisons as multiplication equations.</p>
	Gain familiarity with factors and multiples.		<p>4.OA.A.2 Multiply or divide to solve contextual problems involving multiplicative comparison, and distinguish multiplicative comparison from additive comparison. <i>For example, school A has 300 students and school B has 600 students: to say that school B has two times as many students is an example of multiplicative comparison; to say that school B has 300 more students is an example of additive comparison.</i></p>
	Generate and analyze patterns.		<p>4.OA.A.3 Solve multi-step contextual problems posed with whole numbers and having whole-number answers using the four operations, including problems in which remainders must be interpreted. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding.</p>
		<p>B. Gain familiarity with factors and multiples.</p>	<p>4.OA.B.4 Find all factor pairs for a whole number in the range 1–100. Recognize that a whole number is a multiple of each of its factors. Determine whether a given whole number in the range 1–100 is a multiple of a given one-digit number. Determine whether a given whole number in the range 1–100 is prime or composite.</p>
		<p>C. Generate and analyze patterns.</p>	<p>4.OA.C.5 Generate a number or shape pattern that follows a given rule. Identify apparent features of the pattern that were not explicit in the rule itself. <i>For example, given the rule "Add 3" and the starting number 1, generate terms in the resulting sequence and observe that the terms appear to alternate between odd and even numbers. Explain informally why the numbers will continue to alternate in this way.</i></p>

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s with a symbol for

tions, including g for the unknown ting.

its factors. whether a given

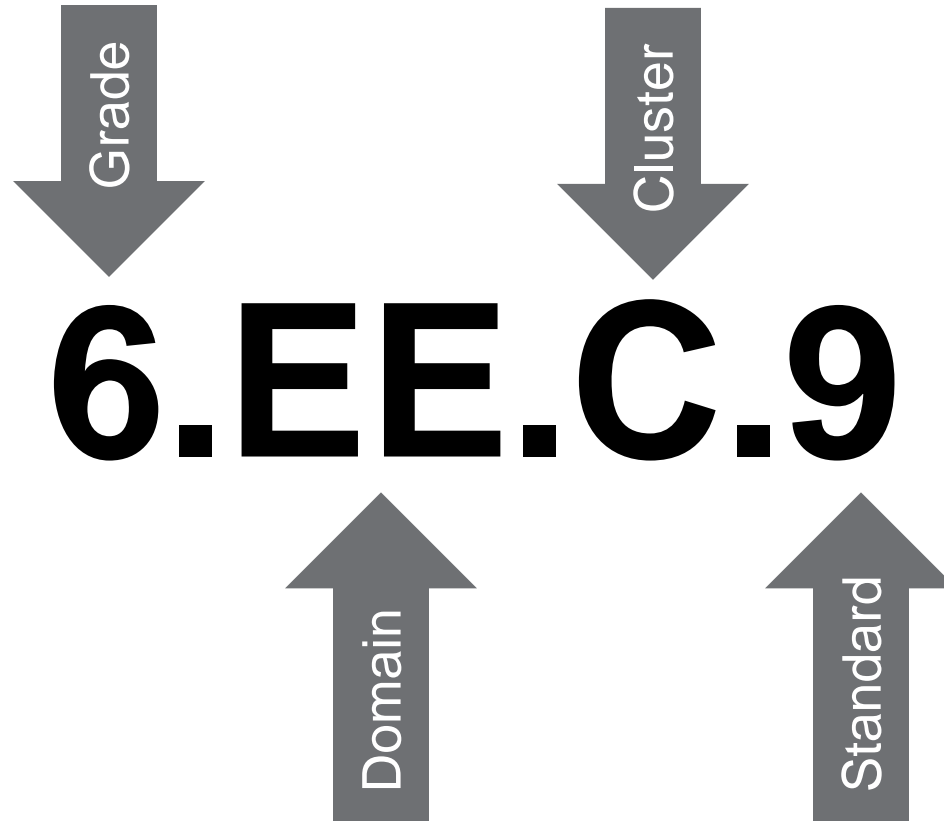
ot explicit in the rule observe that the terms n this way.

	Major Content		Supporting Content
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High School: Scope & Clarification

Cluster Headings	Content Standards	Scope & Clarifications
<p>B. Solve equations and inequalities in one variable.</p>	<p>A1.A.REI.B.3 Solve quadratic equations and inequalities in one variable.</p> <ul style="list-style-type: none"> a. Use the method of completing the square to rewrite any quadratic equation in x into an equation of the form $(x - p)^2 = q$ that has the same solutions. Derive the quadratic formula from this form. b. Solve quadratic equations by inspection (e.g., for $x^2 = 49$), taking square roots, completing the square, knowing and applying the quadratic formula, and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions 	<p><i>For A1.A.REI.B.3b:</i></p> <p><i>Tasks do not require students to write solutions for quadratic equations that have roots with nonzero imaginary parts. However, tasks can require the student to recognize cases in which a quadratic equation has no real solutions.</i></p> <p><i>Note: solving a quadratic equation by factoring relies on the connection between zeros and factors of polynomials. This is formally assessed in Algebra II.</i></p>
<p>C. Solve systems of equations.</p>	<p>A1.A.REI.C.4 Write and solve a system of linear equations in context.</p>	<p><i>Solve systems both algebraically and graphically.</i></p> <p><i>Systems are limited to at most two equations in two variables.</i></p>

Nomenclature and Coding



Nomenclature and Coding

8.F.B.4

Literacy Skills for Mathematical Proficiency

Communication in mathematics requires literacy skills in reading, vocabulary, speaking, listening, and writing.

Literacy Skills for Mathematical Proficiency

1. Use multiple reading strategies.
2. Understand and use correct mathematical vocabulary.
3. Discuss and articulate mathematical ideas.
4. Write mathematical arguments.

Module 2 Review

- Reinforce the continued expectations of the Tennessee Math Standards.
- Revisit the three instructional shifts and their continued *and* connected role in the revised standards.
- Review the overarching changes to the revised Tennessee Math Standards.

10-Minute Break





**Module 3:
Summary of Revisions
by Grade Band**

Goals

- Review a summary of the revisions to the math standards by grade band.
- Compare 2016-17 standards to 2017-18 standards.

Turn & Talk

“To assess student achievement accurately, teachers and administrators must know and understand the content standards that their students are to master. Again, we cannot teach or assess achievement that we have not defined.”

—S. Chappuis, Stiggins, Arter & J. Chappuis (2006)

Revisions to Math Standards

Specific
to
K–5

- Refined for clarity
- Increased fluency expectations
- Revised examples

K–5: Overarching Revisions

- **Supporting and additional work of the grade is combined as supporting work of the grade**
- Increased fluency expectations
- Added/shifted a small number of standards to strengthen coherence across grade levels
- Revised language to provide clarity and continuity
- Highlighted chart for grade-level mastery expectations for addition, subtraction, multiplication, and division

K–5: Overarching Revisions

- Supporting and additional work of the grade is combined as supporting work of the grade
- **Increased fluency expectations**
- Added/shifted a small number of standards to strengthen coherence across grade levels
- Revised language to provide clarity and continuity
- Highlighted chart for grade-level mastery expectations for addition, subtraction, multiplication, and division

Sample Revision: K–2

	Increased Fluency Expectations	
	Former Standard	Current Standard
Kindergarten	K. OA.5 Fluently add and subtract within <u>5</u> .	K.OA.A.5 Fluently add and subtract within <u>10</u> using mental strategies.
First Grade	1.OA.6. Add and subtract within <u>20</u> , demonstrating fluency for addition and subtraction within <u>10</u> .	1.OA.C.6 Fluently add and subtract within <u>20</u> using mental strategies. By the end of Grade 1, know from memory all sums up to <u>10</u> .
Second Grade	2.OA.2 Fluently add and subtract within <u>20</u> using mental strategies. By end of Grade 2, know from memory all sums of two one-digit numbers.	2.OA.B.2 Fluently add and subtract within <u>30</u> using mental strategies. By the end of Grade 2, know from memory all sums of two one-digit numbers and related subtraction facts.

K–5: Overarching Revisions

- Supporting and additional work of the grade is combined as supporting work of the grade
- Increased fluency expectations
- **Added/shifted a small number of standards to strengthen coherence across grade levels**
- Revised language to provide clarity and continuity
- Highlighted chart for grade-level mastery expectations for addition, subtraction, multiplication, and division

Sample Revision: K–2

	Former Standard	Current Standard
Kindergarten	No Past Standard	K.MD.B.3 Identify the penny, nickel, dime, and quarter and recognize the value of each.
First Grade	No Past Standard	1.MD.B.4 Count the value of a set of like coins less than one dollar using the ¢ symbol only.
Second Grade	2.MD.8 Solve word problems involving dollar bills, quarters, dimes, nickels, and pennies, using \$ and ¢ symbols appropriately.	2.MD.C.8 Solve contextual problems involving dollar bills, quarters, dimes, nickels, and pennies using ¢ and \$ symbols appropriately.

