Teacher Training
Revised ELA and Math Standards

Math 9–12

Tennessee Department of Education | 2017 Summer Teacher Training

TN Department of Education

Welcome, Teachers!

We are excited to welcome you to this summer's teacher training on the revised math standards. We appreciate your dedication to the students in your classroom and your growth as an educator. As you interact with the math standards over the next two days, we hope you are able to find ways to connect this new content to your own classroom. Teachers perform outstanding work every school year, and our hope is that the knowledge you gain this week will enhance the high-quality instruction you provide Tennessee's children every day.

We are honored that the content of this training was developed by and with Tennessee educators *for* Tennessee educators. We believe it is important for professional development to be informed by current educators, who work every day to cultivate every student's potential.

We'd like to thank the following educators for their contribution to the creation and review of this content:

Dr. Holly Anthony, Tennessee Technological University
Michael Bradburn, Alcoa City Schools
Dr. Jo Ann Cady, University of Tennessee
Sherry Cockerham, Johnson City Schools
Dr. Allison Clark, Arlington Community Schools
Kimberly Herring, Cumberland County Schools
Dr. Joseph Jones, Cheatham County Schools
Dr. Emily Medlock, Lipscomb University

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Part 1: The Standards

Module 1: Standards Review Process

Module 2: Tennessee Academic Standards

Module 3: Summary of Revisions

Part 2: Developing a Deeper Understanding

Module 4: Diving into the Standards (KUD)

Part 3: Instructional Shifts

Module 5: Revisiting the Shifts and SMP's

Module 6: Literacy Skills for Mathematical Proficiency

Part 4: Assessment and Materials

Module 7: Connecting Standards and Assessment

Module 8: Evaluating Instructional Materials

Part 5: Putting it All Together

Module 9: Instructional Planning

Notes

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Agenda: Day 1

Time	Content
8–11:15 (includes break)	**Part 1: The Standards** • 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)	**Part 2: Developing a Deeper Understanding** • M4: Diving into the Standards (KUD) **Part 3: Instructional Shifts** • M5: Revisiting the Shifts and SMP's • M6: Literacy Skills for Mathematical Proficiency

Goals: Day 1

- 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 the Standards for Mathematical Practice (SMPs).
- Explore the Literacy Skills for Mathematical Proficiency.

Agenda: Day 2

Time	Content
8–11:15 (includes break)	**Part 4: Aligned Materials and Assessments** • M7: Assessing Student Understanding
11:15–12:30	**Lunch (on your own)**
12:30–4 (includes break)	• M8: Evaluating Instructional Materials **Part 5: Putting it All Together** • M9: Instructional Planning

Goals: Day 2

- Examine best practices for assessing student learning.
- Develop a process for evaluating instructional materials.
- Connect standards and assessment through instructional planning.

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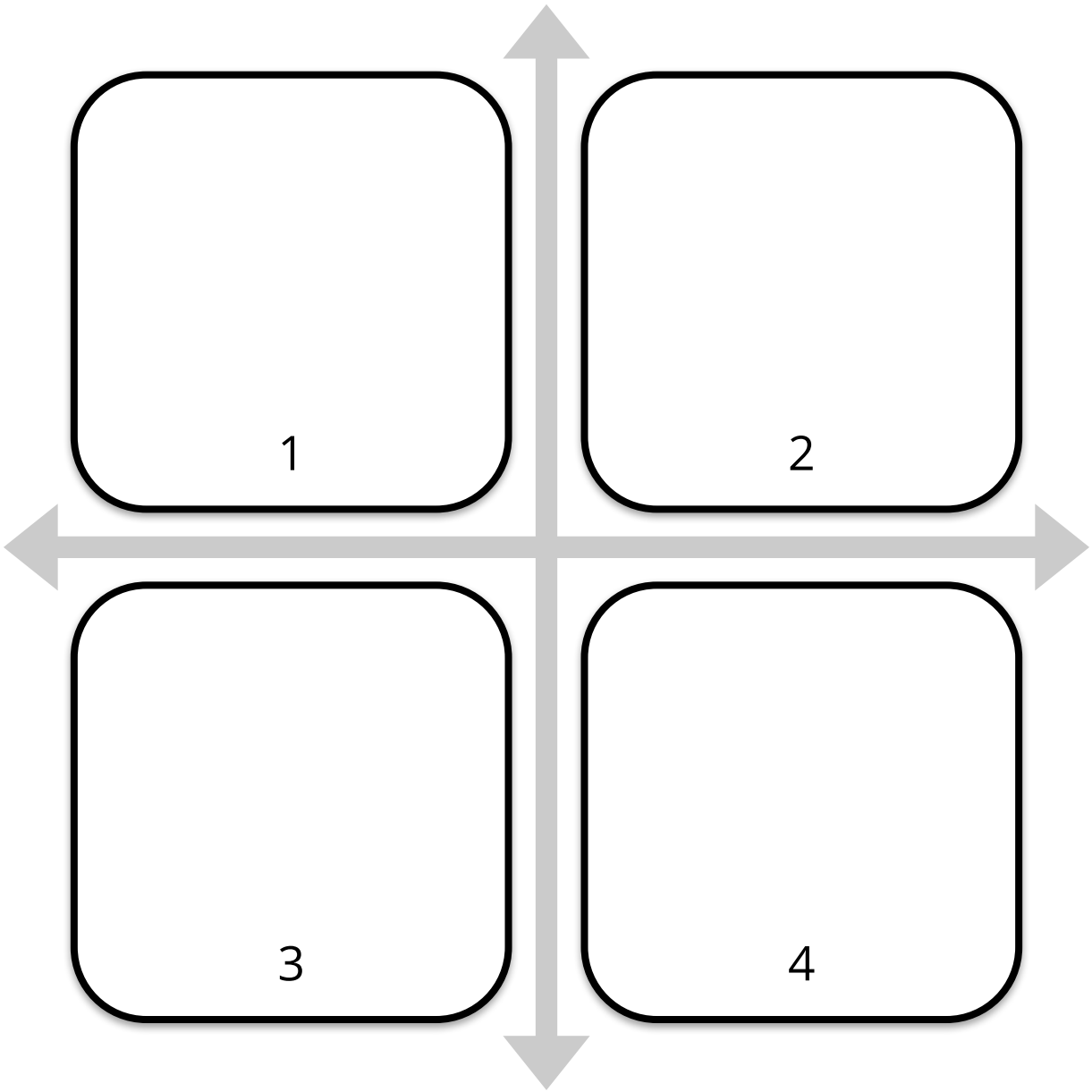
Appointment Time

Make four appointments to meet with fellow participants throughout the training to discuss the content. Record participants' names in the form below and bookmark this page for your reference.



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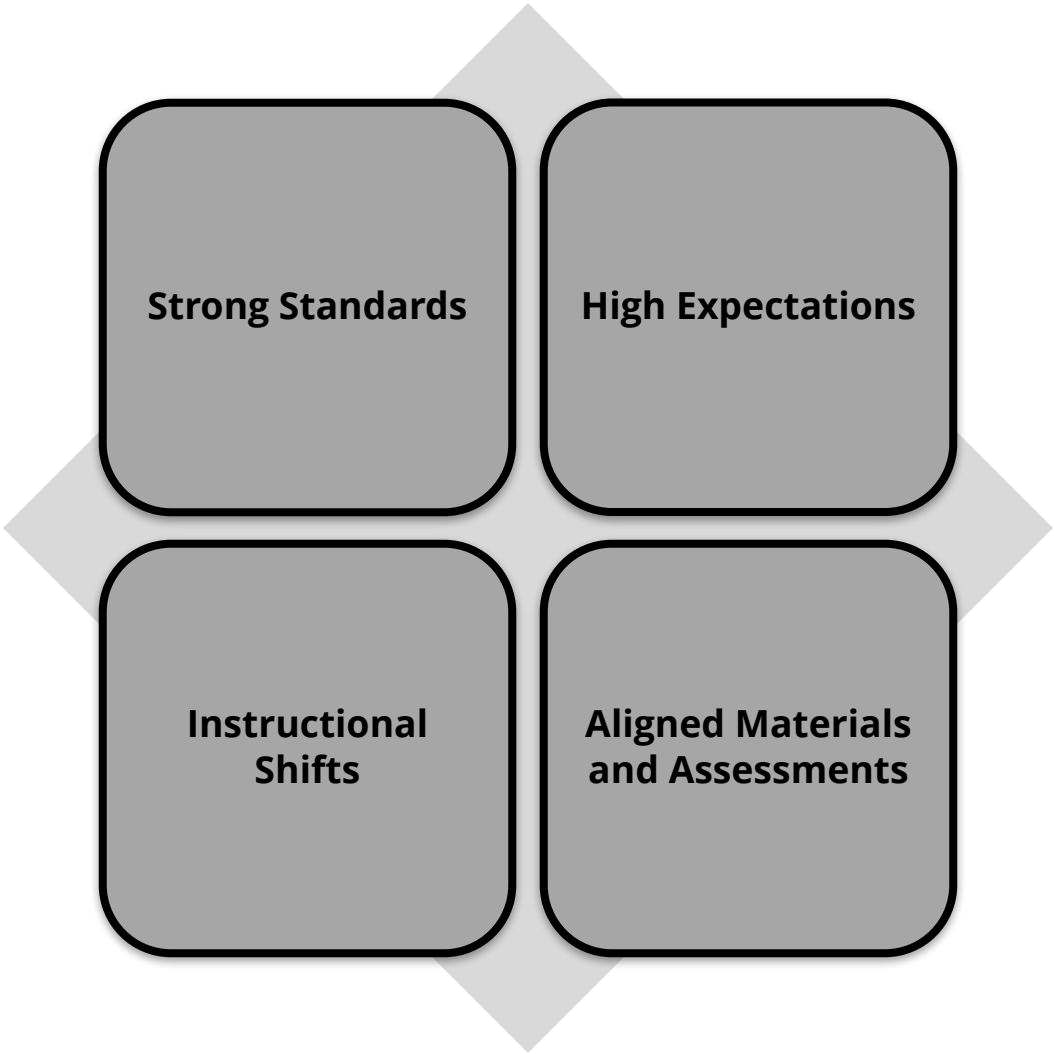
Key Ideas for Teacher Training



We know that Tennessee educators are working hard and striving to get better. This summer's teacher training is an exciting opportunity to learn about our state's newly adopted math and ELA standards and ways to develop a deeper understanding of the standards to improve classroom instructional practices. The content of this training is aligned to the standards and is designed to address the needs of educators across our state.

Throughout this training, you will find a series of key ideas that are designed to focus our work on what is truly important. These key ideas align to the training objectives and represent the most important concepts of this course.

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.

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.

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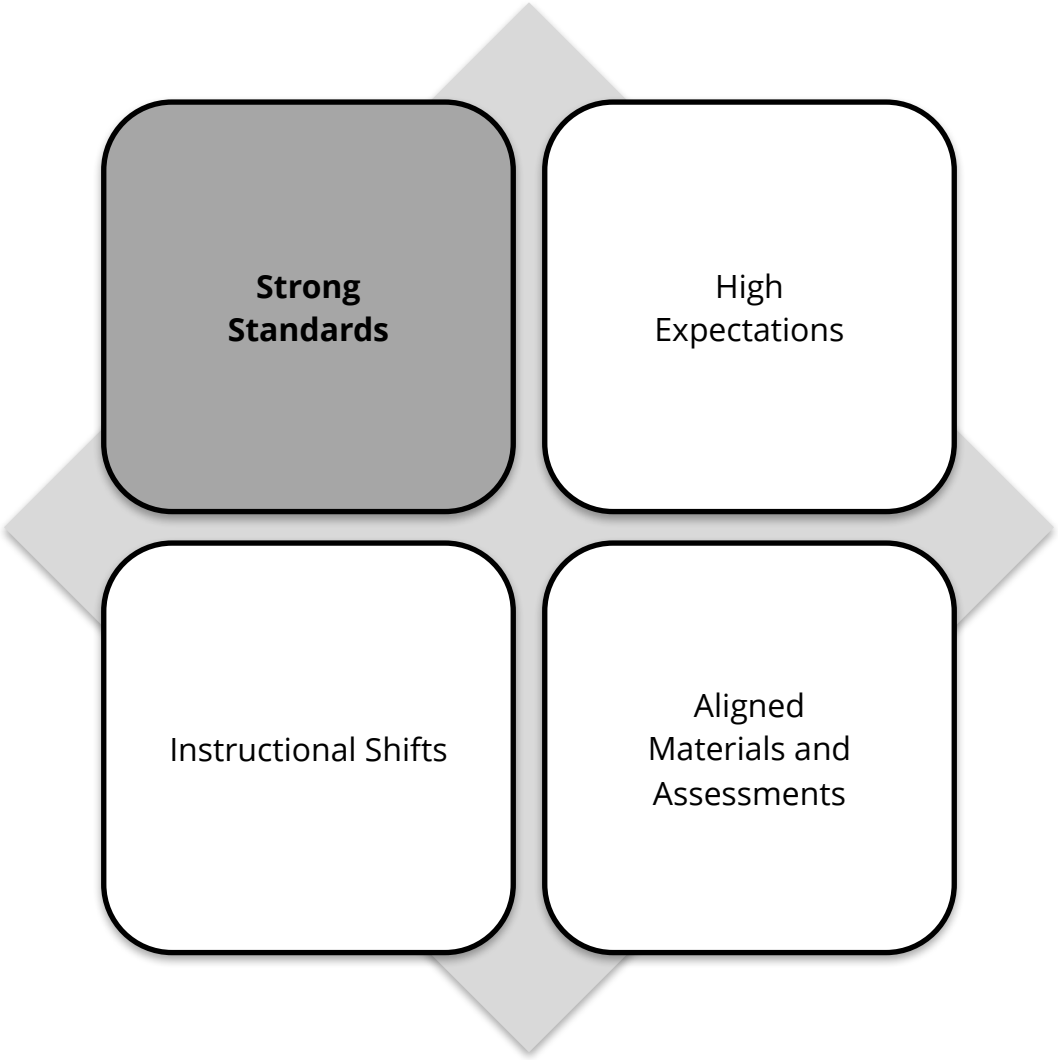
TAB PAGE

Part 1: The Standards

Module 1: The Standards Review Process



Standards Review Process

The graphic below illustrates Tennessee's standards review process. Here you can see the various stakeholders involved throughout the process.

- The process begins with a website for public feedback.
- Tennessee educators who are experts in their content area and grade band serve on the advisory panels. These educators review all the public feedback and the current standards, then use their content expertise and knowledge of Tennessee students to draft a revised set of standards.
- The revised standards are posted for a second feedback collection from Tennessee's stakeholders.
- The Standards Recommendation Committee (SRC) consists of 10 members appointed by legislators. This group looks at all the feedback from the website, the current standards, and revised drafts. Recommendations are then made for additional revisions if needed.
- The SRC recommends the final draft to the State Board of Education for approval.

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Educator Advisory Team Members

Every part of the state was represented with multiple voices.

Timeline of Standards Adoptions and Aligned Assessments Implementation

Subject	Standards Proposed to State Board for Final Read	LEAs: New Standards in Classrooms	Aligned Assessment
Math	April 2016	2017–18	2017–18
ELA	April 2016	2017–18	2017–18
Science	October 2016	2018–19	2018–19
Social Studies	July 2017	2019–20	2019–20

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.

"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."

What is your role in ensuring that all students are college and career ready?

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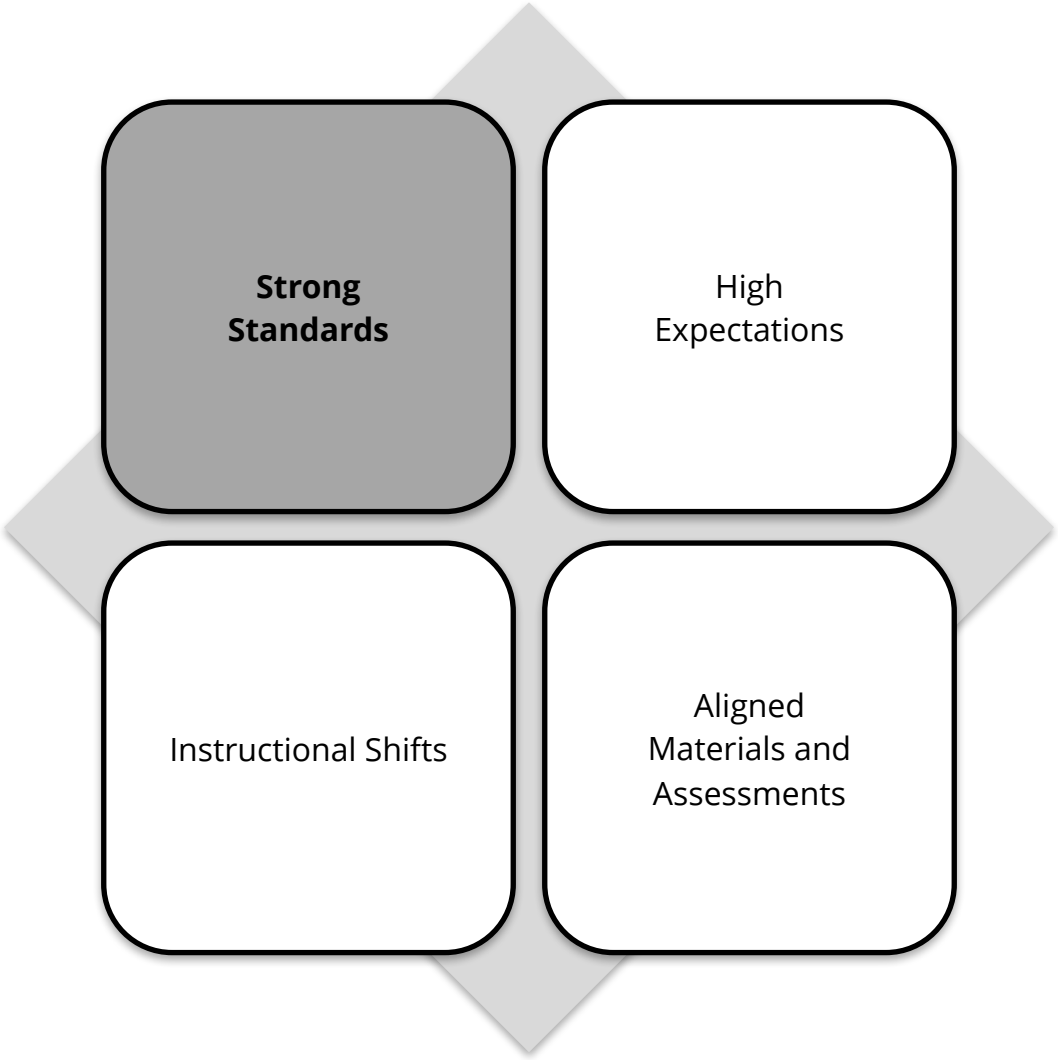
TAB PAGE

Part 1: The Standards

Module 2: The Tennessee Mathematics Academic Standards



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Goals

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

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.

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Instructional Shifts

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Aligned Materials and Assessments

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Setting the Stage

Directions:

1. Read and annotate the *General Introduction* to the TN Math Standards (pages 1–2) focusing on the "Mathematically Prepared" and "Conceptual Understanding, Procedural Fluency, and Application" sections.
2. After reading and annotating the two parts, write the sentence or phrase you felt was the most important in the box below and your rationale for choosing it.