Sample Revision: 3–5

	Former Standard	Current Standard
Fourth Grade	<p>4.MD.1 Know relative sizes of measurement units within one system of units including km, m, cm; kg, g; lb, oz.; l, ml; hr, min, sec. Within a single system of measurement, <u>express measurements in a larger unit in terms of a smaller unit.</u> Record measurement equivalents in a two column table. For example, know that 1 ft is 12 times as long as 1 in. Express the length of a 4 ft snake as 48 in. Generate a conversion table for feet and inches listing the number pairs (1, 12), (2, 24), (3, 36),...</p>	<p>4.MD.A.1 Measure and estimate to determine relative sizes of measurement units within a single system of measurement involving length, liquid volume, and mass/weight of objects using customary and metric units.</p>
Fifth Grade	<p>5.MD.1 Convert among different-sized standard measurement units within a given measurement system (e.g., convert 5 cm to 0.05 m), and use these conversions in solving multi-step, real world problems.</p>	<p>5.MD.A.1 Convert customary and metric measurement units within a single system by <u>expressing measurements of a larger unit in terms of a smaller unit.</u> Use these conversions to solve multi-step real world problems involving distances, intervals of time, liquid volumes, masses of objects, and money (including problems involving simple fractions or decimals). For example, 3.6 liters and 4.1 liters can be combined as 7.7 liters or 7700 milliliters.</p>

K–5: Overarching Revisions

- Supporting and additional work of the grade is combined as supporting work of the grade
- Increased fluency expectations
- Added/shifted a small number of standards to strengthen coherence across grade levels
- **Revised language to provide clarity and continuity**
- Highlighted chart for grade-level mastery expectations for addition, subtraction, multiplication, and division

Sample Revision: K–2

Former Standard

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

Current Standard

2.NBT.A.3 Read and write numbers to 1000 using **standard form, word form,** and expanded form.

Sample Revision: 3–5

Former Standard

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

Current Standard

4.NBT.A.3 Round multi-digit whole numbers to any place **(up to and including the hundred-thousand place)** using understanding of place value.

K–5: Overarching Revisions

- Supporting and additional work of the grade is combined as supporting work of the grade
- Increased fluency expectations
- Added/shifted a small number of standards to strengthen coherence across grade levels
- Revised language to provide clarity and continuity
- **Highlighted chart for grade-level mastery expectations for addition, subtraction, multiplication, and division**

Addition and Subtraction Chart

Table 1 Common addition and subtraction situations

	Result Unknown	Change Unknown	Start Unknown
Add to	Two bunnies sat on the grass. Three more bunnies hopped there. How many bunnies are on the grass now? $2 + 3 = ?$ (K)	Two bunnies were sitting on the grass. Some more bunnies hopped there. Then there were five bunnies. How many bunnies hopped over to the first two? $2 + ? = 5$ (1 st)	Some bunnies were sitting on the grass. Three more bunnies hopped there. Then there were five bunnies. How many bunnies were on the grass before? $? + 3 = 5$ One-Step Problem (2 nd)
	Five apples were on the table. I ate two apples. How many apples are on the table now? $5 - 2 = ?$ (K)	Five apples were on the table. I ate some apples. Then there were three apples. How many apples did I eat? $5 - ? = 3$ (1 st)	Some apples were on the table. I ate two apples. Then there were three apples. How many apples were on the table before? $? - 2 = 3$ One-Step Problem (2 nd)
Put Together/ Take Apart ³	Total Unknown	Addend Unknown	Both Addends Unknown ²
	Three red apples and two green apples are on the table. How many apples are on the table? $3 + 2 = ?$ (K)	Five apples are on the table. Three are red and the rest are green. How many apples are green? $3 + ? = 5, 5 - 3 = ?$ (K)	Grandma has five flowers. How many can she put in her red vase and how many in her blue vase? $5 = 0 + 5, 5 = 5 + 0$ $5 = 1 + 4, 5 = 4 + 1$ $5 = 2 + 3, 5 = 3 + 2$ (1 st)
Compare ⁴	Difference Unknown	Bigger Unknown	Smaller Unknown
	("How many more?" version): Lucy has two apples. Julie has five apples. How many more apples does Julie have than Lucy? (1 st)	(Version with "more"): Julie has three more apples than Lucy. Lucy has two apples. How many apples does Julie have? One-Step Problem (1 st)	(Version with "more"): Julie has 3 more apples than Lucy. Julie has five apples. How many apples does Lucy have? $5 - 3 = ? \quad ? + 3 = 5$ One-Step Problem (2 nd)
	("How many fewer?" version): Lucy has two apples. Julie has five apples. How many fewer apples does Lucy have than Julie? $2 + ? = 5, 5 - 2 = ?$ (1 st)	(Version with "fewer"): Lucy has 3 fewer apples than Julie. Lucy has two apples. How many apples does Julie have? $2 + 3 = ?, 3 + 2 = ?$ One-Step Problem (2 nd)	(Version with "fewer"): Lucy has three fewer apples than Julie. Julie has five apples. How many apples does Lucy have? One-Step Problem (1 st)

K: Problem types to be mastered by the end of the Kindergarten year.

1st: Problem types to be mastered by the end of the First Grade year, including problem types from the previous year. However, First Grade students should have experiences with all 12 problem types.

2nd: Problem types to be mastered by the end of the Second Grade year, including problem types from the previous years.

Multiplication and Division Chart

Table 2 Common multiplication and division situations¹

	Unknown Product $3 \times 6 = ?$	Group Size Unknown ("How many in each group?" Division) $3 \times ? = 18$, and $18 \div 3 = ?$	Number of Groups Unknown ("How many groups?" Division) $? \times 6 = 18$, and $18 \div 6 = ?$
Equal Groups	<p>There are 3 bags with 6 plums in each bag. How many plums are there in all?</p> <p><i>Measurement example.</i> You need 3 lengths of string, each 6 inches long. How much string will you need altogether?</p>	<p>If 18 plums are shared equally into 3 bags, then how many plums will be in each bag?</p> <p><i>Measurement example.</i> You have 18 inches of string, which you will cut into 3 equal pieces. How long will each piece of string be?</p>	<p>If 18 plums are to be packed 6 to a bag, then how many bags are needed?</p> <p><i>Measurement example.</i> You have 18 inches of string, which you will cut into pieces that are 6 inches long. How many pieces of string will you have?</p>
Arrays, ² Area ³	<p>There are 3 rows of apples with 6 apples in each row. How many apples are there?</p> <p><i>Area example.</i> What is the area of a 3 cm by 6 cm rectangle?</p>	<p>If 18 apples are arranged into 3 equal rows, how many apples will be in each row?</p> <p><i>Area example.</i> A rectangle has area 18 square centimeters. If one side is 3 cm long, how long is a side next to it?</p>	<p>If 18 apples are arranged into equal rows of 6 apples, how many rows will there be?</p> <p><i>Area example.</i> A rectangle has area 18 square centimeters. If one side is 6 cm long, how long is a side next to it?</p>
Compare	<p>A blue hat costs \$6. A red hat costs 3 times as much as the blue hat. How much does the red hat cost?</p> <p><i>Measurement example.</i> A rubber band is 6 cm long. How long will the rubber band be when it is stretched to be 3 times as long?</p>	<p>A red hat costs \$18 and that is 3 times as much as a blue hat costs. How much does a blue hat cost?</p> <p><i>Measurement example.</i> A rubber band is stretched to be 18 cm long and that is 3 times as long as it was at first. How long was the rubber band at first?</p>	<p>A red hat costs \$18 and a blue hat costs \$6. How many times as much does the red hat cost as the blue hat?</p> <p><i>Measurement example.</i> A rubber band was 6 cm long at first. Now it is stretched to be 18 cm long. How many times as long is the rubber band now as it was at first?</p>
General	$a \times b = ?$	$a \times ? = p$, and $p \div a = ?$	$? \times b = p$, and $p \div b = ?$

Revisions to Math Standards

Specific
to
6–8

- Refined major work of the grade
- Revised supporting work of the grade, especially in statistics and probability

Grades 6–8: Overarching Revisions

- **Slight revisions made to geometry in grade 8.**
- Supporting and additional work of the grade is combined as supporting work of the grade.
- Revised language to provide clarity and continuity.
- Revised a small number of standards to strengthen coherence by condensing, expanding, and removing standards.
- Revised a small number of statistics and probability standards.

Grades 6–8: Overarching Revisions

- Slight revisions made to geometry in grade 8.
- **Supporting and additional work of the grade is combined as supporting work of the grade.**
- Revised language to provide clarity and continuity.
- Revised a small number of standards to strengthen coherence by condensing, expanding, and removing standards.
- Revised a small number of statistics and probability standards.

Grades 6–8: Overarching Revisions

- Slight revisions made to geometry in grade 8.
- Supporting and additional work of the grade is combined as supporting work of the grade.
- **Revised language to provide clarity and continuity.**
- Revised a small number of standards to strengthen coherence by condensing, expanding, and removing standards.
- Revised a small number of statistics and probability standards.

Grades 6–8: Sample Revision

Former Standard

6.SP.A.2 Understand that a set of data collected to answer a statistical question has a distribution which can be described by its center, spread, and overall shape.

Current Standard

6.SP.A.2 Understand that a set of data collected to answer a statistical question has a distribution which can be described by its center (**mean, median, mode**), spread (**range**), and overall shape.

Grades 6–8: Overarching Revisions

- Slight revisions made to geometry in grade 8.
- Supporting and additional work of the grade is combined as supporting work of the grade.
- Revised language to provide clarity and continuity.
- **Revised a small number of standards to strengthen coherence by condensing, expanding, and removing standards.**
- Revised a small number of statistics and probability standards.