Most Important Idea:
Rationale:
Key Ideas from Discussion:

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What Has NOT Changed

- Students **prepared** for college and career
- K–12 **learning progressions**
- Traditional and integrated **pathways** (for high school)
- Standards for **Mathematical Practice**
- **Instructional shifts**

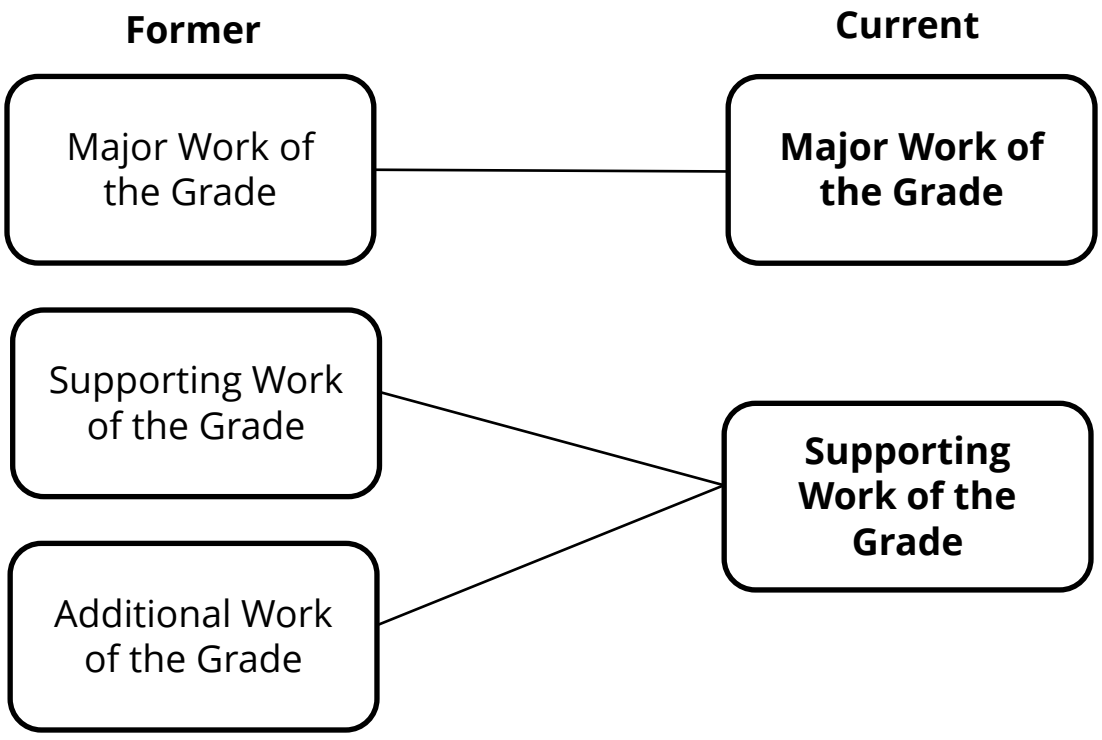
Notes:

What HAS Changed

- Category Change
- Revised Structured
- Coding & Nomenclature
- Literacy Skills for Mathematical Proficiency

What HAS Changed

Category Change



Notes:

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What HAS Changed

Revised Structure

Operations and Algebraic Thinking (OA)

Cluster Headings	Content Standards
A. Use the four operations with whole numbers to solve problems. (See Table 1 - Addition and Subtraction Situations and Table 2 - Multiplication and Division Situations)	**4.OA.A.1** Interpret a multiplication equation as a comparison (e.g., interpret 35 = 5 x 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. **4.OA.A.2** Multiply or divide to solve contextual problems involving multiplicative comparison, and distinguish multiplicative comparison from additive comparison. *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.* **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.
B. Gain familiarity with factors and multiples.	**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.
C. Generate and analyze patterns.	**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. *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.*

Major Content | Supporting Content

Notes:

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What HAS Changed

Revised Structure

Cluster Headings	Content Standards	Scope & Clarifications
B. Solve equations and inequalities in one variable.	**A1.A.REI.B.3** Solve quadratic equations and inequalities in one variable. **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	*For A1.A.REI.B.3b:* *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.* *Note: solving a quadratic equation by factoring relies on the connection between zeros and factors of polynomials. This is formally assessed in Algebra II.*
C. Solve systems of equations.	**A1.A.REI.C.4** Write and solve a system of linear equations in context.	*Solve systems both algebraically and graphically.* *Systems are limited to at most two equations in two variables.*

Notes:

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What HAS Changed

Coding and Nomenclature

M1.A.SSE.A.1

M1	
A	
SSE	
A	
1	

A2.N.RN.A.1

A2	
N	
RN	
A	
1	

Notes:

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What HAS Changed

Literacy Skills for Mathematical Proficiency

Communication in mathematics requires literacy skills in reading, vocabulary, speaking, listening, and writing. Students must be able to:

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.

Notes:

Module 2 Review

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

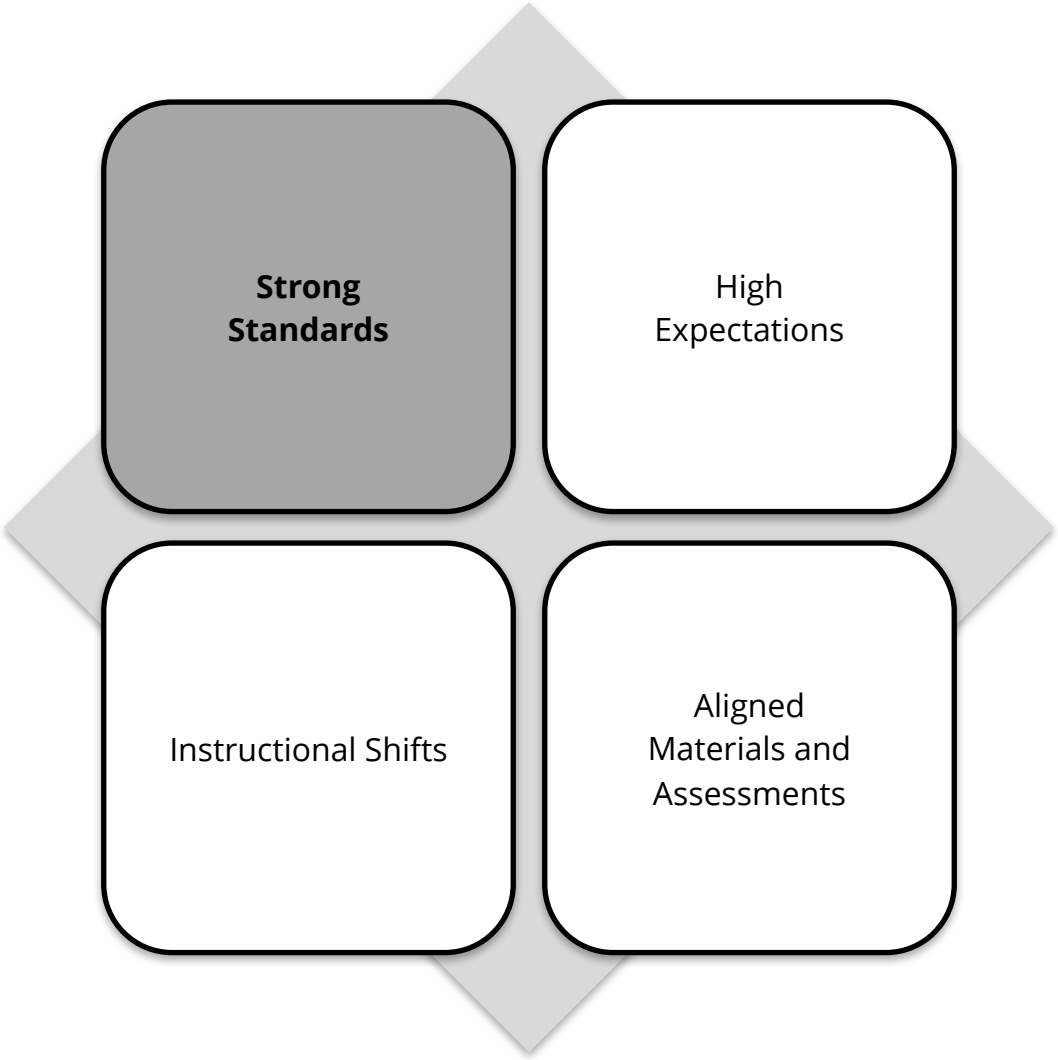
Strong Standards

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

TAB PAGE

Part 1: The Standards

Module 3: Summary of Revisions



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Goals

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

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.

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.

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Why Standards?

"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, and J. Chappuis, 2006

What about this quotation sticks out to you?

Notes:

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Revisions to the Math Standards

Specific to K–5

- Refined for clarity
- Increased fluency expectations
- Revised examples

Overarching Revisions

- Supporting and additional work of the grade is combined as supporting work of the grade
- Increased fluency expectations

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

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Revisions to the Math Standards

Specific to K–5

- Refined for clarity
- Increased fluency expectations
- Revised examples

Overarching Revisions

- Added/shifted a small number of standards to strengthen coherence across grade levels

	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.

TN Department of Education

Revisions to the Math Standards

Specific to K–5

- Refined for clarity
- Increased fluency expectations
- Revised examples

Overarching Revisions

- Added/shifted a small number of standards to strengthen coherence across grade levels

	Former Standard	Current Standard
Fourth Grade	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, express measurements in a larger unit in terms of a smaller unit. 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),…	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.
Fifth Grade	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.	5.MD.A.1 Convert customary and metric measurement units within a single system by expressing measurements of a larger unit in terms of a smaller unit. 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.

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Revisions to the Math Standards

Specific to K–5

- Refined for clarity
- Increased fluency expectations
- Revised examples

Overarching Revisions

- Revised language to provide clarity and continuity
- Highlighted chart for–grade level mastery expectation for addition, subtraction, multiplication and division

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.

Former Standard
4.NBT.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.

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Revisions to the Math Standards

Specific to 6–8

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

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

Former Standard
6.SP.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.

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Revisions to the Math Standards

Specific to 6–8

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

Overarching Revisions

- Revised a small number of standards to strengthen coherence by condensing, expanding, and removing standards
- Revised a small number of statistics and probability standards

Former Standard

6.EE.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.

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.

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Revisions to the Math Standards

Specific to 6–8

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

Overarching Revisions

- Revised a small number of standards to strengthen coherence by condensing, expanding, and removing standards
- Revised a small number of statistics and probability standards

Removed Standard

7.G.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.

Former Standard

6.SP.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 with reference to the context in which the data were gathered.

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Revisions to the Math Standards

Specific to 9–12

- Refined and revised scope and clarifications
- Revisions for Algebra II and Integrated Math III
- Restructured additional math courses to reflect college and career readiness

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 additional mathematics courses

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

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

Moved Standard
A2/M3.F.TF.5 to P.F.TF.A.4 Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.

This standard moved from Algebra II/Integrated III to Pre-Calculus.

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Revisions to the Math Standards

Specific to 9–12

- Refined and revised scope and clarifications
- Revisions for Algebra II and Integrated Math III
- Restructured additional courses to reflect college and career readiness

Overarching Revisions

- Restructured additional mathematics courses to reflect college and career readiness by removing three courses and adding “Applied Mathematical Concepts”

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

Former:

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

Current:

- **Applied Mathematical Concepts**
- Bridge Math
- Pre-Calculus
- Statistics
- Calculus

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Revisions to the Math Standards

New Applied Mathematical Concepts Course

- For students interested in careers that use applied mathematics such as banking, industry, or human resources
- Rich problem solving experience
- Combines standards from Senior Finite Math and Discrete Mathematics
- Designed with industry needs in mind
- Alignment with first three math courses and ACT college and career readiness
- Possible dual credit exam

Problems in Applied Mathematical Concepts

AM.G.L.A.3: Solve a variety of logic puzzles

What's the easiest way to heat a pan of water for 9 minutes when you have only a 6-minute hour-glass timer and a 21-minute hour-glass timer?

AM.D.ID.A.2: Use a variety of counting methods to organize information, determine probabilities, and solve problems.

Given a group of students: G = {Allen, Brenda, Chad, Dorothy, Eric} list and count the different ways of choosing the following officers or representatives for student congress. Assume that no one can hold more than one office.

A president, a secretary, and a treasurer, if the president must be a woman and the other two must be men.

AM.N.NQ.B.6: Solve contextual problems involving financial decision-making.

The cash price of a fitness system is $659.99. The customer paid $115 as a down payment. The remainder will be paid in 36 monthly installments of $19.16 each. Find the amount of the finance charge.

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Revisions to the Math Standards

Standards Comparison Activity

Compare the former standards to the current standards

Directions:

1. Highlight any changes you notice between the former standards and the current standards in the column on the right.
2. Use the included chart to compare the former standards with the current standards.

Notes:

Notation	TN Standards through May 2017		Revised TN Standards	
	Standard	Clarification	Standard	Clarification
A1.N.RN.A.3	3. Explain why the sum or product of two rational numbers is rational; and that they product of a nonzero rational number and an irrational number is irrational.	*There is no additional scope or clarification information for this standard.*		
A1.N.Q.A.1	1. Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.	*There is no additional scope or clarification information for this standard.*	**A1.N.Q.A.1** Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
A1.N.Q.A.2	2. Define appropriate quantities for the purpose of descriptive modeling.	*This standard will be assessed in Algebra I by ensuring that some modeling tasks (involving Algebra I content or securely held content from grades 6-8) require the student to create a quantity of interest in the situation being described (i.e., a quantity of interest is not selected for the student by the task). For example, in a situation involving data, the student might autonomously decide that a measure of center is a key variable in a situation, and then choose to work with the mean*	**A1.N.Q.A**.2 Identify, interpret, and justify appropriate quantities for the purpose of descriptive modeling.	*Descriptive modeling refers to understanding and interpreting graphs; identifying extraneous information; choosing appropriate units; etc. There are no assessment limits for this standard. The entire standard is assessed in this course.*
A1.N.Q.A.3	3. Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.	*There is no additional scope or clarification information for this standard.*	**A1.N.Q.A.3** Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*

A1.A.SSE.A.1	1. Interpret expressions that represent a quantity in terms of its context.★ a. Interpret parts of an expression, such as terms, factors, and coefficients. b. Interpret complicated expressions by viewing one or more of their parts as a single entity. For example, interpret $P(1+r)^n$ as the product of P and a factor not depending on P.	*There is no additional scope or clarification information for this standard.*	**A1.A.SSE.A.1** Interpret expressions that represent a quantity in terms of its context.★ a. Interpret parts of an expression, such as terms, factors, and coefficients. b. Interpret complicated expressions by viewing one or more of their parts as a single entity.	*For example, interpret $P(1 + r)^n$ as the product of P and a factor not depending on P.* *There are no assessment limits for this standard. The entire standard is assessed in this course.*
A1.A.SSE.A.2	*2.* Use the structure of an expression to identify ways to rewrite it. For example, see $x^4 - y^4$ as $\left(x^2\right)^2 - \left(y^2\right)^2$, thus recognizing it as a difference of squares that can be *factored as* $\left(x^2 - y^2\right)\left(x^2 + y^2\right)$	*i) Tasks are limited to numerical expressions and polynomial expressions in one variable.* *ii) Examples: Recognize $53^2 - 47^2$ as a difference of squares and see an opportunity to rewrite it in the easier-to-evaluate form (53+47)(53-47). See an opportunity to rewrite $a^2 + 9a + 14$ as (a+7)(a-2).*	**A1.A.SSE.A.2** Use the structure of an expression to identify ways to rewrite it.	*For example, recognize $53^2 - 47^2$ as a difference of squares and see an opportunity to rewrite it in the easier to-evaluate form (53 + 47)(53 – 47). See an opportunity to rewrite $a^2 + 9a + 14$ as $(a + 7)(a + 2)$.* *Tasks are limited to numerical expressions and polynomial expressions in one variable.*
A1.A.SSE.B.3	3. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. ★ a. Factor a quadratic expression to reveal the zeros of the function it defines. b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.	*i) Tasks have a real-world context. As described in the standard, there is an interplay between the mathematical structure of the expression and the structure of the situation such that choosing and producing an equivalent form of the expression reveals something about the situation.* *ii) Tasks are limited to exponential expressions with integer exponents.*	**A1.A.SSE.B.3** Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.★ a. Factor a quadratic expression to reveal the zeros of the function it defines. b. Complete the square in a quadratic expression in the form $Ax^2 + Bx + C$ where A = 1 to reveal the maximum or minimum value of the function it defines.	*For A1.A.SSE.B.3c:* *For example, the growth of bacteria can be modeled by either $f(t) = 3^{(t+2)}$ or $g(t) = 9(3^t)$ because the expression $3^{(t+2)}$ can be rewritten as $(3^t)(3^2) = 9(3^t)$.* *i) Tasks have a real-world context. As described in the standard, there is an interplay between the mathematical structure of the expression and the structure of the situation such that choosing and producing an equivalent form of the expression reveals something about the situation.*

	c. Use the properties of exponents to transform expressions for exponential functions. For example the expression 1.15^t can be rewritten as $(1.15^{1/12})^{12t} \approx 1.012^{12t}$ to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.		c. Use the properties of exponents to rewrite exponential expressions.	*ii) Tasks are limited to exponential expressions with integer exponents.*
A1.A.APR.A.1	1. Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.	*There is no additional scope or clarification information for this standard.*	**A1.A.APR.A.1** Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
A1.A.APR.B.3	3. Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.	*i) Tasks are limited to quadratic and cubic polynomials in which linear and quadratic factors are available. For example, find the zeros of $(x - 2)(x^2 - 9)$.*	**A1.A.APR.B.2** Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.	*Graphing is limited to linear and quadratic polynomials*
A1.A.CED.A.1	1. Create equations and inequalities in one variable and use them to solve problems. *Include equations arising from linear and quadratic functions, and simple rational and*	*i) Tasks are limited to linear, quadratic, or exponential equations with integer exponents.*	**A1.A.CED.A.1** Create equations and inequalities in one variable and use them to solve problems.	*Tasks are limited to linear, quadratic, or exponential equations with integer exponents.*

	exponential functions.			
A1.A.CED.A.2	2. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.	*There is no additional scope or clarification information for this standard*	**A1.A.CED.A.2** Create equations in two or more variables to represent relationships between quantities; graph equations with two variables on coordinate axes with labels and scales.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
A1.A.CED.A.3	3. Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.	*There is no additional scope or clarification information for this standard*	**A1.A.CED.A.3** Represent constraints by equations or inequalities and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context.	*For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.* *There are no assessment limits for this standard. The entire standard is assessed in this course.*
A1.A.CED.A.4	4. Rearrange formulas to highlight a quantity of interest, using the same reasoning a sin solving equations. For example, rearrange Ohm's law $V = IR$ to highlight resistance R.	*There is no additional scope or clarification information for this standard*	**A1.A.CED.A.4** Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.	*i) Tasks are limited to linear, quadratic, piecewise, absolute value, and exponential equations with integer exponents* *. ii) Tasks have a real-world context.*
A1.A.REI.A.1	1. Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.	*i) Tasks are limited to quadratic equations*	**A1.A.REI.A.1** Explain each step in solving an equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.	*Tasks are limited to linear, quadratic, piecewise, absolute value, and exponential equations with integer exponents.*

A1.A.REI.B.3	3. Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.	*There is no additional scope or clarification information for this standard.*	**A1.A.REI.B.2** Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
A1.A.REI.B.4	4. Solve quadratic equations in one variable. a. Use the method of completing the square to transform 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, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as $a \pm bi$ for real numbers a and b.	*For A-REI.4b:* *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.* *Note, solving a quadratic equation by factoring relies on the connection between zeros and factors of polynomials (cluster A-APR.B). Cluster AAPR.B is formally assessed in A2.*	**A1.A.REI.B.3** Solve quadratic equations and inequalities in one variable. 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.	*For A1.A.REI.B.3b:* *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.* *Note: solving a quadratic equation by factoring relies on the connection between zeros and factors of polynomials. This is formally assessed in Algebra II.*
			A1.A.REI.C.4 Write and solve a system of linear equations in context.	*Solve systems both algebraically and graphically.* *Systems are limited to at most two equations in two variables.*
A1.A.REI.C.5	5. Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions.	*There is no additional scope or clarification information for this standard.*		

A1.A.REI.C.6	6. Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.	*i) Tasks have a real-world context.* *ii) Tasks have hallmarks of modeling as a mathematical practice (less defined tasks, more of the modeling cycle, etc.).*		
A1.A.REI.D.10	10. Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).	*There is no additional scope or clarification information for this standard.*	**A1.A.REI.D.5** Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).	*There are no assessment limits for this standard. The entire standard is assessed in this course*
A1.A.REI.D.11	11. Explain why the *x*-coordinates of the points where the graphs of the equations $y = f(x)$ and $y = g(x)$ intersect are the solutions of the equation $f(x) = g(x)$; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where $f(x)$ and/or $g(x)$ are linear, polynomial, rational, absolute value, exponential, and logarithmic functions. ★	*i) Tasks that assess conceptual understanding of the indicated concept may involve any of the function types mentioned in the standard except exponential and logarithmic functions.* *ii) Finding the solutions approximately is limited to cases where f(x) and g(x) are polynomial functions.*	**A1.A.REI.D.6** Explain why the x-coordinates of the points where the graphs of the equations $y = f(x)$ and $y = g(x)$ intersect are the solutions of the equation $f(x) = g(x)$; find the approximate solutions using technology. ★	*Include cases where f(x) and/or g(x) are linear, quadratic, absolute value, and exponential functions. For example, f(x) = 3x + 5 and g(x) = x2 + 1.* *Exponential functions are limited to domains in the integers.*
A1.A.REI.D.12	12. Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.	*There is no additional scope or clarification information for this standard.*	**A1.A.REI.D.7** Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*

A1.F.IF.A.1	1. Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If f is a function and *x* is an element of its domain, then *f(x)* denotes the output of f corresponding to the input *x*. The graph of *f* is the graph of the equation *y* = f(*x*).	*There is no additional scope or clarification information for this standard.*	**A1.F.IF.A.1** Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If *f* is a function and *x* is an element of its domain, then f(x) denotes the output of f corresponding to the input *x*. The graph of *f* is the graph of the equation *y* = *f(x)*.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
A1.F.IF.A.2	2. Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.	*There is no additional scope or clarification information for this standard.*	**A1.F.IF.A.2** Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
A1.F.IF.A.3	3. Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. For example, the Fibonacci sequence is defined recursively by *f*(0) = *f*(1) = 1, *f*(*n*+1) = *f*(*n*) + *f*(*n*-1) for *n* ≥ 1.	*i) This standard is part of the Major work in Algebra I and will be assessed accordingly.*		
A1.F.IF.B.4	4. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums	*i) Tasks have a real-world context.* *ii) Tasks are limited to linear functions, quadratic functions, square root functions, cube root functions, piecewise-defined functions (including step functions and absolute value functions), and exponential functions with domains in the integers.* *Compare note (ii) with standard F-IF.7. The function types listed here are the same as those listed in the*	**A1.F.IF.B.3** For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. ★	*Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; and end behavior.* *i) Tasks have a real-world context.* *ii) Tasks are limited to linear functions, quadratic functions, absolute value functions, and exponential functions with domains in the integers.*

	and minimums; symmetries; end behavior; and periodicity. ★	*Algebra I column for standards F-IF.6 and F-IF.9.*		
A1.F.IF.B.5	5. Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. For example, if the function *h(n)* gives the number of person-hours it takes to assemble *n* engines in a factory, then the positive integers would be an appropriate domain for the function.★	*There is no additional scope or clarification information for this standard.*	**A1.F.IF.B.4** Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. ★	*For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.* *There are no assessment limits for this standard. The entire standard is assessed in this course.*
A1.F.IF.B.6	6. Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.★	*i) Tasks have a real-world context.* *ii) Tasks are limited to linear functions, quadratic functions, square root functions, cube root functions, piecewise-defined functions (including step functions and absolute value functions), and exponential functions with domains in the integers.* *The function types listed here are the same as those listed in the Algebra I column for standards F-IF.4 and F-IF.9.*	**A1.F.IF.B.5** Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.★	*i) Tasks have a real-world context.* *ii) Tasks are limited to linear functions, quadratic functions, piecewise-defined functions (including step functions and absolute value functions), and exponential functions with domains in the integers.*
A1.F.IF.C.7	7. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. ★ a. Graph linear and quadratic functions and show intercepts, maxima, and minima. b. Graph square root, cube	*There is no additional scope or clarification information for this standard.*	**A1.F.IF.C.6** Graph functions expressed symbolically and show key features of the graph, by hand and using technology. a. Graph linear and quadratic functions and show intercepts, maxima, and minima. b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.	*Tasks in A1.F.IF.C.6b are limited to piecewise, step and absolute value functions.*

	root, and piecewise-defined functions, including step functions and absolute value functions			
A1.F.IF.C.8	8. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. a. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.	*There is no additional scope or clarification information for this standard.*	**A1.F.IF.C.7** Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. a. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
A1.F.IF.C.9	9. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.	*i) Tasks are limited to linear functions, quadratic functions, square root functions, cube root functions, piecewise-defined functions (including step functions and absolute value functions), and exponential functions with domains in the integers.* *The function types listed here are the same as those listed in the Algebra I column for standards F-IF.4 and F-IF.6.*	**A1.F.IF.C.8** Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).	*i) Tasks have a real-world context.* *ii) Tasks are limited to linear functions, quadratic functions, piecewise-defined functions (including step functions and absolute value functions), and exponential functions with domains in the integers.*
A1.F.BF.A.1	1. Write a function that describes a relationship between two quantities. ★ a. Determine an explicit expression, a recursive process, or steps for calculation from a context.	*i) Tasks have a real-world context.* *ii) Tasks are limited to linear functions, quadratic functions, and exponential functions with domains in the integers.*	**A1.F.BF.A.1** Write a function that describes a relationship between two quantities.★ a. Determine an explicit expression, a recursive process, or steps for calculation from a context.	*i) Tasks have a real-world context.* *ii) Tasks are limited to linear functions, quadratic functions, and exponential functions with domains in the integers.*

A1.F.BF.B.3	3. Identify the effect on the graph of replacing *f*(*x*) by *f*(*x*) + *k*, *k* f(*x*), *f*(*kx*), and *f*(x + *k*) for specific values of *k* (both positive and negative); find the value of *k* given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd function from their graphs and algebraic expressions for them.	*i) Identifying the effect on the graph of replacing f(x) by f(x) + k, k f(x), f(kx), and f(x+k) for specific values of k (both positive and negative) is limited to linear and quadratic functions.* *ii) Experimenting with cases and illustrating an explanation of the effects on the graph using technology is limited to linear functions, quadratic functions, square root functions, cube root functions, piecewise-defined functions (including step functions and absolute value functions), and exponential functions with domains in the integers.* *iii) Tasks do not involve recognizing even and odd functions.* *The function types listed in note (ii) are the same as those listed in the Algebra I column for standards F-IF.4, F-IF.6, and F-IF.9.*	**A1.F.BF.B.2** Identify the effect on the graph of replacing *f*(*x*) by *f*(*x*) + *k*, *k f*(*x*), *f*(*kx*), and f(x + k) for specific values of *k* (both positive and negative); find the value of *k* given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology.	*i) Identifying the effect on the graph of replacing f(x) by f(x) + k, k f(x), and f(x+k) for specific values of k (both positive and negative) is limited to linear, quadratic, and absolute value functions.* *ii) f(kx) will not be included in Algebra 1. It is addressed in Algebra 2.* *iii) Experimenting with cases and illustrating an explanation of the effects on the graph using technology is limited to linear functions, quadratic functions, absolute value, and exponential functions with domains in the integers.* *iv) Tasks do not involve recognizing even and odd functions.*
A1.F.LE.A.1	1. Distinguish between situations that can be modeled with linear functions and with exponential functions. a. Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals. b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.	*There is no additional scope or clarification information for this standard.*	**A1.F.LE.A.1** Distinguish between situations that can be modeled with linear functions and with exponential functions. a. Recognize that linear functions grow by equal differences over equal intervals and that exponential functions grow by equal factors over equal intervals. b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*

	c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.		c. Recognize situations in which a quantity grows or decays by a constant factor per unit interval relative to another.	
A1.F.LE.A.2	2. Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).	*i) Tasks are limited to constructing linear and exponential functions in simple context (not multi-step).*	**A1.F.LE.A.2** Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a table, a description of a relationship, or input-output pairs.	*Tasks are limited to constructing linear and exponential functions in simple context (not multi-step).*
A1.F.LE.A.3	3. Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.	*There is no additional scope or clarification information for this standard.*	**A1.F.LE.A.3** Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
A1.F.LE.B.5	5. Interpret the parameters in a linear or exponential function in terms of a context.	*i) Tasks have a real-world context.* *ii) Exponential functions are limited to those with domains in the integers.*	**F.LE.B.4** Interpret the parameters in a linear or exponential function in terms of a context.	*For example, the total cost of an electrician who charges 35 dollars for a house call and 50 dollars per hour would be expressed as the function y = 50x + 35. If the rate were raised to 65 dollars per hour, describe how the function would change.* *i) Tasks have a real-world context.* *ii) Exponential functions are limited to those with domains in the integers.*

A1.S.ID.A.1	1. Represent data with plots on the real number line (dot plots, histograms, and box plots).	*There is no additional scope or clarification information for this standard.*	**A1.S.ID.A.1** Represent single or multiple data sets with dot plots, histograms, stem plots (stem and leaf), and box plots.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
A1.S.ID.A.2	2. Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.	*There is no additional scope or clarification information for this standard.*	**A1.S.ID.A.2** Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
A1.S.ID.A.3	3. Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).	*There is no additional scope or clarification information for this standard.*	**A1.S.ID.A.3** Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
A1.S.ID.B.5	5. Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data	*There is no additional scope or clarification information for this standard.*		
A1.S.ID.B.6	6. Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context.	*For S-ID.6a:* *i) Tasks have a real-world context.* *ii) Exponential functions are limited to those with domains in the integers.*	**A1.S.ID.B.4** Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context.	*Emphasize linear models, quadratic models, and exponential models with domains in the integers.* *For A1.S.ID.B.4a:* *i) Tasks have a real-world context.* *ii) Exponential functions are limited to those with domains in the integers.*

	Emphasize linear, quadratic, and exponential models. b. Informally assess the fit of a function by plotting and analyzing residuals. c. Fit a linear function for a scatter plot that suggests a linear association.		b. Fit a linear function for a scatter plot that suggests a linear association.	
A1.S.ID.C.7	7. Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.	*There is no additional scope or clarification information for this standard.*	**A1.S.ID.C.5** Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
A1.S.ID.C.8	8. Compute (using technology) and interpret the correlation coefficient of a linear fit.	*There is no additional scope or clarification information for this standard.*	**A1.S.ID.C.6** Use technology to compute and interpret the correlation coefficient of a linear fit.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
A1.S.ID.C.9	9. Distinguish between correlation and causation.	*There is no additional scope or clarification information for this standard.*	**A1.S.ID.C.7** Distinguish between correlation and causation.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*

	Major Work of the Grade		Supporting Work

Notation	TN Standards through May 2017		Revised TN Standards	
	Standard	Clarification	Standard	Clarification
A2.N.RN.A.1	1. Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents. *For example, we define $5^{1/3}$ to be the cube root of 5 because we want $(5^{1/3})^3 = 5^{(1/3)3}$ to hold, so $(5^{1/3})^3$ must equal 5.*	*There is no additional scope or clarification information for this standard.*	**A2.N.RN.A.1** Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents.	*For example, we define $5^{1/3}$ to be the cube root of 5 because we want $(5^{1/3})^3 = 5^{(⅓)3}$ to hold, so $(5^{1/3})^3$ must equal 5.* *There are no assessment limits for this standard. The entire standard is assessed in this course.*
A2.N.RN.A.2	2. Rewrite expressions involving radicals and rational exponents using the properties of exponents.	*There is no additional scope or clarification information for this standard.*	**A2.N.RN.A.2** Rewrite expressions involving radicals and rational exponents using the properties of exponents.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
A2.N.NQ.A.2	2. Define appropriate quantities for the purpose of descriptive modeling.	*This standard will be assessed in Algebra II by ensuring that some modeling tasks (involving Algebra II content or securely held content from previous grades and courses) require the student to create a quantity of interest in the situation being described (i.e., this is not provided in the task). For example, in a situation involving periodic phenomena, the student might autonomously decide that amplitude is a key variable in a situation, and then choose to work with peak amplitude.*	**A2.NQ.A.1** Identify, interpret, and justify appropriate quantities for the purpose of descriptive modeling.	*Descriptive modeling refers to understanding and interpreting graphs; identifying extraneous information; choosing appropriate units; etc.* *There are no assessment limits for this standard. The entire standard is assessed in this course.*
A2.N.CN.A.1	1. Know there is a complex number *i* such that $i^2 = –1$, and every complex number has the form $a + bi$ with a and b real.	*There is no additional scope or clarification information for this standard.*	**A2.N.CN.A**.1 Know there is a complex number *i* such that $i^2 = –1$, and every complex number has the form $a + b$i with a and b real.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*

A2.N.CN.A.2	2. Use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.	*There is no additional scope or clarification information for this standard.*	**A2.N.CN.A.2** Know and use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.	There are no assessment limits for this standard. The entire standard is assessed in this course.
A2.N.CN.B.7	7. Solve quadratic equations with real coefficients that have complex solutions.	*There is no additional scope or clarification information for this standard.*	**A2.N.CN.B.3** Solve quadratic equations with real coefficients that have complex solutions.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
A2.A.SSE.A.2	2. Use the structure of an expression to identify ways to rewrite it. *For example, see $x^4 - y^4$ as $(x^2)^2 - (y^2)^2$, thus recognizing it as a difference of squares that can be factored as $(x^2 - y^2)(x^2 + y^2)$.*	*i) Tasks are limited to polynomial, rational, or exponential expressions.* *ii) Examples: see $x^4 - y^4$ as $(x^2)^2 - (y^2)^2$, thus recognizing it as a difference of squares that can be factored as $(x^2 - y^2)(x^2 + y^2)$. In the equation $x^2 + 2x + 1 + y^2 = 9$, see an opportunity to rewrite the first three terms as $(x+1)^2$, thus recognizing the equation of a circle with radius 3 and center (-1, 0). See $(x^2 + 4)/(x^2 + 3)$ as $((x^2+3) + 1)/(x^2+3)$, thus recognizing an opportunity to write it as $1 + 1/(x^2 + 3)$.*	**A2.A.SSE.A.1** Use the structure of an expression to identify ways to rewrite it.	*For example, see $2x^4 + 3x^2 - 5$ as its factors $(x^2 - 1)$ and $(2x2 + 5)$; see $x^4 - y^4$ as $(x^2)^2 - (y^2)^2$, thus recognizing it as a difference of squares that can be factored as* $(x^2 - y^2)(x^2 + y^2)$; see $(x^2 + 4)/(x^2 + 3)$ as $((x^2 + 3) + 1)/(x^2 + 3)$, thus recognizing an opportunity to write it as $1 + 1/(x 2 + 3)$. Tasks are limited to polynomial, rational, or exponential expressions.
A2.A.SSE.B.3	3. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.★ c. Use the properties of exponents to transform expressions for exponential	*i) Tasks have a real-world context. As described in the standard, there is an interplay between the mathematical structure of the expression and the structure of the situation such that choosing and producing an equivalent form of the expression reveals something about the situation.* *ii) Tasks are limited to exponential*	**A2.A.SSE.B.2** Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.★ a. Use the properties of exponents to rewrite expressions for exponential functions.	*For example the expression 1.15^t can be rewritten as $((1.15)^{1/12})^{12t} \approx 1.012^{12t}$ to reveal that the approximate equivalent monthly interest rate is 1.2% if the annual rate is 15%.* *i) Tasks have a real-world context. As described in the standard, there is an interplay between the mathematical structure of the expression and the structure of the situation such that choosing and producing an equivalent form of the expression*

	functions. *For example the expression* 1.15^t *can be rewritten as* $(1.15^{1/12})^{12t} \approx 1.012^{12t}$ *to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.*	*expressions with rational or real exponents.*		*reveals something about the situation.* *ii) Tasks are limited to exponential expressions with rational or real exponents.*
A2.A.SSE.B.4	4. Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems. *For example, calculate mortgage payments.*★	*There is no additional scope or clarification information for this standard.*	**A2.A.SSE.B.3** Recognize a finite geometric series (when the common ratio is not 1), and know and use the sum formula to solve problems in context.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
A2.A.APR.A.2	2. Know and apply the Remainder Theorem: For a polynomial $p(x)$ and a number a, the remainder on division by $x – a$ is $p(a)$, so $p(a) = 0$ if and only if $(x – a)$ is a factor of $p(x)$.	*There is no additional scope or clarification information for this standard.*	**A2.A.APR.A.1** Know and apply the Remainder Theorem: For a polynomial p(x) and a number a, the remainder on division by x – a is p(a), so p(a) = 0 if and only if (x – a) is a factor of p(x).	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
A2.A.APR.A.3	3. Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.	*i) Tasks include quadratic, cubic, and quartic polynomials and polynomials for which factors are not provided. For example, find the zeros of* $(x^2 - 1)(x^2 + 1)$	**A2.A.APR.A.2** Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.	*Tasks include quadratic, cubic, and quartic polynomials and polynomials for which factors are not provided. For example, find the zeros of* $(x^2 - 1)(x^2 + 1)$.
A2.A.APR.B.4	4. Prove polynomial identities and use them to describe numerical relationships. *For example, the polynomial identity* $(x^2 + y^2)^2 = (x^2 – y^2)^2 + (2xy)^2$ *can be used to generate Pythagorean triples.*	*There is no additional scope or clarification information for this standard.*	**A2.A.APR.B.3** Know and use polynomial identities to describe numerical relationships.	*For example, compare* $(31)(29) = (30 + 1)(30 – 1) = 302 – 1$ *2 with* $(x + y)(x – y) = x^2 – y^2$. *There are no assessment limits for this standard. The entire standard is assessed in this course.*
A2.A.APR.C.6	6. Rewrite simple rational expressions in different forms; write $a(x)/b(x)$ in the form $q(x) + r(x)/b(x)$, where $a(x)$, $b(x)$, $q(x)$, and $r(x)$ are polynomials with	*There is no additional scope or clarification information for this standard.*	**A2.A.APR.C.4** Rewrite rational expressions in different forms.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*

	the degree of $r(x)$ less than the degree of $b(x)$, using inspection, long division, or, for the more complicated examples, a computer algebra system.			
A2.A.CED.A.1	1. Create equations and inequalities in one variable and use them to solve problems. *Include equations arising from linear and quadratic functions, and simple rational and exponential functions.*	*i) Tasks are limited to exponential equations with rational or real exponents and rational functions. ii) Tasks have a real-world context.*	**A2.A.CED.A.1** Create equations and inequalities in one variable and use them to solve problems.	*Include equations arising from linear and quadratic functions, and rational and exponential functions.* *Tasks have a real-world context.*
			A2.A.CED.A.2 Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.	*i) Tasks are limited to square root, cube root, polynomial, rational, and logarithmic functions. ii) Tasks have a real-world context*
A2.A.REI.A.1	1. Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.	*i) Tasks are limited to simple rational or radical equations*	**A2.A.REI.A.1** Explain each step in solving an equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.	*Tasks are limited to square root, cube root, polynomial, rational, and logarithmic functions.*
A2.A.REI.A.2	2. Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.	*There is no additional scope or clarification information for this standard.*	**A2.A.REI.A.2** Solve rational and radical equations in one variable, and identify extraneous solutions when they exist.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
A2.A.REI.B.4	4. Solve quadratic equations in	*i) In the case of equations that have roots with nonzero imaginary*	**A2.A.REI.B.3** Solve quadratic	*In the case of equations that have roots with nonzero imaginary parts, students write the solutions as a ±*