Grades 6–8: Sample Revision

Former Standard

6.EE.C.9 Use variables to represent two quantities in a real-world problem that change in relationship to one another. *For example, Susan is putting money in her savings account by depositing a set amount each week (50). Represent her savings account balance with respect to the number of weekly deposits ($s = 50w$, illustrating the relationship between balance amount s and number of weeks w). Write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation.*

Grades 6–8: Sample Revision

Current Standard

6.EE.C.9 Use variables to represent two quantities in a real-world problem that change in relationship to one another. *For example, Susan is putting money in her savings account by depositing a set amount each week (50). Represent her savings account balance with respect to the number of weekly deposits ($s = 50w$, illustrating the relationship between balance amount s and number of weeks w).*

- a.** Write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable.
- b.** Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation.

Grades 6–8: Sample Revision

Former Standard

7.G.A.3 Describe the two-dimensional figures that result from slicing three dimensional figures, as in plane sections of right rectangular prisms and right rectangular pyramids

Grades 6–8: Overarching Revisions

- Slight revisions made to geometry in grade 8.
- Supporting and additional work of the grade is combined as supporting work of the grade.
- Revised language to provide clarity and continuity.
- Revised a small number of standards to strengthen coherence by condensing, expanding, and removing standards.
- **Revised a small number of statistics and probability standards.**

Grades 6–8: Sample Revision

Former Standard

6.SP.B.5c Summarize numerical data sets in relation to their context, such as by: c. Giving quantitative measures of center (median and/or mean) and variability (**interquartile range and/or mean absolute deviation**), as well as describing any overall pattern and any striking deviations from the overall pattern with reference to the context in which the data were gathered.

Current Standard

6.SP.B.5c Summarize numerical data sets in relation to their context, such as by: c. Giving quantitative measures of center (median and/or mean) and variability (**range**), as well as describing any overall pattern and any striking deviations from the overall pattern with reference to the context in which the data were gathered.

Revisions to Math Standards

Specific
to
9–12

- Revised scope and clarifications
- Revisions for Algebra II and Integrated III
- Restructured additional Mathematics courses to reflect college and career readiness

Grades 9–12: Overarching Revisions

- **Supporting and additional work of the grade is combined as supporting work of the grade.**
- Removed or shifted a small number of standards to the major work of the grade to streamline vertical progression.
- Revised language and examples to provide clarity and continuity.
- Shifted a small number of supporting work of the grade standards to the additional mathematics courses.
- Restructured additional courses to reflect college and career readiness.

Grades 9–12: Overarching Revisions

- Supporting and additional work of the grade is combined as supporting work of the grade.
- **Removed or shifted a small number of standards to the major work of the grade to streamline vertical progression.**
- Revised language and examples to provide clarity and continuity.
- Shifted a small number of supporting work of the grade standards to the additional mathematics courses.
- Restructured additional courses to reflect college and career readiness.

Grades 9–12: Overarching Revisions

- Supporting and additional work of the grade is combined as supporting work of the grade.
- Removed or shifted a small number of standards to the major work of the grade to streamline vertical progression.
- **Revised language and examples to provide clarity and continuity.**
- Shifted a small number of supporting work of the grade standards to the additional mathematics courses.
- Restructured additional courses to reflect college and career readiness.

Grades 9–12: Sample Revisions

Former Standard

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

Current Standard

G.SRT.C.8 *Know and* use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.

Grades 9–12: Overarching Revisions

- Supporting and additional work of the grade is combined as supporting work of the grade.
- Removed or shifted a small number of standards to the major work of the grade to streamline vertical progression.
- Revised language and examples to provide clarity and continuity.
- **Shifted a small number of supporting work of the grade standards to the additional mathematics courses.**
- Restructured additional courses to reflect college and career readiness.

Grades 9–12: Sample Revisions

Moved Standard

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

Grades 9–12: Overarching Revisions

- Supporting and additional work of the grade is combined as supporting work of the grade.
- Removed or shifted a small number of standards to the major work of the grade to streamline vertical progression.
- Revised language and examples to provide clarity and continuity.
- Shifted a small number of supporting work of the grade standards to the additional mathematics courses.
- **Restructured additional courses to reflect college and career readiness.**

Additional Mathematics Courses Rationale

- **High expectations**
- Retention of **rigorous standards**
- Clearly **defined** and **coherent** pathways
- **Equity** and **opportunity**
- Aligned with **student interest** in postsecondary fields
- Shift to a **discipline- and career-based pathway**

Additional Mathematics Courses

- **Advanced Algebra and Trigonometry**
- **Discrete Math**
- **Finite Math**
- Bridge Math
- Pre-Calculus
- Statistics
- Calculus

Additional Mathematics Courses

- **Applied Mathematical Concepts (New Course)**
- Bridge Math
- Pre-Calculus
- Statistics
- Calculus

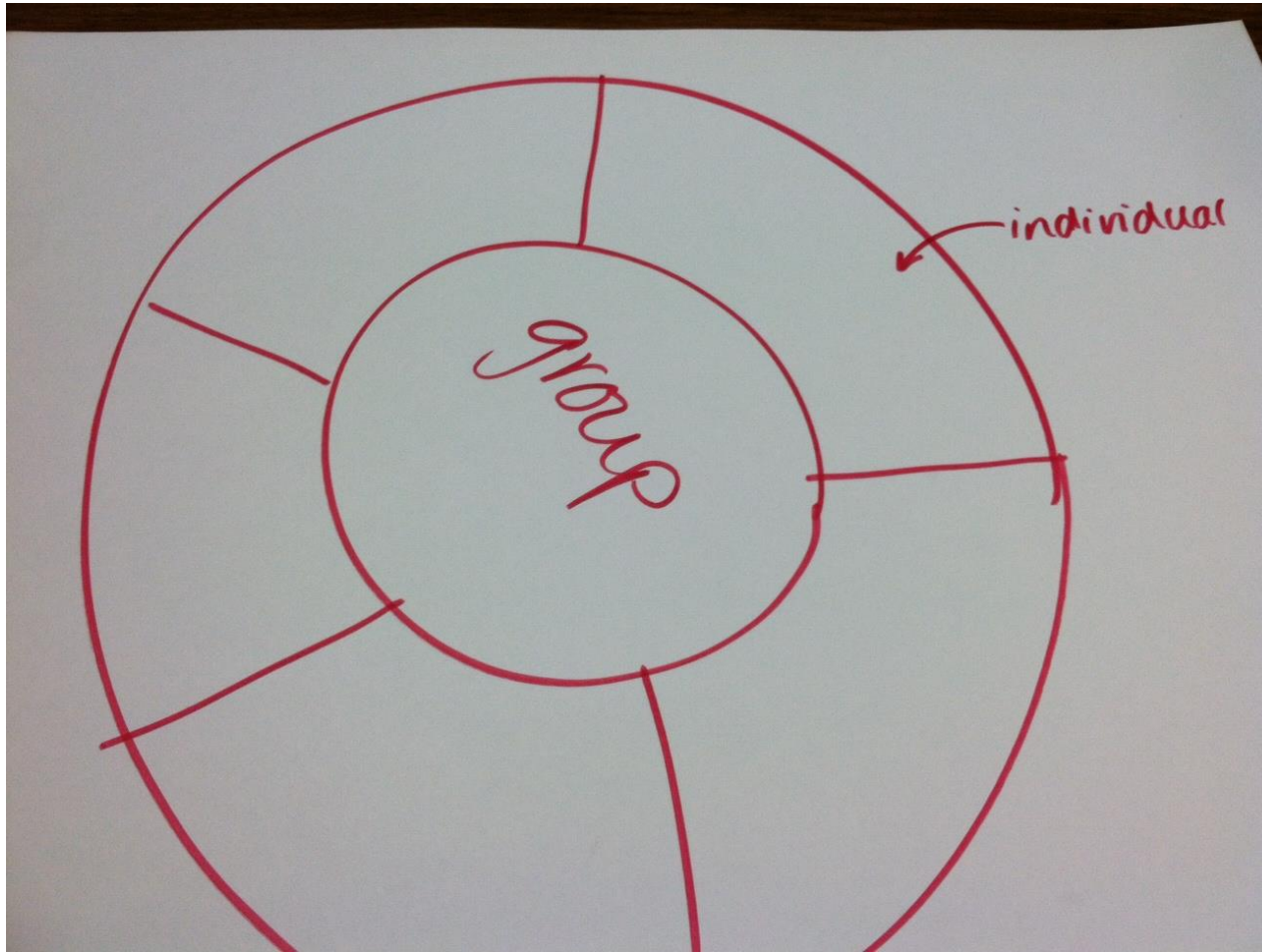
Standards Comparison Activity

- Compare the 2016-17 standards to the revised standards for your assigned grade or course.
- Highlight any changes in the 2017-18 column.