	one variable. b. Solve quadratic equations by inspection (e.g., for x^2 = 49), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as $a \pm bi$ for real numbers a and b.	*parts, students write the solutions as a ± bi for real numbers a and b.*	equations and inequalities in one variable. a. 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 and write them as $a \pm bi$ for real numbers a and b.	*bi for real numbers a and b*
A2.A.REI.C.6	6. Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.	*i) Tasks are limited to 3x3 systems.*	**A2.A.REI.C.4** Write and solve a system of linear equations in context.	*When solving algebraically, tasks are limited to systems of at most three equations and three variables. With graphic solutions, systems are limited to only two variables.*
A2.A.REI.C.7	7. Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. *For example, find the points of intersection between the line $y = -3x$* and the circle $x^2 + y^2 = 3$.	*There is no additional scope or clarification information for this standard.*	**A2.A.REI.C.5** Solve a system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
A2.A.REI.D.11	11. Explain why the x-coordinates of the points where the graphs of the equations $y = f(x)$ and $y = g(x)$ intersect are the solutions of the equation $f(x) = g(x)$; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases	*i) Tasks may involve any of the function types mentioned in the standard.*	**A2.A.REI.D.6** Explain why the x-coordinates of the points where the graphs of the equations $y = f(x)$ and $y = g(x)$ intersect are the solutions of the equation $f(x) = g(x)$; find the approximate solutions using technology. ★	*Include cases where f(x) and/or g(x) are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.* *Tasks may involve any of the function types mentioned in the standard.*

	where $f(x)$ and/or $g(x)$ are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.★			
A2.F.IF.A.3	3. Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. *For example, the Fibonacci sequence is defined recursively by f(0) = f(1) = 1, f(n+1) = f(n) + f(n-1) for n ≥ 1.*	*i) This standard is Supporting work in Algebra II. This standard should support the Major work in F-BF.2 for coherence.*		
A2.F.IF.B.4	4. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.*★	*i) Tasks have a real-world context* *ii) Tasks may involve polynomial, exponential, logarithmic, and trigonometric functions. Compare note* *(ii) with standard F-IF.7.* *The function types listed here are the same as those listed in the Algebra II column for standards F-IF.6 and F-IF.9.*	**A2.F.IF.A.1** For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. ★	*Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; and end behavior.* *i) Tasks have a real-world context.* *ii) Tasks may involve square root, cube root, polynomial, exponential, and logarithmic functions.*
A2.F.IF.B.6	6. Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph. ★	*i) Tasks have a real-world context.* *ii) Tasks may involve polynomial, exponential, logarithmic, and trigonometric functions.* *The function types listed here are the same as those listed in the Algebra II column for standards F-IF.4 and F-IF.9.*	**A2.F.IF.A.2** Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.★	i) Tasks have a real-world context. ii) Tasks may involve polynomial, exponential, and logarithmic functionS.
A2.F.IF.C.7	7. Graph functions expressed symbolically and show key features of the graph, by hand	*There is no additional scope or clarification information for this standard.*	**A2.F.IF.B.3** Graph functions expressed symbolically and show key features of the graph, by hand	*A2.F.IF.B.3a: Tasks are limited to square root and cube root functions. The other functions are assessed in Algebra 1.*

	in simple cases and using technology for more complicated cases.★ c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior. e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.		and using technology.★ a. Graph square root, cube root, and piecewise defined functions, including step functions and absolute value functions. b. Graph polynomial functions, identifying zeros when suitable factorizations are available and showing end behavior. c. Graph exponential and logarithmic functions, showing intercepts and end behavior.	
A2.F.IF.C.8	8. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. b. Use the properties of exponents to interpret expressions for exponential functions. For example, identify percent rate of change in functions such as $y = (1.02)^t$, $y = (0.97)^t$, $y = (1.01)^{12t}$, $y = (1.2)^{t/10}$, and classify them as representing exponential growth or decay.	*There is no additional scope or clarification information for this standard.*	**A2.F.IF.B.4** Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. a. Know and use the properties of exponents to interpret expressions for exponential functions.	*For example, identify percent rate of change in functions such as $y = 2x$, $y = (1/2)^x$, $y = 2^{-x}$, $y = (1/2)^{-x}$.* *There are no assessment limits for this standard. The entire standard is assessed in this course.*
A2.F.IF.C.9	9. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.	*i) Tasks may involve polynomial, exponential, logarithmic, and trigonometric functions.* *The function types listed here are the same as those listed in the Algebra II column for standards F-IF.4 and F-IF.6.*	**A2.F.IF.B.5** Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).	*Tasks may involve polynomial, exponential, and logarithmic functions.*

A2.F.BF.A.1	1. Write a function that describes a relationship between two quantities.★ a. Determine an explicit expression, a recursive process, or steps for calculation from a context. b. Combine standard function types using arithmetic operations. For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.	*For F-BF.1a:* *i) Tasks have a real-world context* *ii) Tasks may involve linear functions, quadratic functions, and exponential functions.*	**A2.F.BF.A.1** Write a function that describes a relationship between two quantities.★ a. Determine an explicit expression, a recursive process, or steps for calculation from a context. b. Combine standard function types using arithmetic operations.	*For example, given cost and revenue functions, create a profit function.* *For A2.F.BF.A.1a:* *i) Tasks have a real-world context.* *I* *i) Tasks may involve linear functions, quadratic functions, and exponential functions.*
A2.F.BF.A.2	2. Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.★	*There is no additional scope or clarification information for this standard.*	**A2.F.BF.A.2** Know and write arithmetic and geometric sequences with an explicit formula and use them to model situations.★	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
A2.F.BF.B.3	3. Identify the effect on the graph of replacing *f*(*x*) by *f*(*x*) + *k, k f(x), f(kx),* and *f*(*x* + *k)* for specific values of *k* (both positive and negative); find the value of *k* given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them.	*) Tasks may involve polynomial, exponential, logarithmic, and trigonometric functions* *ii) Tasks may involve recognizing even and odd functions.* *The function types listed in note (i) are the same as those listed in the Algebra II column for standards F-IF.4, F-IF.6, and F-IF.9.*	**A2.F.BF.B.3** Identify the effect on the graph of replacing f(*x*) by f(*x*) + k, k f(*x*), f(*kx*), and f(*x* + *k*) for specific values of k (both positive and negative); find the value of *k* given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology.	*i) Tasks may involve polynomial, exponential, and logarithmic functions.* *ii) Tasks may involve recognizing even and odd functions.*
A2.F.BF.B.4	4. Find inverse functions. a. Solve an equation of the form f(*x*) = *c* for a simple function f that has an inverse	*There is no additional scope or clarification information for this standard.*	**A2.F.BF.B.4** Find inverse functions. a. Find the inverse of a function	*There are no assessment limits for this standard. The entire standard is assessed in this course.*

	and write an expression for the inverse. For example, f(x) =2x^3 or f(x) = (x+1)/(x–1) for $x \neq 1$.		when the given function is one-to-one.	
A2.F.LE.A.2	2. Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).	*i) Tasks will include solving multi-step problems by constructing linear and exponential functions.*	**A2.F.LE.A.1** Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a table, a description of a relationship, or input-output pairs.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
A2.F.LE.A.4	4. For exponential models, express as a logarithm the solution to $ab^{ct} = d$ where *a, c*, and *d* are numbers and the base *b* is 2, 10, or e; evaluate the logarithm using technology.	*There is no additional scope or clarification information for this standard*	**A2.F.LE.A.2** For exponential models, express as a logarithm the solution to $ab^{c}t = d$ where *a, c,* and *d* are numbers and the base *b* is 2, 10, or *e*; evaluate the logarithm using technology.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
A2.F.LE.B.5	5. Interpret the parameters in a linear or exponential function in terms of a context.	*i) Tasks have a real-world context.* *ii) Tasks are limited to exponential functions with domains not in the integers.*	**A2.F.LE.B.3** Interpret the parameters in a linear or exponential function in terms of a context.	*For example, the equation $y = 5000\ (1.06)^x$ models the rising population of a city with 5000 residents when the annual growth rate is 6 percent. What will be the effect on the equation if the city's growth rate was 7 percent instead of 6 percent?* *There are no assessment limits for this standard. The entire standard is assessed in this course.*
A2.F.TF.A.1	1. Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle *x.*	*There is no additional scope or clarification information for this standard.*	**A2.F.TF.A.1** Understand and use radian measure of an angle. a. Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle. b. Use the unit circle to find *sin* θ, *cos* θ, and *tan* θ when θ is a commonly recognized angle between 0 and 2π.	*Commonly recognized angles include all multiples $n\pi/6$ and $n\pi/4$, where n is an integer. There are no assessment limits for this standard. The entire standard is assessed in this course.*
A2.F.TF.A.2	2. Explain how the unit circle	*There is no additional scope*	**A2.F.TF.A.2** Explain how the unit	*There are no assessment limits for this standard.*

	in the coordinate plane enables the extension of trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle.	*or clarification information for this standard.*	circle in the coordinate plane enables the extension of trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle.	*The entire standard is assessed in this course.*
A2.F.TF.B.5	5. Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.★	*There is no additional scope or clarification information for this standard.*		
A2.F.TF.C.8	8. Prove the Pythagorean identity $sin^2(\theta) + cos^2(\theta) = 1$ and use it to find *sin*(θ), *cos*(θ), or *tan*(θ) given *sin*(θ), *cos*(θ), or *tan*(θ) and the quadrant of the angle.	*There is no additional scope or clarification information for this standard.*		
			A2.F.TF.B.3 Know and use trigonometric identities to find values of trig functions. a. Given a point on a circle centered at the origin, recognize and use the right triangle ratio definitions of *sin* θ, *cos* θ, and *tan* θ to evaluate the trigonometric functions. b. Given the quadrant of the angle, use the identity $sin^2\theta + cos^2\theta = 1$ to find *sin* θ given *cos* θ, or vice versa.	*Commonly recognized angles include all multiples nπ /6 and nπ /4, where n is an integer.* *There are no assessment limits for this standard. The entire standard is assessed in this course.*
A2.GPE.A.2	2. Derive the equation of a parabola given a focus and directrix.	*There is no additional scope or clarification information for this standard.*		
A2.S.ID.A.4	4. Use the mean and standard	*There is no additional scope*	**A2.S.ID.A.1** Use the mean and	*There are no assessment limits for this standard. The entire standard is assessed in this course.*

	deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve.	*or clarification information for this standard.*	standard deviation of a data set to fit it to a normal distribution and to estimate population percentages using the Empirical Rule.	
A2.S.ID.B.6	6. Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. *Emphasize linear, quadratic, and exponential models.*	*i) Tasks have a real-world context.* *ii) Tasks are limited to exponential functions with domains not in the integers and trigonometric functions.*	**A2.S.ID.B.2** Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data.	*Use given functions or choose a function suggested by the context.* *Emphasize linear, quadratic, and exponential models.* *i) Tasks have a real-world context.* *ii) Tasks are limited to exponential functions with domains not in the integers.*
A2.S.IC.A.1	1. Understand statistics as a process for making inferences about population parameters based on a random sample from that population.	*There is no additional scope or clarification information for this standard.*		
A2.S.IC.A.2	2. Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation. *For example, a model says a spinning coin falls heads up with probability 0.5. Would a result of 5 tails in a row cause you to question the model?*	*There is no additional scope or clarification information for this standard.*		
A2.S.IC.B.3	3. Recognize the purposes of and differences among sample	*There is no additional scope or clarification information for*	**A2.S.IC.A.1** Recognize the purposes of and differences among	*For example, in a given situation, is it more appropriate to use a sample survey, an experiment,*

	surveys, experiments, and observational studies; explain how randomization relates to each.	*this standard.*	sample surveys, experiments, and observational studies; explain how randomization relates to each.	*or an observational study? Explain how randomization affects the bias in a study.* *There are no assessment limits for this standard. The entire standard is assessed in this course.*
A2.S.IC.B.4	4. Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling.	*There is no additional scope or clarification information for this standard.*	**A2.S.IC.A.2** Use data from a sample survey to estimate a population mean or proportion; use a given margin of error to solve a problem in context	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
A2.S.IC.B.5	5. Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.	*There is no additional scope or clarification information for this standard.*		
A2.S.IC.B.6	6. Evaluate reports based on data.	*There is no additional scope or clarification information for this standard.*		
A2.S.CP.A.1	1. Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events (“or,” “and,” “not”).	*There is no additional scope or clarification information for this standard.*	**A2.S.CP.A.1** Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events (“or,” “and,” “not”).	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
A2.S.CP.A.2	2. Understand that two events *A* and *B* are independent if the probability of *A* and *B* occurring together is the product of their probabilities, and use this characterization to determine if they are independent.	*There is no additional scope or clarification information for this standard.*	**A2.S.CP.A.2** Understand that two events A and B are independent if the probability of A and B occurring together is the product of their probabilities, and use this characterization to determine if they are independent.	*There are no assessment limits for this standard. The entire standard is assessed in this course*
A2.S.CP.A.3	3. Understand the conditional	*There is no additional scope*	**A2.S.CP.A.3** Know and understand	*There are no assessment limits for this standard.*

	probability of *A* given *B* as *P*(*A* and *B*)/*P*(*B*), and interpret independence of *A* and *B* as saying that the conditional probability of *A* given *B* is the same as the probability of *A*, and the conditional probability of *B* given *A* is the same as the probability of *B*.	*or clarification information for this standard.*	the conditional probability of *A* given *B* as *P*(*A* and *B*)/*P*(*B*), and interpret independence of *A* and *B* as saying that the conditional probability of *A* given *B* is the same as the probability of *A*, and the conditional probability of *B* given *A* is the same as the probability of *B*.	*The entire standard is assessed in this course*
A2.S.CP.A.4	4. Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities. For example, collect data from a random sample of students in your school on their favorite subject among math, science, and English. Estimate the probability that a randomly selected student from your school will favor science given that the student is in tenth grade. Do the same for other subjects and compare the results.	*There is no additional scope or clarification information for this standard.*		
A2.S.CP.A.5	5. Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. For example, compare the chance of having lung cancer if you are a smoker with the chance of being a smoker if you have lung cancer.	There is no additional scope or clarification information for this standard.	**A2.S.CP.A.4** Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations.	*For example, compare the chance of having lung cancer if you are a smoker with the chance of being a smoker if you have lung cancer.* *There are no assessment limits for this standard. The entire standard is assessed in this course.*

A2.S.CP.B.6	6. Find the conditional probability of *A* given *B* as the fraction of *B*'s outcomes that also belong to *A*, and interpret the answer in terms of the model.	*There is no additional scope or clarification information for this standard.*	**A2.S.CP.B.5** Find the conditional probability of *A* given *B* as the fraction of *B*'s outcomes that also belong to *A* and interpret the answer in terms of the model.	*For example, a teacher gave two exams. 75 percent passed the first quiz and 25 percent passed both. What percent who passed the first quiz also passed the second quiz?* *There are no assessment limits for this standard. The entire standard is assessed in this course.*
A2.S.CP.B.7	7. Apply the Addition Rule, *P*(*A* or *B*) = *P*(*A*) + *P*(*B*) – *P*(*A* and *B*), and interpret the answer in terms of the model.	*There is no additional scope or clarification information for this standard.*	**A2.S.CP.B.6** Know and apply the Addition Rule, *P*(*A* or *B*) = *P*(*A*) + *P*(*B*) – *P*(*A* and *B*), and interpret the answer in terms of the model.	*For example, in a math class of 32 students, 14 are boys and 18 are girls. On a unit test 6 boys and 5 girls made an A. If a student is chosen at random from a class, what is the probability of choosing a girl or an A student?* *There are no assessment limits for this standard. The entire standard is assessed in this course.*

	Major Work of the Grade		Supporting Work

Notation	TN Standards through May 2017	Revised TN Standards	
		Standard	Clarification
G.CO.A.1	Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc.	**G.CO.A.1** Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, plane, distance along a line, and distance around a circular arc.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
G.CO.A.2	Represent transformations in the plane using, e.g., transparencies and geometry software; describe transformations as functions that take points in the plane as inputs and give other points as outputs. Compare transformations that preserve distance and angle to those that do not (e.g., translation versus horizontal stretch).	**G.CO.A.2** Represent transformations in the plane in multiple ways, including technology. Describe transformations as functions that take points in the plane (pre-image) as inputs and give other points (image) as outputs. Compare transformations that preserve distance and angle measure to those that do not (e.g., translation versus horizontal stretch).	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
G.CO.A.3	Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.	**G.CO.A.3** Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry the shape onto itself.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
G.CO.A.4	Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.	**G.CO.A.4** Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
G.CO.A.5	Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, e.g., graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another.	**G.CO.A.5** Given a geometric figure and a rigid motion, draw the image of the figure in multiple ways, including technology. Specify a sequence of rigid motions that will carry a given figure onto another.	*Rigid motions include rotations, reflections, and translations.* *There are no assessment limits for this standard. The entire standard is assessed in this course.*

G.CO.B.6	Use geometric descriptions of rigid motions to transform figures and to predict the effect of a given rigid motion on a given figure; given two figures, use the definition of congruence in terms of rigid motions to decide if they are congruent.	**G.CO.B.6** Use geometric descriptions of rigid motions to transform figures and to predict the effect of a given rigid motion on a given figure; given two figures, use the definition of congruence in **terms** of rigid motions to determine informally if they are congruent.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
G.CO.B.7	Use the definition of congruence in terms of rigid motions to show that two triangles are congruent if and only if corresponding pairs of sides and corresponding pairs of angles are congruent.	**G.CO.B.7** Use the definition of congruence in terms of rigid motions to show that two triangles are congruent if and only if corresponding pairs of sides and corresponding pairs of angles are congruent.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
G.CO.B.8	Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions.	**G.CO.B.8** Explain how the criteria for triangle congruence (ASA, SAS, AAS, and SSS) follow from the definition of congruence in terms of rigid motions.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
G.CO.C.9	Prove theorems about lines and angles. *Theorems include: vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent and corresponding angles are congruent; points on a perpendicular bisector of a line segment are exactly those equidistant from the segment's endpoints.*	**G.CO.C.9** Prove theorems about lines and angles.	*Proving includes, but is not limited to, completing partial proofs; constructing two-column or paragraph proofs; using transformations to prove theorems; analyzing proofs; and critiquing completed proofs.* *Theorems include but are not limited to: vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent and corresponding angles are congruent; points on a perpendicular bisector of a line segment are exactly those equidistant from the segment's endpoints.*

G.CO.C.10	Prove theorems about triangles. *Theorems include: measures of interior angles of a triangle sum to 180°; base angles of isosceles triangles are congruent; the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; the medians of a triangle meet at a point.*	**G.CO.C.10** Prove theorems about triangles.	*Proving includes, but is not limited to, completing partial proofs; constructing two-column or paragraph proofs; using transformations to prove theorems; analyzing proofs; and critiquing completed proofs.* *Theorems include but are not limited to: measures of interior angles of a triangle sum to 180°; base angles of isosceles triangles are congruent; the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; the medians of a triangle meet at a point*
G.CO.C.11	Prove theorems about parallelograms. *Theorems include: opposite sides are congruent, opposite angles are congruent, the diagonals of a parallelogram bisect each other, and conversely, rectangles are parallelograms with congruent diagonals.*	**G.CO.C.11** Prove theorems about parallelograms.	*Proving includes, but is not limited to, completing partial proofs; constructing two-column or paragraph proofs; using transformations to prove theorems; analyzing proofs; and critiquing completed proofs.* *Theorems include but are not limited to: opposite sides are congruent, opposite angles are congruent, the diagonals of a parallelogram bisect each other, and conversely, rectangles are parallelograms with congruent diagonals.*

G.CO.D.12	Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.). *Copying a segment; copying an angle; bisecting a segment; bisecting an angle; constructing perpendicular lines, including the perpendicular bisector of a line segment; and constructing a line parallel to a given line through a point not on the line.*	**G.CO.D.12** Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.).	*Constructions include but are not limited to: copying a segment; copying an angle; bisecting a segment; bisecting an angle; constructing perpendicular lines, including the perpendicular bisector of a line segment; constructing a line parallel to a given line through a point not on the line, and constructing the following objects inscribed in a circle: an equilateral triangle, square, and a regular hexagon.*
G.CO.D.13	Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle.		
G.SRT.A.1	Verify experimentally the properties of dilations given by a center and a scale factor: a. A dilation takes a line not passing through the center of the dilation to a parallel line, and leaves a line passing through the center unchanged. b. The dilation of a line segment is longer or shorter in the ratio given by the scale factor.	**G.SRT.A.1** Verify informally the properties of dilations given by a center and a scale factor.	*Properties include but are not limited to: a dilation takes a line not passing through the center of the dilation to a parallel line, and leaves a line passing through the center of the dilation unchanged; the dilation of a line segment is longer or shorter in the ratio given by the scale factor.*
G.SRT.A.2	Given two figures, use the definition of similarity in terms of similarity transformations to decide if they are similar; explain using similarity transformations the meaning of similarity for triangles as the equality of all corresponding pairs of angles and the proportionality of all corresponding pairs of sides.	**G.SRT.A.2** Given two figures, use the definition of similarity in terms of similarity transformations to decide if they are similar; explain using similarity transformations the meaning of similarity for triangles as the equality of all corresponding pairs of angles and the proportionality of all corresponding pairs of sides.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*

G.SRT.A.3	Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.	**G.SRT.A.3** Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
G.SRT.B.4	Prove theorems about triangles. Theorems include: a line parallel to one side of a triangle divides the other two proportionally, and conversely; the Pythagorean Theorem proved using triangle similarity.	**G.SRT.B.4** Prove theorems about similar triangles.	*Proving includes, but is not limited to, completing partial proofs; constructing two-column or paragraph proofs; using transformations to prove theorems; analyzing proofs; and critiquing completed proofs.* *Theorems include but are not limited to: a line parallel to one side of a triangle divides the other two proportionally, and conversely; the Pythagorean Theorem proved using triangle similarity.*
G.SRT.B.5	Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.	**G.SRT.B.5** Use congruence and similarity criteria for triangles to solve problems and to justify relationships in geometric figures.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
G.SRT.C.6	Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles.	**G.SRT.C.6** Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
G.SRT.C.7	Explain and use the relationship between the sine and cosine of complementary angles.	**G.SRT.C.7** Explain and use the relationship between the sine and cosine of complementary angles.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*

G.SRT.C.8	Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems. ★	**G.SRT.C.8** Solve triangles. ★ a. Know and use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems. b. Know and use the Law of Sines and Law of Cosines to solve problems in real life situations. Recognize when it is appropriate to use each.	*Ambiguous cases will not be included in assessment.*
G.C.A.1	Prove that all circles are similar.	**G.C.A.1** Recognize that all circles are similar.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
G.C.A.2	Identify and describe relationships among inscribed angles, radii, and chords. *Include the relationship between central, inscribed, and circumscribed angles; inscribed angles on a diameter are right angles; the radius of a circle is perpendicular to the tangent where the radius intersects the circle.*	**G.C.A.2** Identify and describe relationships among inscribed angles, radii, and chords.	*Include the relationship between central, inscribed, and circumscribed angles; inscribed angles on a diameter are right angles; the radius of a circle is perpendicular to the tangent where the radius intersects the circle, and properties of angles for a quadrilateral inscribed in a circle.*
G.C.A.3	Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a circle.		
G.C.A.5	Derive using similarity the fact that the length of the arc intercepted by an angle is proportional to the radius, and define the radian measure of the angle as the constant of proportionality; derive the formula for the area of a sector.		

		G.C.A.3 Construct the incenter and circumcenter of a triangle and use their properties to solve problems in context.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
		G.C.B.4 Know the formula and find the area of a sector of a circle in a real-world context.	*For example, use proportional relationships and angles measured in degrees or radians.* *There are no assessment limits for this standard. The entire standard is assessed in this course.*
G.GPE.A.1	Derive the equation of a circle of given center and radius using the Pythagorean Theorem; complete the square to find the center and radius of a circle given by an equation.	**G.GPE.A.1** Know and write the equation of a circle of given center and radius using the Pythagorean Theorem.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
G.GPE.B.4	Use coordinates to prove simple geometric theorems algebraically. *For example, prove or disprove that a figure defined by four given points in the coordinate plane is a rectangle; prove or disprove that the point (1, $\sqrt{3}$,) lies on the circle centered at the origin and containing the point (0, 2).*	**G.GPE.B.2** Use coordinates to prove simple geometric theorems algebraically.	*For example, prove or disprove that a figure defined by four given points in the coordinate plane is a rectangle; prove or disprove that the point (1, $\sqrt{3}$) lies on the circle centered at the origin and containing the point (0, 2).* *There are no assessment limits for this standard. The entire standard is assessed in this course.*
G.GPE.B.5	Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems (e.g., find the equation of a line parallel or perpendicular to a given line that passes through a given point).	**G.GPE.B.3** Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems.	*For example, find the equation of a line parallel or perpendicular to a given line that passes through a given point.* *There are no assessment limits for this standard. The entire standard is assessed in this course.*

G.GPE.B.6	6. Find the point on a directed line segment between two given points that partitions the segment in a given ratio.	**G.GPE.B.4** Find the point on a directed line segment between two given points that partitions the segment in a given ratio.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
G.GPE.B.7	7. Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula. ★	**G.GPE.B.5** Know and use coordinates to compute perimeters of polygons and areas of triangles and rectangles.★	*For example, use the distance formula. There are no assessment limits for this standard.* *The entire standard is assessed in this course.*
G.GMD.A.1	1. Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone. *Use dissection arguments, Cavalieri's principle, and informal limit arguments.*	**G.GMD.A.1** Give an informal argument for the formulas for the circumference of a circle and the volume and surface area of a cylinder, cone, prism, and pyramid.	*Informal arguments may include but are not limited to using the dissection argument, applying Cavalieri's principle, and constructing informal limit arguments.* *There are no assessment limits for this standard. The entire standard is assessed in this course*
G.GMD.A.3	3. Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems. ★	**G.GMD.A.2** Know and use volume and surface area formulas for cylinders, cones, prisms, pyramids, and spheres to solve problems.★	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
G.GMD.A.4	4. Identify the shapes of two-dimensional cross-sections of three dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.		

G.MG.A.1	1. Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder). ★	**G.MG.A.1** Use geometric shapes, their measures, and their properties to describe objects.★	*For example, model a tree trunk or a human torso as a cylinder.* *There are no assessment limits for this standard. The entire standard is assessed in this course.*
G.MG.A.2	2. Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot). ★		
G.MG.A.3	3. Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios). ★	**G.MG.A.2** Apply geometric methods to solve real-world problems.★	*Geometric methods may include but are not limited to using geometric shapes, the probability of a shaded region, density, and design problems.* *There are no assessment limits for this standard. The entire standard is assessed in this course.*

	Major Content		**Supporting Content**

Notation	2016-17 Standard	2016-17 Scope and Clarification	2017-18 Standard	2017-18 Scope & Clarifications
N-Q.A.1	1. Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.	*There is no additional scope or clarification for this standard.*	**M1.N.Q.A.1** Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
N-Q.A.2	2. Define appropriate quantities for the purpose of descriptive modeling.	*This standard will be assessed in Math I by ensuring that some modeling tasks (involving Math I content or securely held content from grades 6-8) require the student to create a quantity of interest in the situation being described (i.e., a quantity of interest is not selected for the student by the task). For example, in a situation involving data, the student might autonomously decide that a measure of center is a key variable in a situation, and then choose to work with the mean.*	**M1.N.Q.A.2** Identify, interpret, and justify appropriate quantities for the purpose of descriptive modeling.	*Clarification: Descriptive modeling refers to understanding and interpreting graphs; identifying extraneous information; choosing appropriate units; etc.* *Tasks are limited to linear or exponential equations with integer exponents.*
N-Q.A.3	3. Choose a level of accuracy, appropriate to limitations on measurement when reporting quantities.	*There is no additional scope or clarification for this standard.*	**M1.N.Q.A.3** Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
A-SSE.A.1	1.Interpret expressions that represent a quantity in terms of its context.★ a. Interpret parts of an expression, such as terms, factors, and coefficients. b. Interpret complicated expressions by viewing one or more of their parts as a single entity. *For example, interpret* $P(1+r)^n$ *as the product of P and a factor not depending on P.*	i) Tasks are limited to exponential expressions, including related numerical expressions.	**M1.A.SSE.A.1 I**nterpret expressions that represent a quantity in terms of its context. ★ **a.** Interpret parts of an expression, such as terms, factors, and coefficients. **b.** Interpret complicated expressions by viewing one or more of their parts as a single entity.	*For example, interpret* $P(1 + r)^n$ *as the product of P and a factor not depending on P.* *Tasks are limited to linear and exponential expressions, including related numerical expressions*

A-SSE.B.3	3. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.★ c. Use the properties of exponents to transform expressions for exponential functions. *For example the expression* 1.15^t *can be rewritten as* $(1.15^{1/12})^{12t} \approx 1.012^{12t}$ *to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.*	*There is no additional scope or clarification for this standard.*	**M1.A.SSE.B.2** Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. ★ **a.** Use the properties of exponents to rewrite exponential expressions.	*For M1.A.SSE.B.2a: For example, the growth of bacteria can be modeled by either* $f(t) = 3^{(t+2)}$ *or* $g(t) = 9(3^t)$ *because the expression* $3^{(t+2)}$ *can be rewritten as* $(3^t)(3^2) = 9(3^t)$. *Tasks have a real-world context. As described in the standard, there is an interplay between the mathematical structure of the expression and the structure of the situation such that choosing and producing an equivalent form of the expression reveals something about the situation.*
A-CED.A.1	1. Create equations and inequalities in one variable and use them to solve problems. *Include equations arising from linear and quadratic functions, and simple rational and exponential functions.*	i) Tasks are limited to linear or exponential equations with integer exponents. ii) Tasks have a real-world context. iii) In the linear case, tasks have more of the hallmarks of modeling as a mathematical practice (less defined tasks, more of the modeling cycle, etc.).	**M1.A.CED.A.1** Create equations and inequalities in one variable and use them to solve problems.	*i) Tasks are limited to linear or exponential equations with integer exponents.* *ii) Tasks have a real-world context.* *iii) In the linear case, tasks have more of the hallmarks of modeling as a mathematical practice (less defined tasks, more of the modeling cycle, etc.).*
A-CED.A.2	2. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.	i) Tasks are limited to linear equations ii) Tasks have a real-world context. iii) Tasks have the hallmarks of modeling as a mathematical practice (less defined tasks, more of the modeling cycle, etc.).	**M1.A.CED.A.2** Create equations in two or more variables to represent relationships between quantities; graph equations with two variables on coordinate axes with labels and scales.	*i) Tasks are limited to linear equations* *ii) Tasks have a real-world context.* *iii) Tasks have the hallmarks of modeling as a mathematical practice (less defined tasks, more of the modeling cycle, etc.).*

A-CED.A.3	3. Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.*	*There is no additional scope or clarification for this standard.*	**M1.A.CED.A.3** Represent constraints by equations or inequalities and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context.	*For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.* *There are no assessment limits for this standard. The entire standard is assessed in this course.*
A-CED.A.4	4. Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. *For example, rearrange Ohm's law V = IR to highlight resistance R.*	i) Tasks are limited to linear equations ii) Tasks have a real-world context.	**M1.A.CED.A.4** Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.	*i) Tasks are limited to linear equations.* *ii) Tasks have a real-world context.*
A-REI.A.3	3. Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.	*There is no additional scope or clarification for this standard.*	**M1.A.REI.A.1** Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
A-REI.B.5	5. Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions.	*There is no additional scope or clarification for this standard.*		
A-REI.B.6	6. Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.	*There is no additional scope or clarification for this standard.*	**M1.A.REI.B.2** Write and solve a system of linear equations in context.	*Solve systems both algebraically and graphically.* *Systems are limited to at most two equations in two variables.*
A-REI.C.10	10. Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).	*There is no additional scope or clarification for this standard.*	**M1.A.REI.C.3** Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
A-REI.C.11	11. Explain why the *x*-coordinates of the points where the graphs of the equations $y = f(x)$ and $y = g(x)$ intersect are the solutions of the equation $f(x) = g(x)$; find	i) Tasks that assess conceptual understanding of the indicated concept may involve any of the function types mentioned in the	**M1.A.REI.C.4** Explain why the *x*-coordinates of the points where the graphs of the equations $y = f(x)$ and $y = g(x)$ intersect are the solutions of	*Include cases where f(x) and/or g(x) are linear, absolute value, and exponential functions. For*

	the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where $f(x)$ and/or $g(x)$ are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.★	standard except exponential and logarithmic functions. ii) Finding the solutions approximately is limited to cases where f(x) and g(x) are polynomial.	the equation $f(x) = g(x)$; find the approximate solutions using technology. ★	*example:* *$f(x) = 3x + 5$.* *i) Tasks that assess conceptual understanding of the indicated concept may involve any of the function types mentioned in the standard except exponential and logarithmic functions.* *ii) Finding the solutions approximately is limited to cases where f(x) and g(x) are polynomial.* *iii) Tasks are limited to linear and absolute value functions.*
A-REI.C.12	12. Graph the solutions to a linear inequality in two variables as a halfplane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half- planes.	*There is no additional scope or clarification for this standard.*	**M1.A.REI.C.5** Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
F-IF.A.1	1. Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If f is a function and x is an element of its domain, then $f(x)$ denotes the output of f corresponding to the input x. The graph of f is the graph of the equation $y = f(x)$.	*There is no additional scope or clarification for this standard.*	**M1.F.IF.A.1** Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If f is a function and x is an element of its domain, then $f(x)$ denotes the output of f corresponding to the input x. The graph of f is the graph of the equation $y = f(x)$.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
F-IF.A.2	2. Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.	*There is no additional scope or clarification for this standard.*	**M1.F.IF.A.2** Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*

F-IF.A.3	3. Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. *For example, the Fibonacci sequence is defined recursively by f(0) = f(1) = 1, f(n+1) = f(n) +f(n-1) for n ≥ 1.*	*There is no additional scope or clarification for this standard.*		
F-IF.B.4	4. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.*★	i) Tasks have a real-world context. ii) Tasks are limited to linear functions, square root functions, cube root functions, piecewise-defined functions (including step functions and absolute value functions), and exponential functions with domains in the integers. *The function types listed here are the same as those listed in the Math I column for standards F-IF.6 and F-IF.9.*	**M1.F.IF.B.3** For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. ★	*Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; and end behavior.* *i) Tasks have a real-world context.* *ii) Tasks are limited to linear functions, absolute value, and exponential functions with domains in the integers.*
F-IF.B.5	5. Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.*★	i) Tasks have a real-world context. ii) Tasks are limited to linear functions, square root functions, cube root functions, piecewise-defined functions (including step functions and absolute value functions), and exponential functions with domains in the integers.	**M1.F.IF.B.4** Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. ★	*For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.* *i) Tasks have a real-world context.* *ii) Tasks are limited to linear functions, piecewise functions (including step functions and absolute value functions), and exponential functions with domains in the integers.*

F-IF.B.6	6. Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.★	i) Tasks have a real-world context. ii) Tasks are limited to linear functions, square root functions, cube root functions, piecewise-defined functions (including step functions and absolute value functions), and exponential functions with domains in the integers. *The function types listed here are the same as those listed in the Math I column for standards F-IF.4 and F-IF.9.*	**M1.F.IF.B.5** Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph. ★	*i) Tasks have a real-world context.* *ii) Tasks are limited to linear functions, piecewise functions (including step functions and absolute value functions), and exponential functions with domains in the integers.*
F-IF.C.7	7. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.★ a. Graph linear and quadratic functions and show intercepts, maxima, and minima.	i) Tasks are limited to linear functions.	**M1.F.IF.C.6** Graph functions expressed symbolically and show key features of the graph, by hand and using technology. **a.** Graph linear and quadratic functions and show intercepts, maxima, and minima.	*Tasks are limited to linear functions.*
F-IF.C.9	9. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.*	i) Tasks have a real-world context. ii) Tasks are limited to linear functions, square root functions, cube root functions, piecewise-defined functions (including step functions and absolute value functions), and exponential functions with domains in the integers. *The function types listed here are the same as those listed in the Math I column for standards F-IF.4 and F-IF.6*	**M1.F.IF.C.7** Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). .	*i) Tasks have a real-world context.* *ii) Tasks are limited to linear functions, piecewise functions (including step functions and absolute value functions), and exponential functions with domains in the integers*
F-BF.A.1	1. Write a function that describes a relationship between two quantities.★ a. Determine an explicit expression, a recursive process, or steps for calculation from a context.	i) Tasks have a real-world context. ii) Tasks are limited to linear functions and exponential functions with domains in the integers.	**M1.F.BF.A.1** Write a function that describes a relationship between two quantities.★ **a.** Determine an explicit expression, a recursive process, or steps for calculation from a context.	*i) Tasks have a real-world context.* *ii) Tasks are limited to linear functions and exponential functions with domains in the integers.*

F-BF.A.2	2. Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.★	*There is no additional scope or clarification for this standard.*	**M1.F.BF.A.2** Write arithmetic and geometric sequences with an explicit formula and use them to model situations.★	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
F-LE.A.1	1. Distinguish between situations that can be modeled with linear functions and with exponential functions. a. Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals. b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another. c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.	*There is no additional scope or clarification for this standard.*	**M1.F.LE.A.1** Distinguish between situations that can be modeled with linear functions and with exponential functions. **a**. Recognize that linear functions grow by equal differences over equal intervals and that exponential functions grow by equal factors over equal intervals. **b**. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another. **c**. Recognize situations in which a quantity grows or decays by a constant factor per unit interval relative to another.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
F-LE.A.2	2. Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).	*There is no additional scope or clarification for this standard.*	**M1.F.LE.A.2** Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a table, a description of a relationship, or input-output pairs.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
F-LE.A.3	3. Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.	*There is no additional scope or clarification for this standard.*	**M1.F.LE.A.3** Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly.	*Tasks are limited linear and exponential functions.*
F-LE.B.5	5. Interpret the parameters in a linear or exponential function in terms of a context.	*There is no additional scope or clarification for this standard.*	**M1.F.LE.B.4** Interpret the parameters in a linear or exponential function in terms of a context.	*For example, the total cost of an electrician who charges 35 dollars for a house call and 50 dollars per hour would be expressed as the function y = 50x + 35. If the rate were raised to 65 dollars per hour,*

				describe how the function would change. *Tasks have a real-world context.*
G-CO.A.1	1. Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc.	*There is no additional scope or clarification for this standard.*	**M1.G.CO.A.1** Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, plane, distance along a line, and distance around a circular arc.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
G-CO.A.2	2. Represent transformations in the plane using, e.g., transparencies and geometry software; describe transformations as functions that take points in the plane as inputs and give other points as outputs. Compare transformations that preserve distance and angle to those that do not (e.g., translation versus horizontal stretch).	*There is no additional scope or clarification for this standard.*	**M1.G.CO.A.2** Represent transformations in the plane in multiple ways, including technology. Describe transformations as functions that take points in the plane (pre-image) as inputs and give other points (image) as outputs. Compare transformations that preserve distance and angle measure to those that do not (e.g., translation versus horizontal stretch).	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
G-CO.A.3	3. Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.	*There is no additional scope or clarification for this standard.*	**M1.G.CO.A.3** Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry the shape onto itself.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
G-CO.A.4	4. Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.	*There is no additional scope or clarification for this standard.*	**M1.G.CO.A.4** Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
G-CO.A.5	5. Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, e.g., graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another.	*There is no additional scope or clarification for this standard.*	**M1.G.CO.A.5** Given a geometric figure and a rigid motion, draw the image of the figure in multiple ways, including technology. Specify a sequence of rigid motions that will carry a given figure onto another.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*