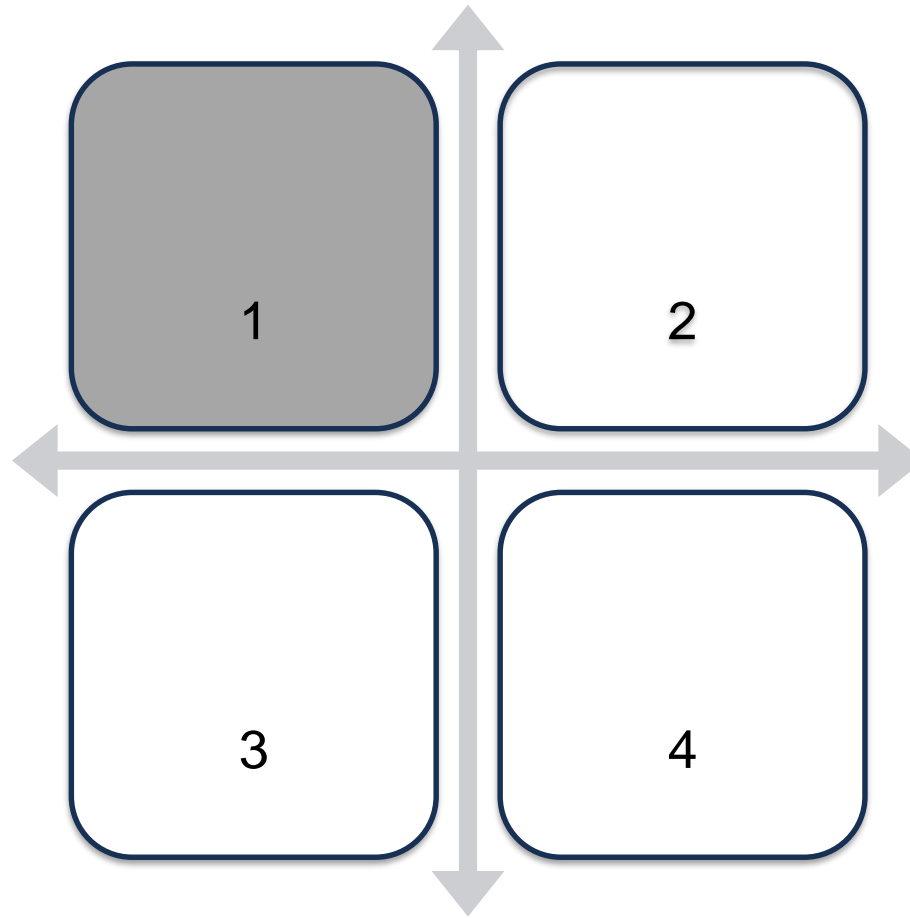
Standards Comparison Activity

- If you had to summarize the revisions to these selected standards in twenty words or less, what would you say?
- Write your response to the question in the participant manual on page 69.

Consensus Circle



Appointment with Peers



Module 3 Review

- The instructional shifts remain the same and are still the focus of the standards.
- The revised standards represent a stronger foundation that will support the progression of rigorous standards throughout the grade levels.
- The revised standards improve connections:
 - Within a single grade level, and
 - Between multiple grade levels.

Part One



Strong Standards

Standards are the bricks that should be masterfully laid through quality instruction to ensure that all students reach the expectation of the standards.

Lunch Break: 1 hour 15 minutes



Please Sign In!





Part 2: Diving into the Standards

Key Idea



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**Module 4:
A Deeper Dive into
Grades 6–8 Math
Standards**

Goals

- Concisely describe a course based on its introduction.
- Develop a means for deconstructing standards to determine the mathematical emphasis of the standard—its intent and purpose.
- Use the KUD approach to guide planning, instruction, and assessment.

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Seeing the Big Picture

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A Closer Look

Take a few minutes to read the Overview page for your grade level and think about how this relates to the overarching revisions we have just seen.

Grade 6	-	pg. 65
Grade 7	-	pg. 72
Grade 8	-	pg. 79

What Would You Tweet?

You have to summarize your course in 140 characters. Write a tweet that will inform others regarding what is included in your course.



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Intent and Purpose

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Intent and Purpose

“With my ears to the ground, listening to my students, my eyes are focused on the mathematical horizon.”

—Ball (1993)

A Closer Look at 6.RP.A.3

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

- a. Make tables of equivalent ratios relating quantities with whole number measurements, find missing values in the tables, and plot the pairs of values on the coordinate plane. Use tables to compare ratios.
- b. Solve unit rate problems including those involving unit pricing and constant speed. For example, if a runner ran 10 miles in 90 minutes, running at that speed, how long will it take him to run 6 miles? How fast is he running in miles per hour?

Highlight Verbs: Expectations of the Student

- Identify the Verbs
- Be sure you will be able to observe the student behavior you want to see that let's you know the student has met the standard.

Highlight Verbs: Expectations of the Student

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

- a. **Make** tables of equivalent ratios relating quantities with whole number measurements, **find** missing values in the tables, and **plot** the pairs of values on the coordinate plane. **Use** tables to **compare** ratios.
- b. **Solve** unit rate problems including those involving unit pricing and constant speed. *For example, if a runner ran 10 miles in 90 minutes, running at that speed, how long will it take him to run 6 miles? How fast is he running in miles per hour?*

The Verbs Lead to the Nouns (or Noun Phrases)

- As noted, the verbs raise the questions of “what” leading one to next highlight the associated nouns.
- One may wish to highlight what might be termed a noun phrase instead of trying to be exact on the object of the verb. Remember that we are trying to understand the intent and purpose of the standard.
- There is also a temptation to almost highlight everything! Let’s limit ourselves to the verbs and the nouns connected to them.

Highlight Verbs: Expectations of the Student

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

- a. **Make** tables of equivalent ratios relating quantities with whole number measurements, **find** missing values in the tables, and **plot** the pairs of values on the coordinate plane. **Use** tables to **compare** ratios.
- b. **Solve** unit rate problems including those involving unit pricing and constant speed. *For example, if a runner ran 10 miles in 90 minutes, running at that speed, how long will it take him to run 6 miles? How fast is he running in miles per hour?*

Dangers of Isolation: Individual Words

What does “reasoning” mean in this standard?

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

Dangers of Isolation: Parts of Standard

- **Isolated:** d. Use ratio reasoning to convert customary and metric measurement units (within the same system); manipulate and transform units appropriately when multiplying or dividing quantities.

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

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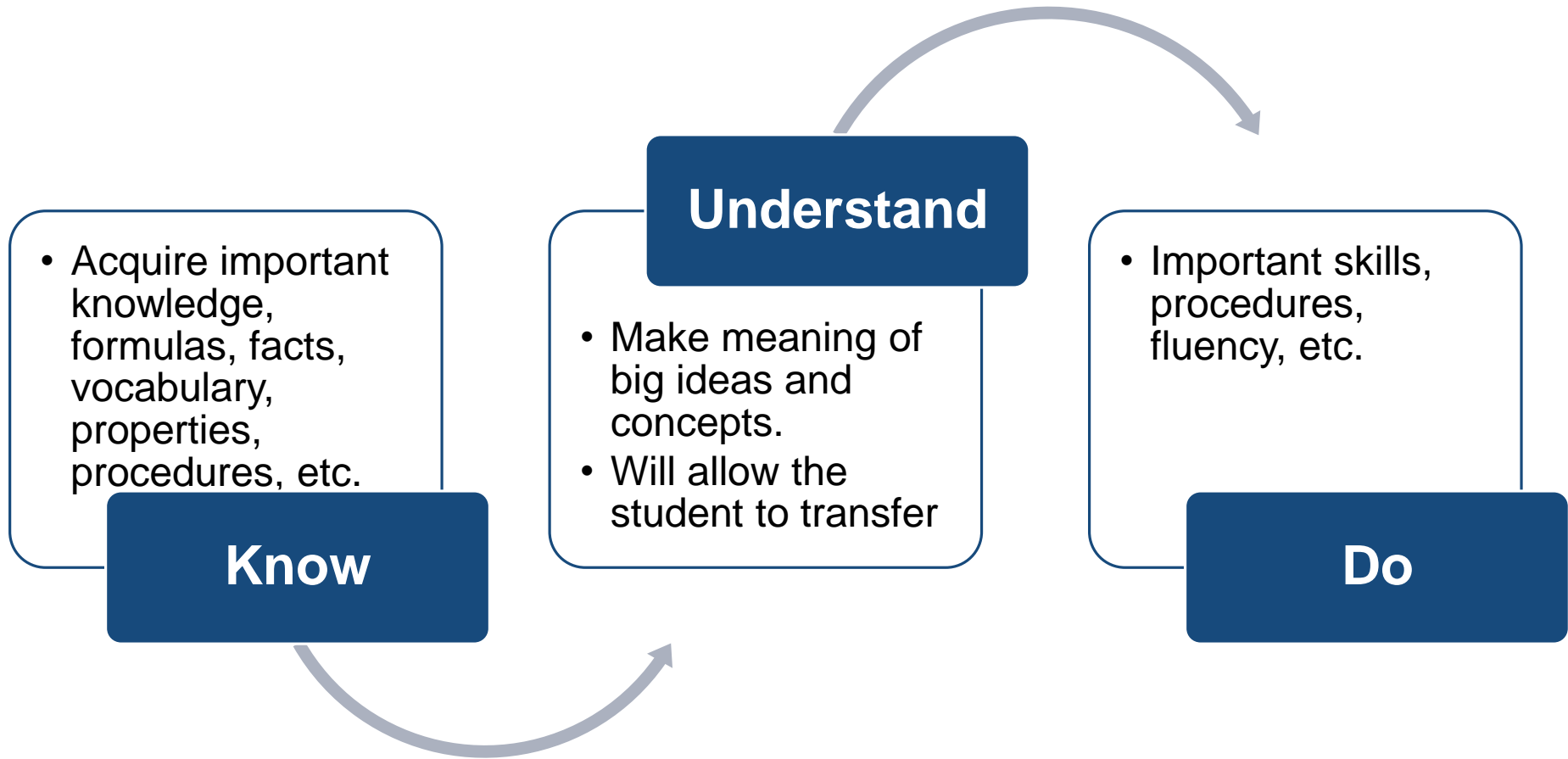
**From Standard to
Instruction: KUD**

®

Know, Understand, and Do

- What is it that the standard wants the student to know, understand, and do?
- KUD – helps to maintain focus in differentiated instruction
 - **Know**: facts, vocabulary, properties, procedures, etc.
 - **Understand**: concepts, ideas, etc
 - **Do**: tasks, approaches, assessment problems, etc.
- The two go together: What is the intent and purpose of the standard and how do I put this into instructional form?