G-C0.B.6	6. Use geometric descriptions of rigid motions to transform figures and to predict the effect of a given rigid motion on a given figure; given two figures, use the definition of congruence in terms of rigid motions to decide if they are congruent.	*There is no additional scope or clarification for this standard.*	**M1.G.CO.B.6** Use geometric descriptions of rigid motions to transform figures and to predict the effect of a given rigid motion on a given figure; given two figures, use the definition of congruence in terms of rigid motions to determine informally if they are congruent.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
G-C0.B.7	7. Use the definition of congruence in terms of rigid motions to show that two triangles are congruent if and only if corresponding pairs of sides and corresponding pairs of angles are congruent.	*There is no additional scope or clarification for this standard.*	**M1.G.CO.B.7** Use the definition of congruence in terms of rigid motions to show that two triangles are congruent if and only if corresponding pairs of sides and corresponding pairs of angles are congruent.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
G-CO.B.8	8. Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions.	*There is no additional scope or clarification for this standard.*	**M1.G.CO.B.8** Explain how the criteria for triangle congruence (ASA, SAS, AAS, and SSS) follow from the definition of congruence in terms of rigid motions.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
G-CO.C.9	9. Prove theorems about lines and angles. *Theorems include: vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent and corresponding angles are congruent; points on a perpendicular bisector of a line segment are exactly those equidistant from the segment's endpoints.*	*There is no additional scope or clarification for this standard.*	**M1.G.CO.C.9** Prove theorems about lines and angles.	*Proving includes, but is not limited to, completing partial proofs; constructing two-column or paragraph proofs; using transformations to prove theorems; analyzing proofs; and critiquing completed proofs.* *Theorems include but are not limited to: vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent and corresponding angles are congruent; points on a perpendicular bisector of a line segment are exactly those equidistant from the segment's endpoints.*

G-CO.C.10	10. Prove theorems about triangles. *Theorems include: measures of interior angles of a triangle sum to 180°; base angles of isosceles triangles are congruent; the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; the medians of a triangle meet at a point.*	*There is no additional scope or clarification for this standard.*	**M1.G.CO.C.10** Prove theorems about triangles. .	*Proving includes, but is not limited to, completing partial proofs; constructing two-column or paragraph proofs; using transformations to prove theorems; analyzing proofs; and critiquing completed proofs.* *Theorems include but are not limited to: measures of interior angles of a triangle sum to 180°; base angles of isosceles triangles are congruent; the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; the medians of a triangle meet at a point.*
G-CO.C.11	11. Prove theorems about parallelograms. *Theorems include: opposite sides are congruent, opposite angles are congruent, the diagonals of a parallelogram bisect each other, and conversely, rectangles are parallelograms with congruent diagonals.*	*There is no additional scope or clarification for this standard.*	**M1.G.CO.C.11** Prove theorems about parallelograms.	*Proving includes, but is not limited to, completing partial proofs; constructing two-column or paragraph proofs; using transformations to prove theorems; analyzing proofs; and critiquing completed proofs.* *Theorems include but are not limited to: opposite sides are congruent, opposite angles are congruent, the diagonals of a parallelogram bisect each other, and conversely, rectangles are parallelograms with congruent diagonals.*
S-ID.A.1	1. Represent data with plots on the real number line (dot plots, histograms, and box plots).	*There is no additional scope or clarification for this standard.*	**M1.S.ID.A.1** Represent single or multiple data sets with dot plots, histograms, stem plots (stem and leaf), and box plots.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*

S-ID.A.2	2. Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.	*There is no additional scope or clarification for this standard.*	**M1.S.ID.A.2** Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
S-ID.A.3	3. Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).	*There is no additional scope or clarification for this standard.*	**M1.S.ID.A.3** Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
S-ID.B.5	5. Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data.	*There is no additional scope or clarification for this standard.*		
S-ID.B.6	6. Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. *Use given functions or choose a function suggested by the context. Emphasize linear, quadratic, and exponential models.* c. Fit a linear function for a scatter plot that suggests a linear association.	i) Tasks have real-world context. ii) Tasks are limited to linear functions and exponential functions with domains in the integers.	**M1.S.ID.B.4** Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. **a.** Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. **b.** Fit a linear function for a scatter plot that suggests a linear association.	*i) Tasks have real-world context.* *ii) Tasks are limited to linear functions and exponential functions with domains in the integers.*
S-ID.C.7	7. Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*	**M1.S.ID.C.5** Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
S-ID.C.8	8. Compute (using technology) and interpret the correlation coefficient of a linear fit.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*	**M1.S.ID.C.6** Compute (using technology) and interpret the correlation coefficient of a linear fit.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*

S-ID.C.9	9. Distinguish between correlation and causation.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*	**M1.S.ID.C.7** Distinguish between correlation and causation.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*

★* = Modeling Standard

Notation	2016-17 Standard	2016-17 Scope and Clarification	2017-18 Standard	2017-18 Scope & Clarifications
N-RN.A.1	1. Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents. *For example, we define $5^{1/3}$ to be the cube root of 5 because we want $(5^{1/3})^3 = 5^{(1/3)^3}$ to hold, so $(5^{1/3})^3$ must equal 5.*	*There is no additional scope or clarification for this standard.*	**M2.N.RN.A.1** Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents.	*For example, we define $5^{1/3}$ to be the cube root of 5 because we want $(5^{1/3})^3 = 5^{(1/3)^3}$ to hold, so $(5^{1/3})^3$ must equal 5.* *There are no assessment limits for this standard. The entire standard is assessed in this course.*
N-RN.A.2	2. Rewrite expressions involving radicals and rational exponents using the properties of exponents.	*There is no additional scope or clarification for this standard.*	**M2.N.RN.A.2** Rewrite expressions involving radicals and rational exponents using the properties of exponents.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
N-RN.A.3	3. Explain why the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational.	*There is no additional scope or clarification for this standard.*		
N-Q.A.2	2. Define appropriate quantities for the purpose of descriptive modeling.	*This standard will be assessed in Math II by ensuring that some modeling tasks (involving Math I content or securely held content from grades 6-8) require the student to create a quantity of interest in the situation being described (i.e., a quantity of interest is not selected for the student by the task). For example, in a situation involving data, the student might autonomously decide that a measure of center is a key variable in a situation, and then choose to work with the mean.*	**M2.N.Q.A.1** Identify, interpret, and justify appropriate quantities for the purpose of descriptive modeling.	*Descriptive modeling refers to understanding and interpreting graphs; identifying extraneous information; choosing appropriate units; etc.* *Tasks are limited to linear or exponential equations with integer exponents.*
N-CN.A.1	1. Know there is a complex number i such that $i^2 = -1$, and every complex number has the form $a + bi$ with a and b real.	*There is no additional scope or clarification for this standard.*	**M2.N.CN.A.1** Know there is a complex number i such that $i^2 = -1$, and every complex number has the form $a + bi$ with a and b real.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*

N-CN.A.2	2. Use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.	*There is no additional scope or clarification for this standard.*	**M2.N.CN.A.2** Know and use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
N-CN.B.7	7. Solve quadratic equations with real coefficients that have complex solutions.	*There is no additional scope or clarification for this standard.*	**M2.N.CN.B.3** Solve quadratic equations with real coefficients that have complex solutions.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
A-SSE.A.1	1.Interpret expressions that represent a quantity in terms of its context. ⋆ b. Interpret complicated expressions by viewing one or more of their parts as a single entity. *For example, interpret* $P(1+r)^n$ *as the product of P and a factor not depending on P.*	i) Tasks are limited to quadratic expressions.	**M2.A.SSE.A.1** Interpret expressions that represent a quantity in terms of its context. ⋆ a. Interpret complicated expressions by viewing one or more of their parts as a single entity.	*For example, interpret* $P(1 + r)^n$ *as the product of P and a factor not depending on P.* *Tasks are limited to quadratic expressions.*
A-SSE.A.2	Use the structure of an expression to identify ways to rewrite it. For example, see $x^4 – y^4$ as $(x^2)^2 – (y^2)^2$, thus recognizing it as a difference of squares that can be factored as $(x^2 – y^2)(x^2 + y^2)$.	i) Tasks are limited to quadratic and exponential expressions, including related numerical expressions. ii) Examples: See an opportunity to rewrite $a^2 + 9a + 14$ as (a+7)(a+2). Recognize $53^2 - 47^2$ as a difference of squares and see an opportunity to rewrite it in the easier-to-evaluate form (53+47)(53-47).	**M2.A.SSE.A.2** Use the structure of an expression to identify ways to rewrite it.	*For example, recognize* $53^2 - 47^2$ *as a difference of squares and see an opportunity to rewrite it in the easier-to-evaluate form (53 + 47) (53 – 47).* *See an opportunity to rewrite* $a^2 + 9a + 14$ *as (a + 7) (a + 2).* *Tasks are limited to numerical expressions and polynomial expressions in one variable*
A-SSE.B.3	3. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. ⋆ a. Factor a quadratic expression to reveal the zeros of the function it defines. b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.	*There is no additional scope or clarification for this standard.*	**M2.A.SSE.B.3** Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. ⋆ **a.** Factor a quadratic expression to reveal the zeros of the function it defines. **b.** Complete the square in a quadratic expression in the form	*There are no assessment limits for this standard. The entire standard is assessed in this course.*

			$Ax^2 + Bx + C$ where $A = 1$ to reveal the maximum or minimum value of the function it defines.	
A-APR.A.1	1. Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials	*There is no additional scope or clarification for this standard.*	**M2.A.APR.A.1** Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
A-CED.A.1	1. Create equations and inequalities in one variable and use them to solve problems. *Include equations arising from linear and quadratic functions, and simple rational and exponential functions.*	i) Tasks are limited to quadratic and exponential equations. ii) Tasks have a real-world context. iii) In simpler cases (such as exponential equations with integer exponents), tasks have more of the hallmarks of modeling as a mathematical practice (less defined tasks, more of the modeling cycle, etc.).	**M2.A.CED.A.1** Create equations and inequalities in one variable and use them to solve problems.	*Include equations arising from linear and quadratic functions and rational and exponential functions. Tasks have a real-world context.*
A-CED.A.2	2. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.	i) Tasks are limited to quadratic equations. ii) Tasks have a real-world context. iii) Tasks have the hallmarks of modeling as a mathematical practice (less defined tasks, more of the modeling cycle, etc.).	**M2.A.CED.A.2** Create equations in two or more variables to represent relationships between quantities; graph equations with two variables on coordinate axes with labels and scales.	i) Tasks are limited to quadratic equations ii) Tasks have a real-world context. iii) Tasks have the hallmarks of modeling as a mathematical practice (less defined tasks, more of the modeling cycle, etc.).
A-CED.A.4	4. Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. *For example, rearrange Ohm's law V = IR to highlight resistance R.*	i) Tasks are limited to quadratic equations. ii) Tasks have a real-world context.	**M2.A.CED.A.3** Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. *i) Tasks are limited to quadratic, square root, cube root, and piecewise functions.* *ii) Tasks have a real-world context.*	*i) Tasks are limited to quadratic, square root, cube root, and piecewise functions.* *ii) Tasks have a real-world context.* *iii) Tasks have the hallmarks of modeling as a mathematical practice (less defined tasks, more of the modeling cycle, etc.).*

A-REI.A.1	1. Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.	*i) Tasks are limited to quadratic equations.*	**M2.A.REI.A.1** Explain each step in solving an equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.	*Tasks are limited to linear, quadratic, exponential equations with integer exponents, square root, cube root, piecewise, and exponential functions.*
A-REI.B.4	4. Solve quadratic equations in one variable. a. Use the method of completing the square to transform 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, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as $a \pm bi$ for real numbers *a* and *b*.	*There is no additional scope or clarification for this standard.*	**M2.A.REI.B.2** Solve quadratic equations and inequalities in one variable. **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 and write them as $a \pm bi$ for real numbers a and b.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
A-REI.B.7	7. Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. *For example, find the points of intersection between the line $y = –3x$ and the circle $x^2 + y^2 = 3$.*	*There is no additional scope or clarification for this standard.*	**M2.A.REI.C.3** Write and solve a system of linear equations in context.	*When solving algebraically, tasks are limited to systems of at most three equations and three variables. With graphic solutions systems are limited to only two variables.*
			M2.A.REI.C.4 Solve a system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*

F-IF.B.4	4. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.*★	*I)Tasks have a real-world context.* *ii) Tasks are limited to quadratic and exponential functions.* *The function types listed here are the same as those listed in Math II column for standards F-IF.6 and F-IF.9.*	**M2.F.IF.A.1** For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities and sketch graphs showing key features given a verbal description of the relationship. ★	*Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; and end behavior.* *i) Tasks have a real-world context.* *ii) Tasks are limited to quadratic, exponential functions with integer exponents, square root, and cube root functions.*
F-IF.B.5	5.Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.*★	i) Tasks have a real-world context. ii) Tasks are limited to quadratic functions.	**M2.F.IF.A.2** Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. ★	*For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.* *Tasks are limited to quadratic, square root, cube root, piecewise, and exponential functions.*
F-IF.B.6	6. Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.★	i) Tasks have a real-world context. ii) Tasks are limited to quadratic and exponential functions. *The function types listed here are the same as those listed in the Math II column for standards F-IF.4 and F-IF.9.*	**M2.F.IF.A.3** Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph. ★	*i) Tasks have a real-world context.* *ii) Tasks may involve quadratic, square root, cube root, piecewise, and exponential functions.*
F-IF.C.7	7. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated	For F-IF.7a: i) Tasks are limited to quadratic functions.	**M2.F.IF.B.4** Graph functions expressed symbolically and show key features of the graph, by hand and using technology.★	*M2.F.IF.B.4a – Tasks are limited to quadratic functions.* *M2.F.IF.B.4c – Tasks are*

	cases.★ a. Graph linear and quadratic functions and show intercepts, maxima, and minima. b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions. e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.	For F-IF.7e: i) Tasks are limited to exponential functions.	**a.** Graph linear and quadratic functions and show intercepts, maxima, and minima. **b.** Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions. **c.** **c.** Graph exponential and logarithmic functions, showing intercepts and end behavior.	*limited to exponential functions.*
	8. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. a. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context. b. Use the properties of exponents to interpret expressions for exponential functions. *For example, identify percent rate of change in functions such as* $y = (1.02)^t$, $y = (0.97)^t$, $y = (1.01)^{12t}$, $y = (1.2)^{t/10}$, *and classify them as representing exponential growth or decay.*	*There is no additional scope or clarification for this standard.*	**M2.F.IF.B.5** Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. **a.** Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context. **b.** **b.** Know and use the properties of exponents to interpret expressions for exponential functions.	*For example, identify percent rate of change in functions such as* $y = 2x$, $y = (1/2)^x$, $y = 2-x$, $y = (1/2)^{-x}$. *There are no assessment limits for this standard. The entire standard is assessed in this course.*
F-IF.C.9	9. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.*	i) Tasks are limited to on quadratic and exponential functions. ii) Tasks do not have a real-world context. *The function types listed here are the same as those listed in the Math II column for standards F-IF.4 and F-IF.6.*	**M2.F.IF.B.6** Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).	*i) Tasks do not have a real-world context.* *ii) Tasks may involve quadratic, square root, cube root, piecewise, and exponential functions.*

F-BF.A.1	1. Write a function that describes a relationship between two quantities.★ b. Combine standard function types using arithmetic operations. *For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.*	*For F-BF.1a:* *i) Tasks have real-world content.* *ii) Tasks may involve linear functions, quadratic functions, and exponential functions.*	**M2.F.BF.A.1** Write a function that describes a relationship between two quantities.★ **a.** Determine an explicit expression, a recursive process, or steps for calculation from a context. **b.** Combine standard function types using arithmetic operations.	*For M2.F.BF.A.1a:* *i) Tasks have a real-world context.* *ii) Tasks may involve linear and quadratic functions.*
F-BF.B.3	3. Identify the effect on the graph of replacing *f*(*x*) by *f*(*x*) + *k*, *k f*(*x*), *f*(*kx*), and *f*(*x* + *k*) for specific values of *k* (both positive and negative); find the value of *k* given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. *Include recognizing even and odd functions from their graphs and algebraic expressions for them.*	i) Identifying the effect on the graph of replacing f(x) by f(x) + k, k f(x), f(kx), and f(x+k) for specific values of *k* (both positive and negative) is limited to linear and quadratic functions. ii) Experimenting with cases and illustrating an explanation of the effects on the graph using technology is limited to linear functions, quadratic functions, square root functions, cube root functions, piecewise-defined functions (including step functions and absolute value functions), and exponential functions. iii) Tasks do not involve recognizing even and odd functions.	**M2.F.BF.B.2** Identify the effect on the graph of replacing *f(x)* by *f(x) + k*, *kf(x), f(kx),* and *f(x + k)* for specific values of k (both positive and negative); find the value of *k* given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology**.**	*i) Identifying the effect on the graph of replacing f(x) by f(x) + k, k f(x), and f(x+k) for specific values of k (both positive and negative) is limited to linear, quadratic, and absolute value functions.* *ii) Experimenting with cases and illustrating an explanation of the effects on the graph using technology is limited to linear, quadratic, square root, cube root, and exponential functions.* *iii) Tasks do not involve recognizing even and odd functions.*
G-SRT.A.1	1. Verify experimentally the properties of dilations given by a center and a scale factor: a. A dilation takes a line not passing through the center of the dilation to a parallel line, and leaves a line passing through the center unchanged. b. The dilation of a line segment is longer or shorter in the ratio given by the scale factor.	*There is no additional scope or clarification for this standard.*	**M2.G.SRT.A.1** Verify informally the properties of dilations given by a center and a scale factor.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*

G-SRT.A.2	2. Given two figures, use the definition of similarity in terms of similarity transformations to decide if they are similar; explain using similarity transformations the meaning of similarity for triangles as the equality of all corresponding pairs of angles and the proportionality of all corresponding pairs of sides.	*There is no additional scope or clarification for this standard.*	**M2.G.SRT.A.2** Given two figures, use the definition of similarity in terms of similarity transformations to decide if they are similar; explain using similarity transformations the meaning of similarity for triangles as the equality of all corresponding pairs of angles and the proportionality of all corresponding pairs of sides**.**	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
G-SRT.A.3	3. Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.	*There is no additional scope or clarification for this standard.*	**M2.G.SRT.A.3** Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar**.**	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
G-SRT.B.4	4. Prove theorems about triangles. *Theorems include: a line parallel to one side of a triangle divides the other two proportionally, and conversely; the Pythagorean Theorem proved using triangle similarity.*	*There is no additional scope or clarification for this standard.*	**M2.G.SRT.B.4** Prove theorems about similar triangles.	*Proving includes, but is not limited to, completing partial proofs; constructing two-column or paragraph proofs; using transformations to prove theorems; analyzing proofs; and critiquing completed proofs.* *Theorems include but are not limited to: a line parallel to one side of a triangle divides the other two proportionally, and conversely; the Pythagorean Theorem proved using triangle similarity.*
G-SRT.B.5	5. Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.	*There is no additional scope or clarification for this standard.*	**M2.G.SRT.B.5** Use congruence and similarity criteria for triangles to solve problems and to justify relationships in geometric figures.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
G-SRT.C.6	6. Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles.	*There is no additional scope or clarification for this standard.*	**M2.G.SRT.C.6** Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles.	*There are no assessment limits for this standard.*