KUD



Summary of the Intent and Purpose of the Standard

- Write a brief description of each part of KUD with respect to this standard.
- What does the math look like? What vocabulary stands out? Any symbolism to be understood or other literacy skills needed?
- Can you now write an I Can statement and/or an Essential Question based on our understanding of the standard and the focus that KUD gives us?

Understand: How will Students Demonstrate Mastery?

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

- What is an essential question related to this standard?

How can ratio and rate reasoning help solve real world and mathematical problems?

Understand: How will Students Demonstrate Mastery?

- Reword the standard in student friendly terms:

“I can...”

- Be sure you will be able to observe the student behavior you want to see that let's you know the student has met the standard.

What Do Students *Understand*?

Examples of “I can” statements:

- I can make tables of equivalent fractions.
- I can find missing values in tables.
- I can find a percent of a quantity as a rate of 100
- I can plot pairs of values on a coordinate plane.
- I can use ratio reasoning to solve unit rate problems.
- I can convert customary and metric units.
- I can manipulate and transform units when multiplying or dividing quantities.

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Analyzing Your Standard

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Grade Level Examples

- Please get into small groups based on the grade level you teach.
- You will be given a standard for your grade level.

Analyzing Your Standard

- First, highlight verbs that speak to what the student will do
- Second, highlight the nouns (noun phrases) connected to the verbs.
- Third, KUD, jot down what the students are to know, understand, and do (brief descriptions will do).
- Fourth, determine what the math will look like and touch on vocabulary and literacy skills needed.
- Now, write an I CAN statement and Essential Question that will be used in determining student mastery.

Grade-level Examples

- **6.RP.A.1**
- **6.RP.A.2**
- **7.RP.A.2**
- **7.EE.B.5**
- **8.EE.B.6**

Gallery Walk

Please provide any comments or questions on Post-Its and put them on the chart paper.



Gallery Walk Debrief

- Small Group Discussion
 - Review the feedback you were given.
 - What are your key takeaways?

Ratios and Proportional Relationships

“Proportional reasoning is a milestone in students’ cognitive development. An understanding of proportionality develops slowly over a number of years.”

“Reasoning proportionally involves many understandings, including grasping the meaning of a ratio as a multiplicative comparison and as a composed unit; making connections among ratios, fractions, and quotients; and understanding the ideas involved in moving from basic to more sophisticated levels of proportional reasoning.”

— Lobato, Ellis, & Charles, 2010

Ratios and Proportional Relationships

“Proportional reasoning is linked conceptually to a number of elementary, middle, and high school topics. Proportionality lies at the heart of understanding slope and linear functions, as well as measurement.”

— Lobato, Ellis, & Charles, 2010

Module 4 Review

- Concisely describe a course based on its introduction.
- Develop a means for deconstructing standards to determine the mathematical emphasis of the standard – its intent and purpose.
- Use the KUD approach to guide planning, instruction, and assessment.

Part Two



High Expectations

We have a continued goal to prepare students to be college and career ready.

10-Minute Break





Part 3: Instructional Shifts

Key Idea



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**Module 5:
Revisiting the Shifts &
Standards for
Mathematical Practice**

Goals

- Revisit the concepts of focus, coherence, and rigor and how they play out in instruction.
- Discuss the purpose and place of the content and practice standards.
- Focus on two areas of mindset: praise and mistakes.
- Share instructional strategies related to the Standards for Mathematical Practice.
- Discuss research on the influence of mindsets in the math classroom.

The Standards for Mathematical Practice

- **Why do we have the standards?**
- Tell us what students should know and be able to do
- So, what should students know and do?
 - Content Standards
 - Mathematics Practice Standards
 - Literacy Skills
- **Knowing that these are WHAT students need to learn, teachers determine HOW to teach these.**

Standards for Mathematical Practice

Standards for Mathematical Practice

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

Mindset

- The TN Academic Standards for Mathematics may seem challenging for students whose mindset has been fixed by their past experiences in mathematics classrooms.
- As teachers, we are best positioned to influence students' mathematical mindsets through our actions/practices in the mathematics classroom.

Fixed Mindset vs. Growth Mindset

- Fixed mindset

Intelligence is a fixed trait. You cannot change it.

- Growth mindset

You can grow your intelligence through effort.

Study of Praise and Mindsets



Fixed vs. Growth Mindset

10 Growth Mindset Statements



What can I say to myself?



INSTEAD OF:

TRY THINKING:

I'm not good at this.
I'm awesome at this.
I give up.
This is too hard.

I can't make this any better.
I just can't do Math.
I made a mistake.

She's so smart. I will never be that smart.
It's good enough.
Plan "A" didn't work.

- 1 What am I missing?
- 2 I'm on the right track.
- 3 I'll use some of the strategies we've learned.
- 4 This may take some time and effort.
- 5 I can always improve so I'll keep trying.
- 6 I'm going to train my brain in Math.
- 7 Mistakes help me to learn better.
- 8 I'm going to figure out how she does it.
- 9 Is it really my best work?
- 10 Good thing the alphabet has 25 more letters!

(Original source unknown)

@sylvia duckworth

Why Address Mindsets?

“If there’s a threat of being wrong every time I raise my hand, and being wrong is a bad thing, then very quickly I decide math isn’t for me, I don’t like this, I’m not a smart person”.

—Noah Heller, Harvard Graduate School of Education

Setting Up Positive Norms in the Math Classroom

Everyone can learn math to the highest levels

Mistakes are valuable

Questions are important

Math is about creativity and making sense

Math is about connections and communicating

Math class is about learning not performing

Depth is more important than speed

Instructional Shifts

■ Focus

- The standards are focused on fewer topics so that students can dig deeper within the mathematics.

■ Coherence

- Topics within a grade are connected to support focus. Additionally, standards are linked across grades to ensure vertical coherence.

■ Rigor

- The standards set expectations for a balanced approach to pursuing conceptual understanding, procedural fluency, and application.

Shift One: Focus

- In your grade-level groups, discuss ways you could respond if someone asks you the following question, “Why focus? There’s so much math that students could be learning. Why limit them?”
- Review the table in your participant manual and answer the questions, “Which two of the following represent areas of major focus for the indicated grade?”

Shift One: Focus

6	Understand ratio concepts and use ratio reasoning to solve problems	Students are not required by the Standards to know the divisibility rules.	Apply and extend previous understandings of arithmetic to algebraic expressions
7	Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers	Use properties of operations to generate equivalent expressions	Students are not required by the Standards to generate the prime factorization of a number.
8	Though linear equations are a major focus of 8th grade, students are not required to use a “standard form.”	Define, evaluate, and compare functions	Understand and apply the Pythagorean Theorem

Coherence

	6	7	8
Ratios and Proportional Relationships			
The Number System			
Expressions and Equations			
Geometry			
Statistics and Probability			
Functions			

Shift Three: Rigor

- *Make a true statement: Rigor = _____ + _____ + _____*
- In your groups, discuss ways to respond to one of the following comments: “These standards are expecting that we just teach rote memorization. Seems like a step backwards to me.” Or “I’m not going to spend time on fluency—it should just be a natural outcome of conceptual understanding.”
- The shift towards rigor is required by the standards. Find and copy standards which specifically set expectations for each component of rigor in your participant manual.

Turn & Talk

- What do these instructional shifts look like in the classroom?



Module 5 Review

- We connected the instructional shifts to the standards and our classroom practices.
- We explored students' mathematical mindsets.
- We shared instructional strategies related to the Standards for Mathematical Practice.

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**Module 6:
Literacy Skills for
Mathematical
Proficiency**

Goal

- Develop a better understanding of the Literacy Skills for Mathematical Proficiency.

Literacy in your Math Classroom

Reflect on ways literacy skills are already present in your mathematics classroom.



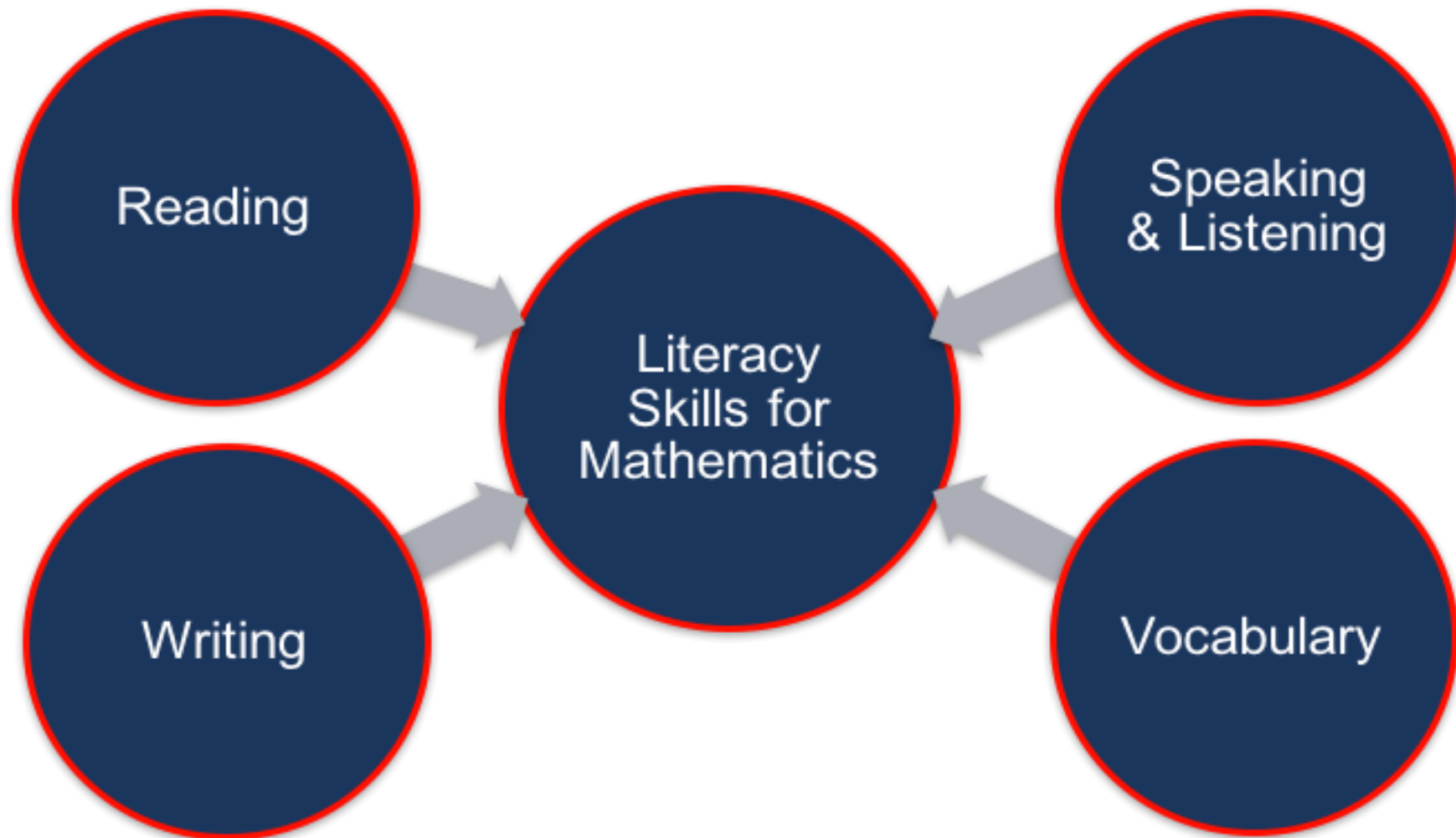
Literacy Skills for Math Proficiency

Communication in mathematics requires literacy skills in reading, vocabulary, speaking, listening, and writing.

Literacy Skills for Mathematical Proficiency

1. Use multiple reading strategies.
2. Understand and use correct mathematical vocabulary.
3. Discuss and articulate mathematical ideas.
4. Write mathematical arguments.

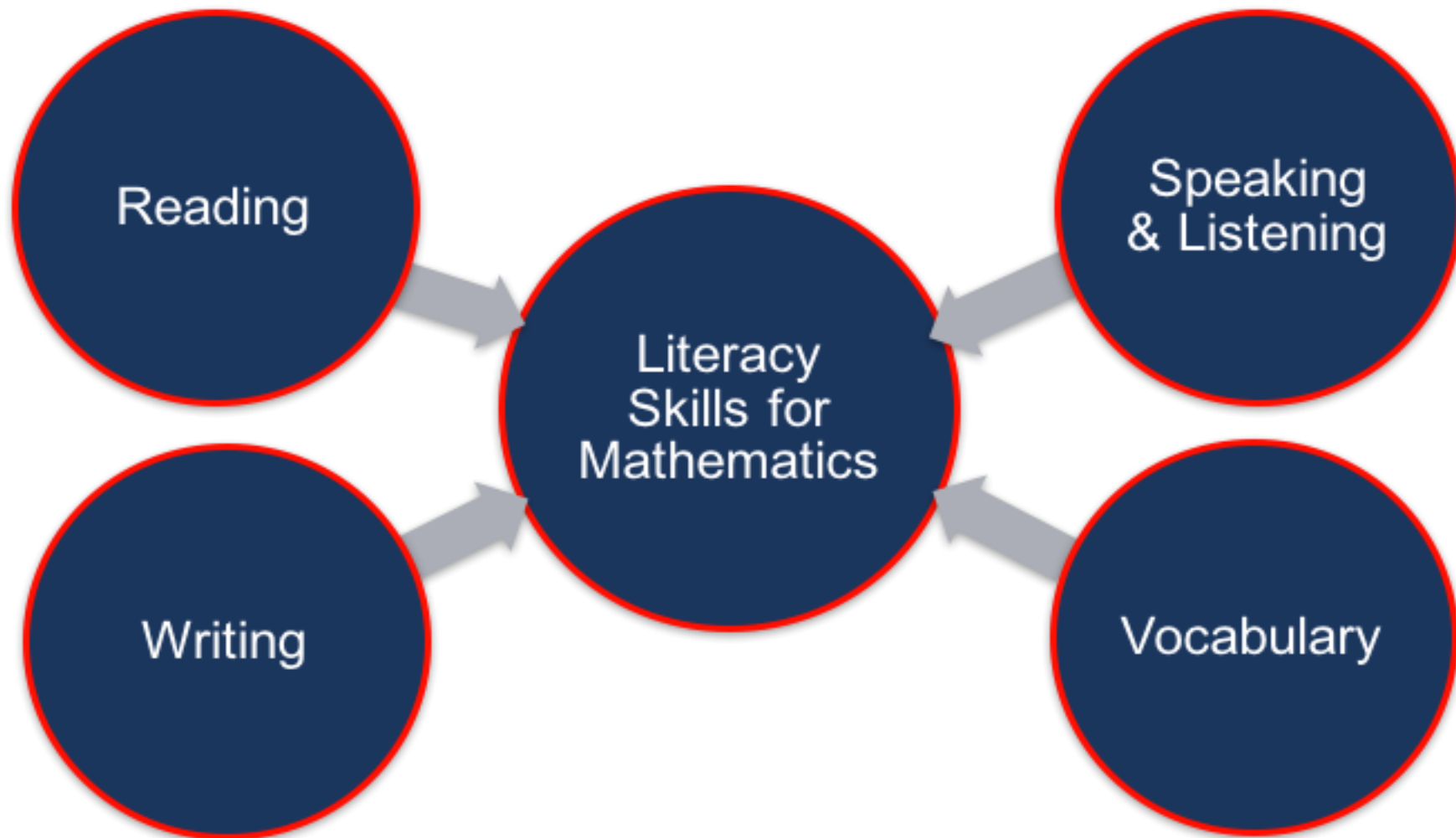
Literacy Skills in the Math Classroom



Group Activity

- Divide into groups.
- Each group will be assigned one literacy topic.
- Each group will read and annotate the paragraph on that topic in the Math Standards Document (pg. 13–14).
- Use chart paper to create a supporting document to share the ideas from your topic with the group.

Literacy Skills in the Math Classroom



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Strategies for Incorporating Literacy Skills in Mathematics

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Research-based Strategies to Teach Math Literacy

- Text Features
 - Highlight key symbols
 - Color code steps or circle action steps
 - Place a box around key terms in vocabulary