G.SRT.C.7	7. Explain and use the relationship between the sine and cosine of complementary angles.	*There is no additional scope or clarification for this standard.*	**M2.G.SRT.C.7** Explain and use the relationship between the sine and cosine of complementary angles.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
G-SRT.C.8	8. Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.★	*There is no additional scope or clarification for this standard.*	**M2.G.SRT.C.8** Solve triangles. ★ a. Know and use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems. b. Know and use the Law of Sines and the Law of Cosines to solve triangles in applied problems. Recognize when it is appropriate to use each.	*Ambiguous cases will not be included in assessment.*
G-GMD.A.1	1. Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone. *Use dissection arguments, Cavalieri's principle, and informal limit arguments.*	*There is no additional scope or clarification for this standard.*	**M2.G.GMD.A.1** Give an informal argument for the formulas for the circumference of a circle and the volume and surface area of a cylinder, cone, prism, and pyramid.	*Informal arguments may include but are not limited to using the dissection argument, applying Cavalieri's principle, and constructing informal limit arguments.*
G-GMD.A.3	3. Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.★	*There is no additional scope or clarification for this standard.*	**M2.G.GMD.A.2** Know and use volume and surface area formulas for cylinders, cones, prisms, pyramids, and spheres to solve problems.★	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
S-ID.B.6	6. Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. *Use given functions or choose a function suggested by the context. Emphasize linear, quadratic, and exponential models.* b. Informally assess the fit of a function by plotting and analyzing residuals.	For S-ID.A.6a: i) Tasks have real-world context. ii) Tasks are limited to quadratic functions. For S-ID.A.6b: i) Tasks have a real-world context. ii) Tasks are limited to linear functions, quadratic functions, and exponential functions with domains in the integers.	**M2.S.ID.A.1** Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data.	*Use given functions or choose a function suggested by the context. Emphasize linear, quadratic, and exponential models. Exponential functions are limited to those with domains in the integers. Tasks have a real-world context.*

S-CP.A.1	1. Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events (“or,” “and,” “not”).	*There is no additional scope or clarification for this standard.*	**M2.S.CP.A.1** Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events (“or,” “and,” “not”).	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
S-CP.A.2	2. Understand that two events *A* and *B* are independent if the probability of *A* and *B* occurring together is the product of their probabilities, and use this characterization to determine if they are independent.	*There is no additional scope or clarification for this standard.*	**M2.S.CP.A.2** Understand that two events A and B are independent if the probability of A and B occurring together is the product of their probabilities, and use this characterization to determine if they are independent.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
S-CP.A.3	3. Understand the conditional probability of *A* given *B* as *P*(*A* and *B*)/*P*(*B*), and interpret independence of *A* and *B* as saying that the conditional probability of *A* given *B* is the same as the probability of *A*, and the conditional probability of *B* given *A* is the same as the probability of *B*.	*There is no additional scope or clarification for this standard.*	**M2.S.CP.A.3** Know and understand the conditional probability of *A* given *B* as *P(A and B)/P(B)*, and interpret independence of *A* and *B* as saying that the conditional probability of *A* given *B* is the same as the probability of *A*, and the conditional probability of *B* given *A* is the same as the probability of *B*.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
S-CP.A.4	4. Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities. *For example, collect data from a random sample of students in your school on their favorite subject among math, science, and English. Estimate the probability that a randomly selected student from your school will favor science given that the student is in tenth grade. Do the same for other subjects and compare the results.*	*There is no additional scope or clarification for this standard.*		

S-CP.A.5	5. Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. *For example, compare the chance of having lung cancer if you are a smoker with the chance of being a smoker if you have lung cancer.*	*There is no additional scope or clarification for this standard.*	**M2.S.CP.A.4** Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
S-CP.A.6	6. Find the conditional probability of *A* given *B* as the fraction of *B*'s outcomes that also belong to *A,* and interpret the answer in terms of the model.	*There is no additional scope or clarification for this standard.*	**M2.S.CP.B.5** Find the conditional probability of A given B as the fraction of B's outcomes that also belong to A and interpret the answer in terms of the model.	*For example, a teacher gave two exams. 75 percent passed the first exam and 25 percent passed both. What percent who passed the first exam also passed the second exam?* *There are no assessment limits for this standard. The entire standard is assessed in this course.*
S-CP.A.7	7. Apply the Addition Rule, P(A or B) = P(A) + P(B) – P(A and B), and interpret the answer in terms of the model.	*There is no additional scope or clarification for this standard.*	**M2.S.CP.B.6** Know and apply the Addition Rule, *P(A or B) = P(A) + P(B) –P(A and B)*, and interpret the answer in terms of the model.	*For example, in a math class of 32 students, 14 are boys and 18 are girls. On a unit test 6 boys and 5 girls made an A. If a student is chosen at random from a class, what is the probability of choosing a girl or an A student?* *There are no assessment limits for this standard. The entire standard is assessed in this course.*

★* = Modeling Standard

Notation	2016-17 Standard	2016-17 Scope and Clarification	2017-18 Standard	2017-18 Scope & Clarifications
N-Q.A.2	2. Define appropriate quantities for the purpose of descriptive modeling.	*This standard will be assessed in Math III by ensuring that some modeling tasks (involving Math III content or securely held content from previous grades and courses) require the student to create a quantity of interest in the situation being described (i.e., a quantity of interest is not selected for the student by the task). For example, in a situation involving periodic phenomena, the student might autonomously decide that amplitude is a key variable in a situation, and then choose to work with peak amplitude.*	**M3.N.Q.A.1** Identify, interpret, and justify appropriate quantities for the purpose of descriptive modeling.	*Descriptive modeling refers to understanding and interpreting graphs; identifying extraneous information; choosing appropriate units; etc.* *There are no assessment limits for this standard. The entire standard is assessed in this course.*
A-SSE.B.2	2. Use the structure of an expression to identify ways to rewrite it. For example, see $x^4 - y^4$ as $(x^2)^2 - (y^2)^2$, thus recognizing it as a difference of squares that can be factored as $(x^2 - y^2)(x^2 + y^2)$.	i) Tasks are limited to polynomial and rational expressions. ii) Examples: see $x^4 - y^4$ as $(x^2)^2 - (y^2)^2$, thus recognizing it as a difference of squares that can be factored as $(x^2 - y^2)(x^2 + y^2)$. In the equation $x^2 + 2x + 1 + y^2 = 9$, see an opportunity to rewrite the first three terms as $(x+1)^2$, thus recognizing the equation of a circle with radius 3 and center (-1, 0). See $(x^2 + 4)/(x^2 + 3)$ as $((x^2+3) + 1)/(x^2+3)$, thus recognizing an opportunity to write it as $1 + 1/(x^2 + 3)$.	**M3.A.SSE.A.1** Use the structure of an expression to identify ways to rewrite it.	*For example, see $2x^4 + 3x^2 - 5$ as its factors $(x^2 - 1)$ and $(2x^2 + 5)$; see* *$x^4 - y^4$ as $(x^2)^2 - (y^2)^2$, thus recognizing it as a difference of squares that can be factored as $(x^2 - y^2)(x^2 + y^2)$; see* *$(x^2 + 4)/(x^2 + 3)$* *as $((x^2+ 3) + 1)/(x^2 + 3)$, thus recognizing an opportunity to write it as $1 + 1/(x^2 + 3)$.* *Tasks are limited to polynomial, rational, or exponential expressions.*
			M3.A.SSE.B.2 Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.★	For example the expression 1.15^t can be rewritten as $((1.15)^{1/12})^{12t} \approx 1.012^{12t}$ to reveal that the approximate equivalent monthly interest rate

			a. Use the properties of exponents to rewrite expressions for exponential functions.	is 1.2% if the annual rate is 15%. i) Tasks have a real-world context. As described in the standard, there is an interplay between the mathematical structure of the expression and the structure of the situation such that choosing and producing an equivalent form of the expression reveals something about the situation. ii) Tasks are limited to exponential expressions with rational or real exponents
A-SSE.B.4	4. Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems. *For example, calculate mortgage payments.*★	*There is no additional scope or clarification for this standard.*	**M3.A.SSE.B.3** Recognize a finite geometric series (when the common ratio is not 1), and know and use the same formula to solve problems in context.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
A-APR.A.2	2. Know and apply the Remainder Theorem: For a polynomial $p(x)$ and a number a, the remainder on division by $x – a$ is $p(a)$, so $p(a) = 0$ if and only if $(x – a)$ is a factor of $p(x)$.	*There is no additional scope or clarification for this standard.*	**M3.A.APR.A.1** Know and apply the Remainder Theorem: For a polynomial $p(x)$ and a number a, the remainder on division by $x – a$ is $p(a)$, so $p(a) = 0$ if and only if $(x – a)$ is a factor of $p(x)$.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
A-APR.A.3	3. Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.	*There is no additional scope or clarification for this standard.*	**M3.A.APR.A.2** Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.	*For example, find the zeros of* $(x^2 - 1)(x^2 + 1)$. *There are no assessment limits for this standard. The entire standard is assessed in this course.*
A-APR.B.4	4. Prove polynomial identities and use them to describe numerical relationships. *For example, the polynomial identity* $(x^2 + y^2)^2 = (x^2 – y^2)^2 + (2xy)^2$ *can be used to generate Pythagorean triples.*	*There is no additional scope or clarification for this standard.*	**M3.A.APR.B.3** Know and use polynomial identities to describe numerical relationships.	*For example, compare* $(31)(29) = (30 + 1)(30 – 1) = 30^2 – 1^2$ *with* $(x + y)(x – y) = x^2 – y^2$.

A-APR.C.6	6. Rewrite simple rational expressions in different forms; write $a(x)/b(x)$ in the form $q(x) + r(x)/b(x)$, where $a(x)$, $b(x)$, $q(x)$, and $r(x)$ are polynomials with the degree of $r(x)$ less than the degree of $b(x)$, using inspection, long division, or, for the more complicated examples, a computer algebra system.	*There is no additional scope or clarification for this standard.*	**M3.A.APR.C.4** Rewrite rational expressions in different forms.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
A-CED.A.1	1. Create equations and inequalities in one variable and use them to solve problems. *Include equations arising from linear and quadratic functions, and simple rational and exponential functions.*	i) Tasks are limited to simple rational or exponential equations. ii) Tasks have a real-world context.	**M3.A.CED.A.1** Create equations and inequalities in one variable and use them to solve problems.	*i) Tasks are limited to polynomial, rational, absolute value, exponential, or logarithmic functions.* *ii) Tasks have a real-world context.*
A-CED.A.2	2. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.	i) Tasks are limited to simple polynomial, rational, or exponential equations ii) Tasks have a real-world context.	**M3.A.CED.A.2** Create equations in two or more variables to represent relationships between quantities; graph equations with two variables on coordinate axes with labels and scales.	*i) Tasks have a real-world context.* *ii) Tasks are limited to polynomial, rational, absolute value, exponential, or logarithmic functions.*
			M3.A.CED.A.3 Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.	*i) Tasks have a real-world context.* *ii) Tasks are limited to polynomial, rational, absolute value, exponential, or logarithmic functions.*
A-REI.A.1	1. Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.	i) Tasks are limited to simple rational or radical equations.	**M3.A.REI.A.1** Explain each step in solving an equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.	*Tasks are limited to simple rational or radical equations*
A-REI.A.2	2. Solve simple rational and radical equations in one variable, and give	*There is no additional scope or clarification for this standard.*	**M3.A.REI.A.2** *Solve rational and radical equations in one variable,*	*There are no assessment limits for this standard. The entire*

	examples showing how extraneous solutions may arise.		*and identify extraneous solutions when they exist.*	*standard is assessed in this course.*
A-REI.D.11	11. Explain why the *x*-coordinates of the points where the graphs of the equations $y = f(x)$ and $y = g(x)$ intersect are the solutions of the equation $f(x) = g(x)$; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where $f(x)$ and/or $g(x)$ are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.★	i) Tasks may involve any of the function types mentioned in the standard.	**M3.A.REI.B.3** Explain why the *x*-coordinates of the points where the graphs of the equations $y = f(x)$ and $y = g(x)$ intersect are the solutions of the equation $f(x) = g(x)$; find the approximate solutions using technology. *	*Tasks may include cases where f(x) and/or g(x) are linear, polynomial, rational, absolute value, exponential, or logarithmic functions.*
F-IF.B.4	4. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.*★	i) Tasks have a real-world context. ii) Tasks may involve polynomial, logarithmic, and trigonometric functions. *The function types listed here are the same as those listed in the Math III column for standards F-IF.6 and F-IF.9.*	**M3.F.IF.A.1** For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities and sketch graphs showing key features given a verbal description of the relationship. ★	*Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; and end behavior.* *i) Tasks have a real-world context.* *ii) Tasks may involve polynomial, exponential, and logarithmic functions.*
F-IF.B.6	6. Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.★	i) Tasks have a real-world context. ii) Tasks may involve polynomial, logarithmic, and trigonometric functions. *The function types listed here are the same as those listed in the Math III column for standards F-IF.4 and F-IF.9.*	**M3.F.IF.A.2** Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph. *	*i) Tasks have a real-world context.* *ii) Tasks may involve polynomial, exponential, and logarithmic functions.*
F-IF.C.7	7. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.★	For F-IF.7e: i) Tasks are limited to logarithmic and trigonometric functions.	**M3.F.IF.B.3** Graph functions expressed symbolically and show key features of the graph, by hand and using technology.★* **a.** Graph linear and quadratic	*There are no assessment limits for this standard. The entire standard is assessed in this course.*

	c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior. e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.		functions and show intercepts, maxima, and minima. **b.** Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions. **c.** Graph polynomial functions, identifying zeros when suitable factorizations are available and showing end behavior. **d.** Graph exponential and logarithmic functions, showing intercepts and end behavior.	
F-IF.C.9	9. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.*	i) Tasks have a real-world context. ii) Tasks may involve polynomial, logarithmic, and trigonometric functions. *The function types listed here are the same as those listed in the Math III column for standards F-IF.4 and F-IF.6.*	**M3.F.IF.B.4** Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).	*Tasks may involve polynomial, exponential, and logarithmic functions.*
F-BF.B.3	3. Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $k\,f(x)$, $f(kx)$, and $f(x + k)$ for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. *Include recognizing even and odd functions from their graphs and algebraic expressions for them.*	i) Tasks are limited to exponential, polynomial, logarithmic, and trigonometric functions. ii) Tasks may involve recognizing even and odd functions. The function types listed in note (i) are the same as those listed in the Math III column for standards F-IF.4, F-IF.6 and F-IF.9.	**M3.F.BF.A.1** Identify the effect on the graph of replacing *f(x)* by *f(x) + k*, *kf(x), f(kx),* and *f(x + k)* for specific values of k (both positive and negative); find the value of *k* given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology**.**	*i) Tasks may involve polynomial, exponential, and logarithmic functions.* *ii) Tasks may involve recognizing even and odd functions.*
F-BF.B.4	4. Find inverse functions. a. Solve an equation of the form f(x) = c	There is no additional scope or clarification information for this	**M3.F.BF.A.2** Find inverse functions. a. Find the inverse of a function	*There are no assessment limits for this standard. The entire*

	for a simple function f that has an inverse and write an expression for the inverse. *For example,* $f(x) = 2x^3$ *or* $f(x) = (x+1)/(x-1)$ *for* $x \neq 1$.	standard.	when the given function is one-to-one.	*standard is assessed in this course.*
			M3.F.LE.A.1 Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
F-LE.B.4	4. For exponential models, express as a logarithm the solution to $ab^{ct} = d$ where *a*, *c*, and *d* are numbers and the base *b* is 2, 10, or *e*; evaluate the logarithm using technology.	*There is no additional scope or clarification for this standard.*	**M3.F.LE.A.2** For exponential models, express as a logarithm the solution to $ab^{ct} = d$ where *a*, *c*, and *d* are numbers and the base *b* is 2, 10, or *e*; evaluate the logarithm using technology.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
F-TF.A.1	1. Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.	*There is no additional scope or clarification for this standard.*	**M3.F.TF.A.1** Understand and use radian measure of an angle. **a.** Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle. **b.** Use the unit circle to find *sin* θ, *cos* θ, and *tan* θ when θ is a commonly recognized angle between 0 and 2π.	*Commonly recognized angles include all multiples of nπ /6 and nπ /4, where n is an integer.* *There are no assessment limits for this standard. The entire standard is assessed in this course.*
F-TF.A.2	2. Explain how the unit circle in the coordinate plane enables the extension of trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle.	*There is no additional scope or clarification for this standard.*	**M3.F.TF.A.2** Explain how the unit circle in the coordinate plane enables the extension of trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
F-TF.B.5	5. Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.★	*There is no additional scope or clarification for this standard.*		

F-TF.C.8	8. Prove the Pythagorean identity $\sin^2(\theta) + \cos^2(\theta) = 1$ and use it to find sin(θ), cos(θ), or tan(θ) given sin(θ), cos(θ), or tan(θ) and the quadrant of the angle.	*There is no additional scope or clarification for this standard.*	**M3.F.TF.B.3** Use trigonometric identities to find values of trig functions. **a.** Given a point on a circle centered at the origin, recognize and use the right triangle ratio definitions of *sin* θ, *cos* θ, and *tan* θ to evaluate the trigonometric functions. **b.** Given the quadrant of the angle, use the identity $\sin^2 \theta + \cos^2 \theta = 1$ to find *sin* θ given *cos* θ, or vice versa.	*Commonly recognized angles include all multiples of nπ /6 and nπ /4, where n is an integer.* *There are no assessment limits for this standard. The entire standard is assessed in this course.*
F-CO.D.12	12. Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.). *Copying a segment; copying an angle; bisecting a segment; bisecting an angle; constructing perpendicular lines, including the perpendicular bisector of a line segment; and constructing a line parallel to a given line through a point not on the line.*	*There is no additional scope or clarification for this standard.*	**M3.G.CO.A.1** Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.).	*Constructions include but are not limited to: copying a segment; copying an angle; bisecting a segment; bisecting an angle; constructing perpendicular lines, including the perpendicular bisector of a line segment; constructing a line parallel to a given line through a point not on the line, and constructing the following objects inscribed in a circle: an equilateral triangle, square, and a regular hexagon.*
F-CO.D.13	13. Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle.	*There is no additional scope or clarification for this standard.*		
G-C.A.1	1. Prove that all circles are similar.	*There is no additional scope or clarification for this standard.*	**M3.G.C.A.1** Recognize that all circles are similar.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
G-C.A.2	2. Identify and describe relationships among inscribed angles, radii, and chords. *Include the relationship between central, inscribed, and circumscribed angles; inscribed angles on a diameter are right angles; the radius of a circle is*	*There is no additional scope or clarification for this standard.*	**M3.G.C.A.2** Identify and describe relationships among inscribed angles, radii, and chords.	*Include the relationship between central, inscribed, and circumscribed angles; inscribed angles on a diameter are right angles; the radius of a circle is perpendicular to the tangent*

	perpendicular to the tangent where the radius intersects the circle.			*where the radius intersects the circle, and properties of angles for a quadrilateral inscribed in a circle.*
G-C.A.3	3. Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a circle.	*There is no additional scope or clarification for this standard.*	**M3.G.C.A.3** Construct the incenter and circumcenter of a triangle and use their properties to solve problems in context.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
G-C.B.5	5. Derive using similarity the fact that the length of the arc intercepted by an angle is proportional to the radius, and define the radian measure of the angle as the constant of proportionality; derive the formula for the area of a sector.	*There is no additional scope or clarification for this standard.*	**M3.G.C.B.4** Find the area of a sector of a circle in a real world context.	*For example, use proportional relationships and angles measured in degrees or radians.* *There are no assessment limits for this standard. The entire standard is assessed in this course.*
G-GPE.A.1	1. Derive the equation of a circle of given center and radius using the Pythagorean Theorem; complete the square to find the center and radius of a circle given by an equation.	*There is no additional scope or clarification for this standard.*	**M3.G.GPE.A.1** Write the equation of a circle of given center and radius using the Pythagorean Theorem.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
G-GPE.A.2	2. Derive the equation of a parabola given a focus and directrix.	*There is no additional scope or clarification for this standard.*		
G-GPE.B.4	4. Use coordinates to prove simple geometric theorems algebraically. *For example, prove or disprove that a figure defined by four given points in the coordinate plane is a rectangle; prove or disprove that the point (1, √3) lies on the circle centered at the origin and containing the point (0, 2).*	*There is no additional scope or clarification for this standard.*	**M3.G.GPE.B.2** Use coordinates to prove simple geometric theorems algebraically.	*For example, prove or disprove that a figure defined by four given points in the coordinate plane is a rectangle; prove or disprove that the point (1, $\sqrt{3}$) lies on the circle centered at the origin and containing the point (0, 2).* *There are no assessment limits for this standard. The entire standard is assessed in this course.*