Let's Try a Problem

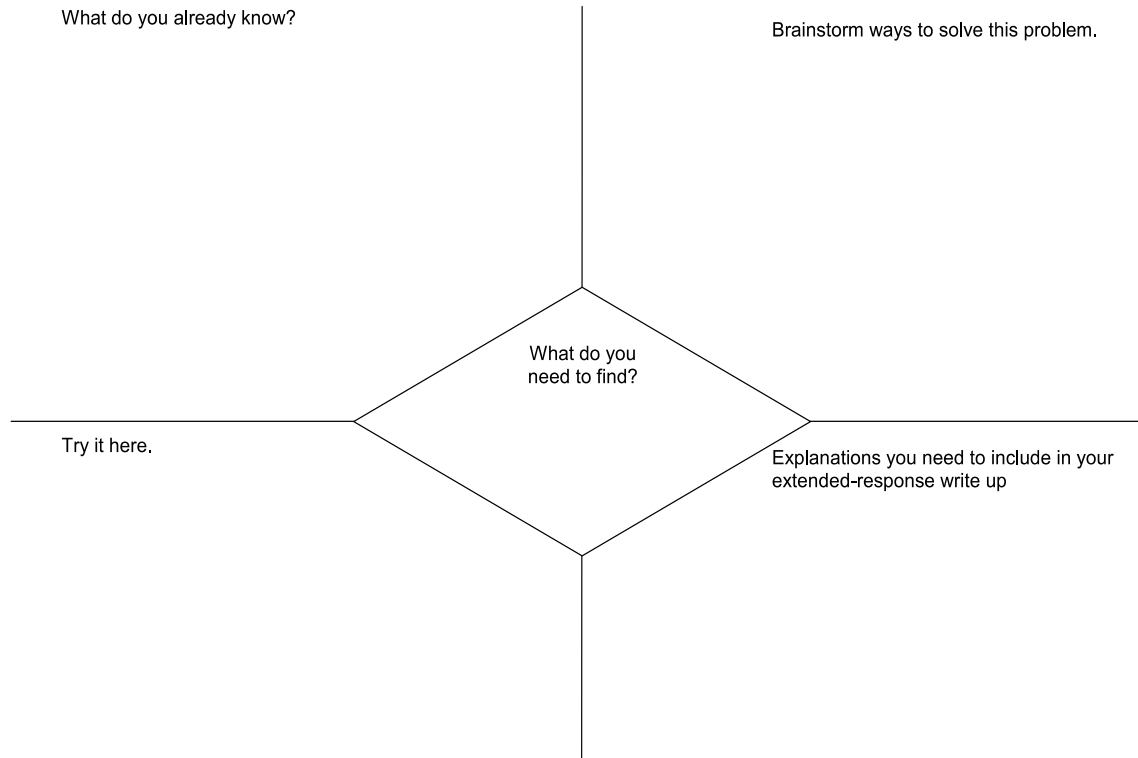
Brandon and Allison participate in an annual community 5K. Brandon can run at a rate of 3 miles in 24 minutes. Allison can run at a rate of 1 mile in 9 minutes. Who has the faster rate? Who finished the race first?

Let's Try a Problem

~~Brandon and Allison participate in an annual community 5K.~~
Brandon can run at a rate of **3 miles in 24 minutes**. Allison can run at a rate of **1 mile in 9 minutes**. **Who** has the **faster rate**? **Who finished the race first?**

Four Corners Graphic Organizer

Four-Corners-and-a-Diamond Math Graphic Organizer



Originally from *Teaching Children Mathematics*, © November 2009, Mathematical graphic organizers, p. 222.
May be adapted for personal use with students.

Four Corners Graphic Organizer

Four-Corners-and-a-Diamond Math Graphic Organizer

What do you already know?

Brandon's rate = 3 miles in 24 minutes
Allison's rate = 1 mi in 9 minutes

Brainstorm ways to solve this problem.

- Calculate rate per person
- Calculate unit rate
- Divide miles per minute

What do you need to find?

Fastest Runner and
Who finished first

Try it here.

Brandon's rate = 3mi in 24 min =
1mi in 8 min
Allison's rate = **1 mi in 9 min**

Explanations you need to include in your extended-response write up

First, I calculated the unit rate of Brandon and Allison. Since Brandon can run a mile in less time than Allison, then Brandon finished the race first. Brandon is the faster runner.

Originally from *Teaching Children Mathematics*, © November 2009, Mathematical graphic organizers, p. 222.
May be adapted for personal use with students.

Vocabulary

“Students must be taught that the language we read and speak in mathematics class is actually a technical jargon, even though it may look and sound like regular English.”

—Hersh, 1997

Mathematics Vocabulary

- Student achievement is dependent upon students' reading comprehension and content area learning.
- Math vocabulary is decontextualized because they are not in everyday conversations.
- Mathematical terms can have specific meanings (i.e., average, reflection).
- Students need to develop a conceptual meaning in order to read and use the words accurately.

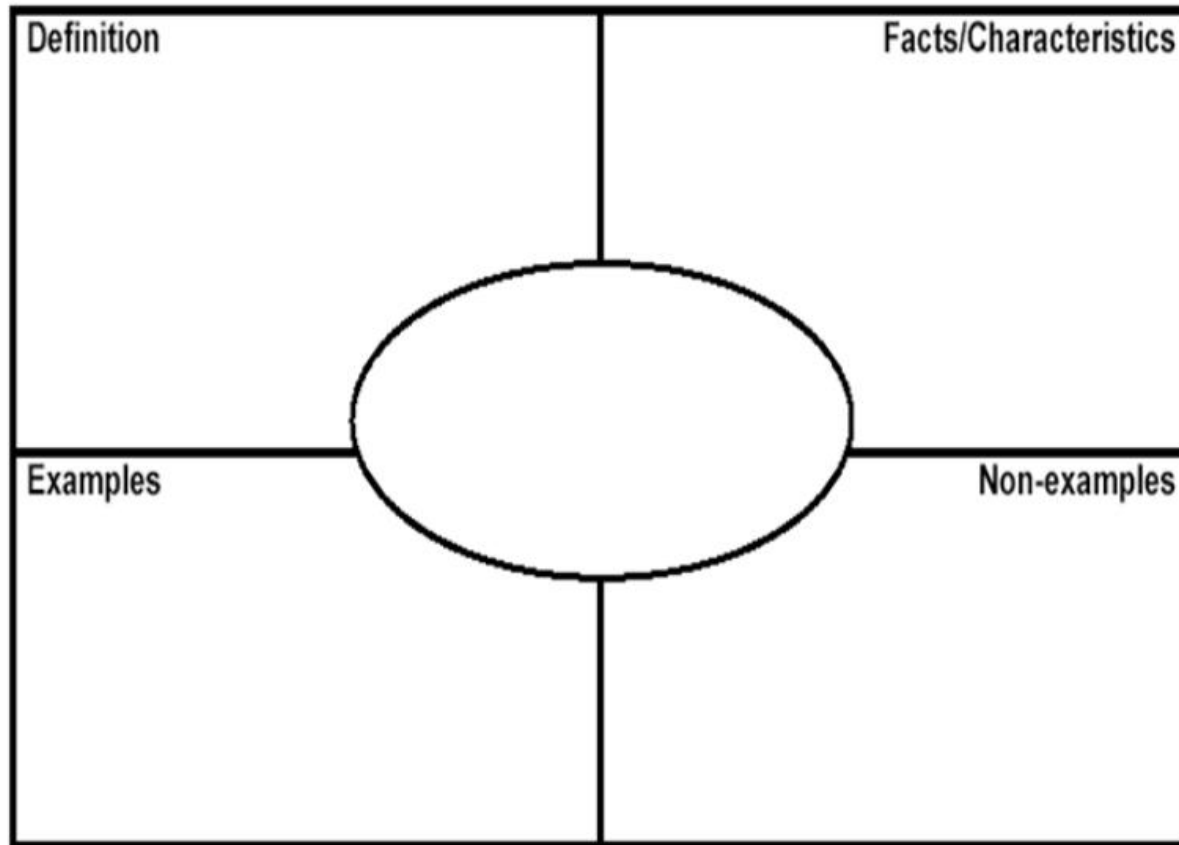
Four Stages of Word Knowledge

1. Students have never encountered the word before.
2. Students have seen/heard the word but do not know the definition.
3. Students know the word but rely on context to define it.
4. Students know the word and can use it comfortably.

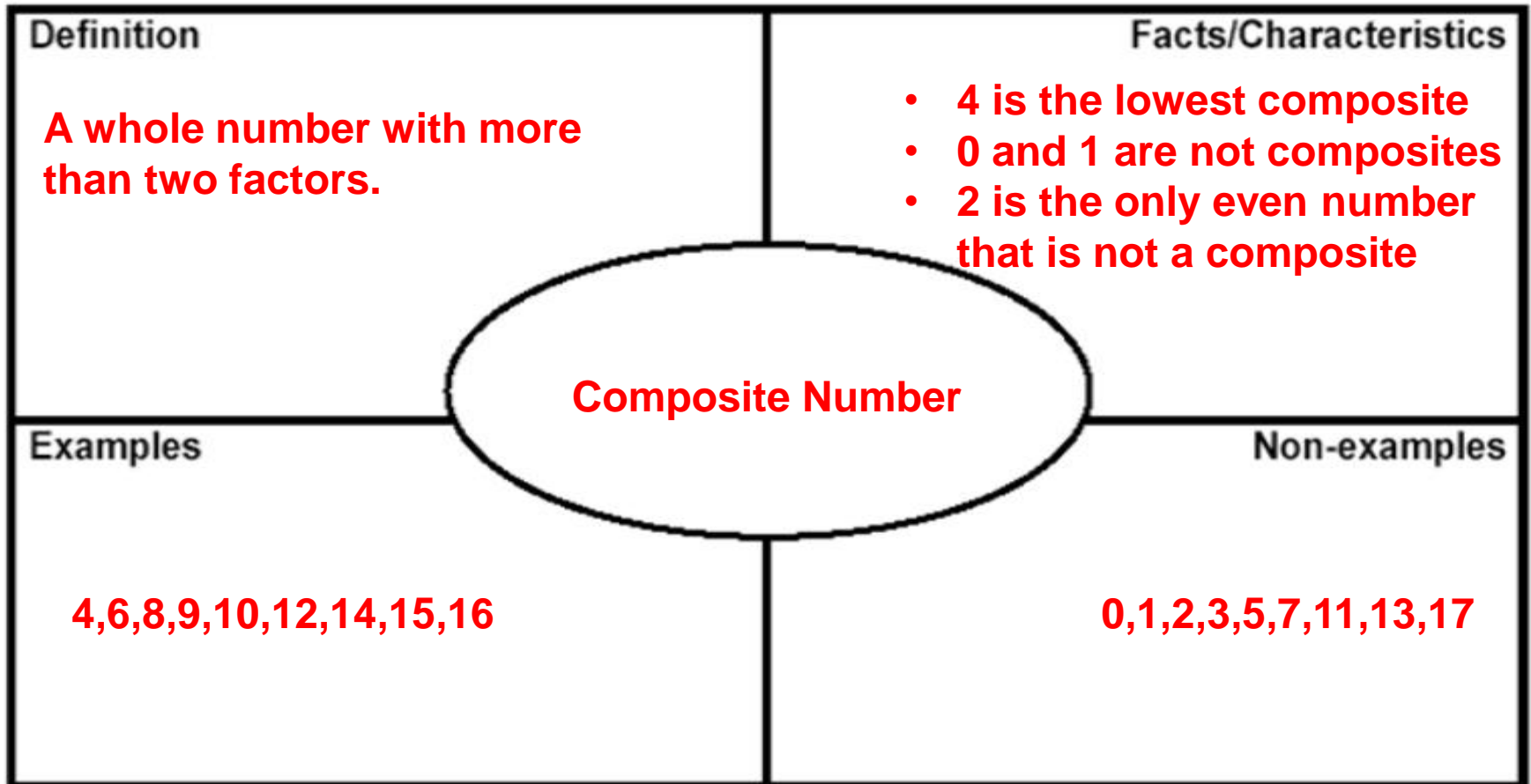
Vocabulary

- Symbols are used as language.
- Many mathematical terms have different meanings in everyday use.
- Can you think of any examples?

Frayer's Model



Sample of Frayer's Model



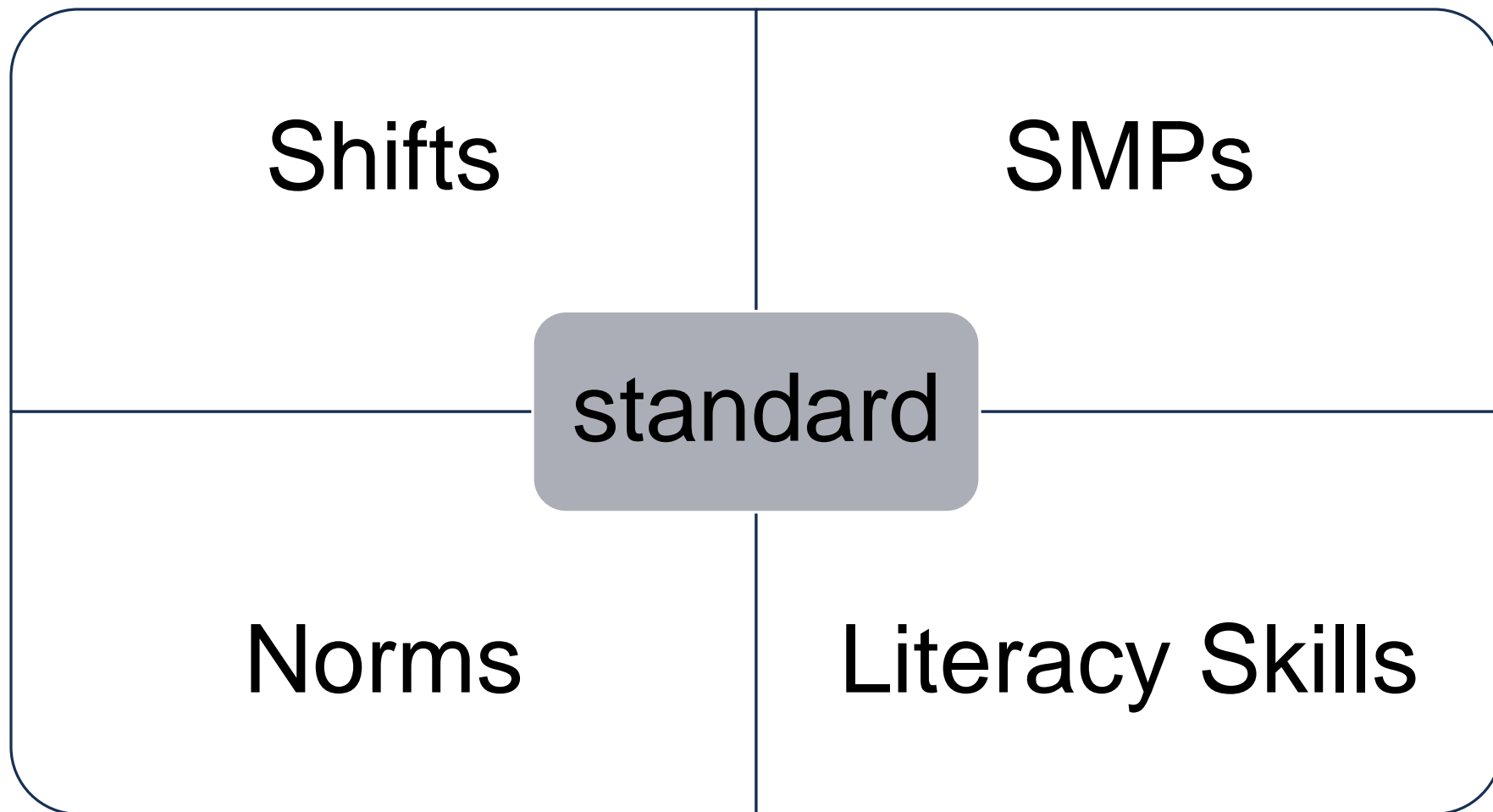
What is Literacy?

“...the ability to identify, understand, interpret, create, communicate, compute, and use printed and written materials associated with varying contexts. Literacy involves a continuum of learning to enable an individual to achieve his or her goals, to develop his or her knowledge and potential, and to participate fully in society as a whole.”

Module 6 Review

- Literacy skills in the math classroom will support students' understanding of the content standards.
- When students can read, write, and speak about math ideas, connections are made between concepts.

Making Connections



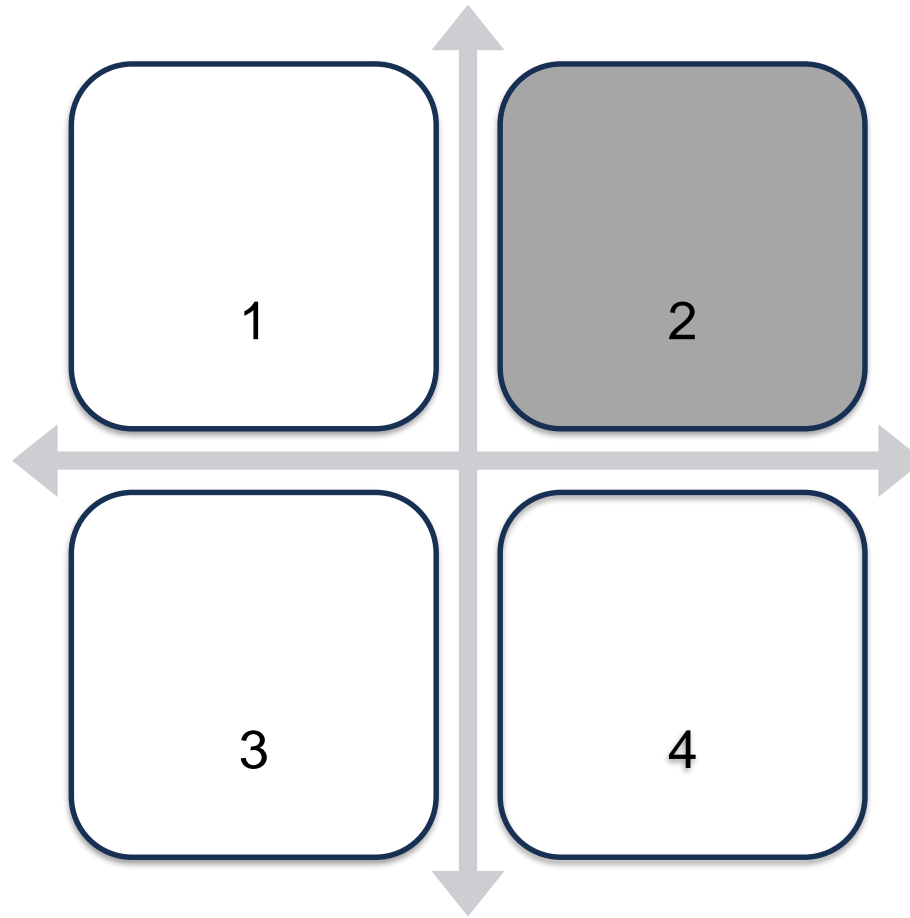
Part Three



Instructional Shifts

The instructional shifts are an essential component of the standards and provide guidance for how the standards should be taught and implemented.

Appointment with Peers



What to Expect: Day 2

- Dig more deeply into assessments and question development.
- Explore what it means to assure alignment of curriculum to standards.
- Explore how to begin to develop instructional planning.





Districts and schools in Tennessee will exemplify excellence and equity such that all students are equipped with the knowledge and skills to successfully embark on their chosen path in life.

Excellence | Optimism | Judgment | Courage | Teamwork