G-GPE.B.5	5. Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems (e.g., find the equation of a line parallel or perpendicular to a given line that passes through a given point).	*There is no additional scope or clarification for this standard.*	**M3.G.GPE.B.3** Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems.	*For example, find the equation of a line parallel or perpendicular to a given line that passes through a given point.* *There are no assessment limits for this standard. The entire standard is assessed in this course.*
G-GPE.B.6	6. Find the point on a directed line segment between two given points that partitions the segment in a given ratio.	*There is no additional scope or clarification for this standard.*	**M3.G.GPE.B.4** Find the point on a directed line segment between two given points that partitions the segment in a given ratio.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
G-GPE.B.7	7. Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula.★	*There is no additional scope or clarification for this standard.*	**M3.G.GPE.B.5** Use coordinates to compute perimeters of polygons and areas of triangles and rectangles.*	*For example, use the distance formula.* *There are no assessment limits for this standard. The entire standard is assessed in this course.*
G-GMD.A.4	4. Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.	*There is no additional scope or clarification for this standard.*		
G-MG.A.1	1. Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).★	*There is no additional scope or clarification for this standard.*	**M3.G.MG.A.1** Use geometric shapes, their measures, and their properties to describe objects.★	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
G-MG.A.2	2. Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot).★	*There is no additional scope or clarification for this standard.*		
G-MG.A.3	3. Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on	*There is no additional scope or clarification for this standard.*	**M3.G.MG.A.2** Apply geometric methods to solve real world problems.★	*Geometric methods may include but are not limited to using geometric shapes, the probability of a shaded region, density, and design problems.*

	ratios).★			*There are no assessment limits for this standard. The entire standard is assessed in this course.*
S-ID.A.4	4. Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve.	*There is no additional scope or clarification for this standard.*	**M3.S.ID.A.1** Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages using the Empirical Rule.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
S-ID.B.6	6. Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. *Use given functions or choose a function suggested by the context. Emphasize linear, quadratic, and exponential models.* b. Informally assess the fit of a function by plotting and analyzing residuals.	For S-ID.6a: i) Tasks have a real-world context. ii) Tasks are limited to exponential functions with domains not in the integers and trigonometric functions	**M3.S.ID.B.2** Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. **a**. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. **b.** Fit a linear function for a scatter plot that suggests a linear association.	*Use given functions or choose a function suggested by the context.* *i) Tasks have a real-world context.* *ii) Tasks are limited to linear, quadratic, and exponential functions with domains not in the integers.*
S-IC.A.1	1. Understand statistics as a process for making inferences about population parameters based on a random sample from that population.	*There is no additional scope or clarification for this standard.*	**M3.S.IC.A.1** Understand statistics as a process for making inferences about population parameters based on a random sample from that population.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
S-IC.A.2	2. Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation. *For example, a model says a spinning coin falls heads up with probability 0.5. Would a result of 5 tails in a row cause you to question the model?*	*There is no additional scope or clarification for this standard.*	**M3.S.IC.A.2** Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation.	*For example, a model says a spinning coin falls heads up with probability 0.5. Would a result of 10 heads in a row cause you to question the model?* *There are no assessment limits for this standard. The entire standard is assessed in this course.*

S-IC.B.3	3. Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.	*There is no additional scope or clarification for this standard.*	**M3.S.IC.B.3** Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.	*For example, in a given situation, is it more appropriate to use a sample survey, an experiment, or an observational study? Explain how randomization affects the bias in a study.* *There are no assessment limits for this standard. The entire standard is assessed in this course.*
S-IC.B.4	4. Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling.	*There is no additional scope or clarification for this standard.*	**M3.S.IC.B.4** Use data from a sample survey to estimate a population mean or proportion; use a given margin of error to solve a problem in context.	*There are no assessment limits for this standard. The entire standard is assessed in this course.*
S-IC.B.5	5. Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.	*There is no additional scope or clarification for this standard.*		
S-IC.B.6	6. Evaluate reports based on data.	*There is no additional scope or clarification for this standard.*		

★* = Modeling Standard

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Standards Comparison Chart

Standard Coding	Dropped from Course	Added to Course	Revised	No change

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Revisions to the Math Standards

Standards Comparison Activity

1. If you had to summarize the revisions to these selected standards in twenty words or less, what would you say?

Notes:
Small Group Consensus:
Whole Group Consensus:

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Appointment with Peers

Please meet with your first partner to discuss the following:

- How will these changes impact your classroom?
- What are your takeaways from modules 1–3?
- How does this align to your observation rubric?

Notes:

Module 3 Review

- The instructional expectations 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.

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.

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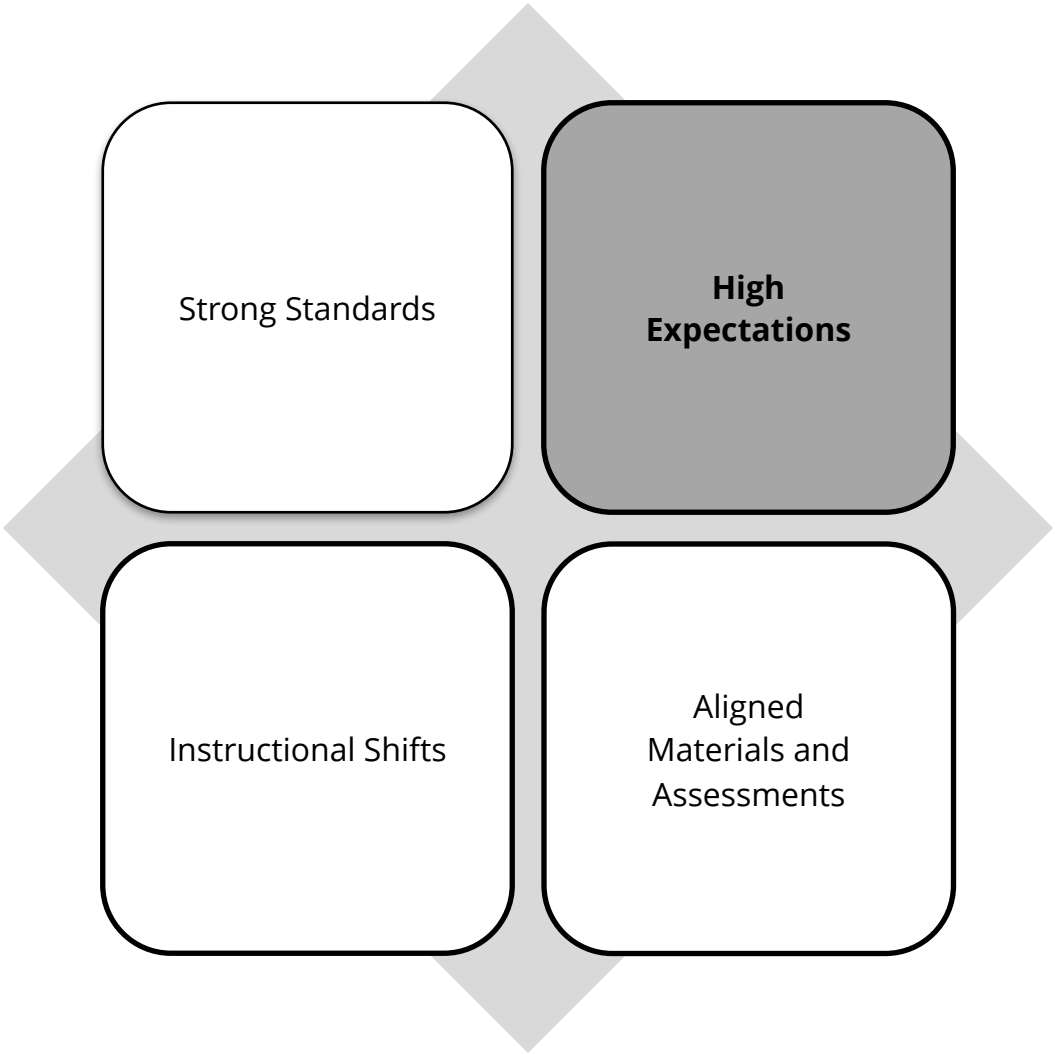
TAB PAGE

Part 2: Developing a Deeper Understanding

Module 4: Diving Into 9–12 Math



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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.

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.

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.

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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.

Notes:

Now summarize your course in 140 characters. Write your tweet to inform others regarding what is included in your grade.

My Tweet:

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Intent and Purpose of the Standards

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

—Ball, 1993

Analyzing Standards

A1.F.IF.C.7 (Note also: A2.F.IF.B.4 and M2.F.IF.B.5)

Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.

a. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.

Notes:

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We are going to look closely at A1.F.IF.C.7.

Know (facts, vocabulary)	Understand (concepts, generalizations)	Do (verbs, skills)
Essential Questions:		
Instruction & Assessment (What does the math look like?)		

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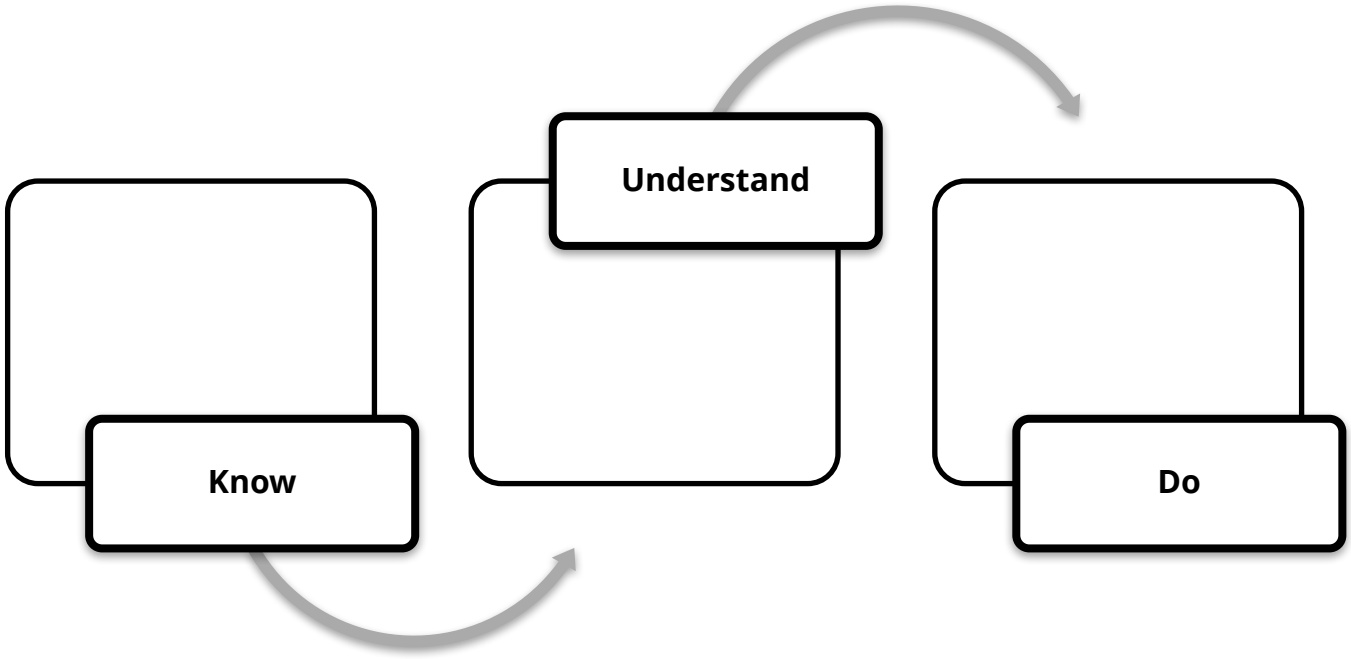
From Standard to Instruction: KUD

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?



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You Try One!

Know (facts, vocabulary)	Understand (concepts, generalizations)	Do (verbs, skills)
Essential Questions:		
Instruction & Assessment (What does the math look like?)		

Module 4 Review

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

High Expectations

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

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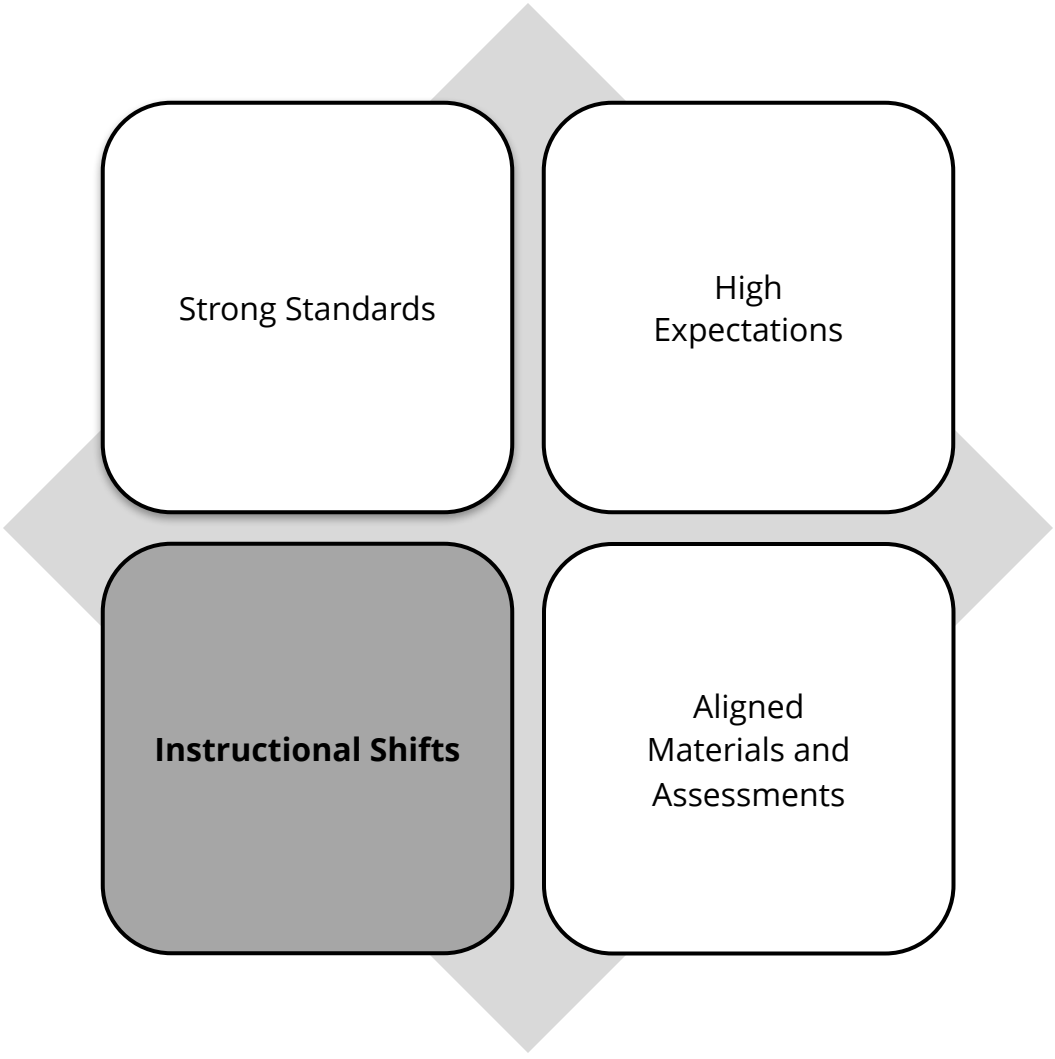
TAB PAGE

Part 3: Instructional Shifts

Module 5: Revisiting the SMP's and Instructional Expectations



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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.
- Explore students' mathematical mindsets.
- Share instructional strategies related to the Standards for Mathematical Practice.
- Discuss research on the influence of mindsets in the math classroom.

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.

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.

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Why Standards for Mathematical Practice?

"Beginning to experiment with small changes to one's teaching practice and collaborating with colleagues can help move students toward the vision of mathematical proficiency described in the Standards for Mathematical Practice"

—Mateas, 2016

- Tell us what students should know and be able to do
- So, what should students know and do?
    - Content Standards
    - Standards for Mathematical Practice
    - Literacy Skills
- **Knowing that these are *what* students need to learn, teachers determine *how* to teach these.**

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.

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Mindset

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

_____ -Intelligence is a fixed trait. You cannot change it.

_____ -You can grow your intelligence through effort.

Notes:

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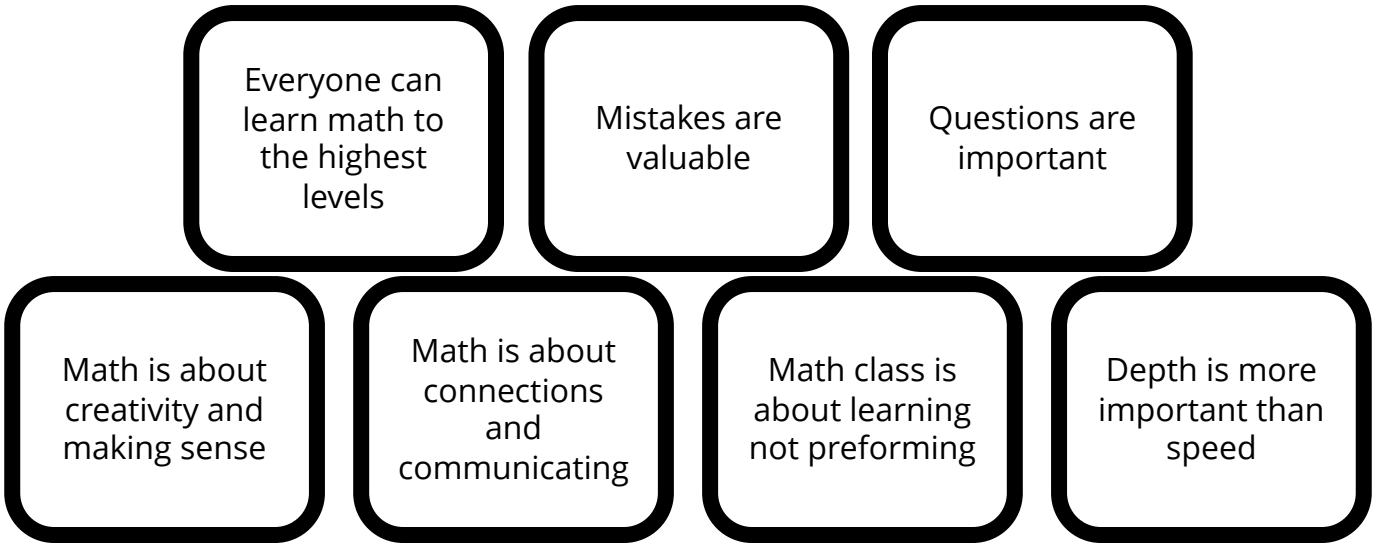
Why Address Mindsets?

"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, 2016



Notes:

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Instructional Expectations

Focus

1. 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?”

2. Review the table below and answer the questions, “Which two of the following represent areas of major focus for the indicated grade?”

8	Standard form of a linear equation.	Define, evaluate, and compare functions.	Understand and apply the Pythagorean Theorem.
Alg. 1	Zeros of polynomials	Linear and quadratic functions.	Creating equations to model situations.
Alg. 2	Exponential and logarithmic functions.	Polar coordinates	Using fractions to model situations.

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Instructional Shifts

Coherence

In the space below, copy all of the standards for your assigned domain and note how coherence is evident in the vertical progression of these standards.

Grade	Standard	Summary of the Standard (If the standard has sub-parts, summarize each sub-part.)

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Instructional Shifts

Rigor

1. Make a true statement: *Rigor* = _____ + _____ + _____

2. 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.”

3. The shift towards rigor is required by the standards. Find and copy in the space below standards which specifically set expectations for each component of rigor.

Standard	Evidence

What do the 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.

Instructional Shifts

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

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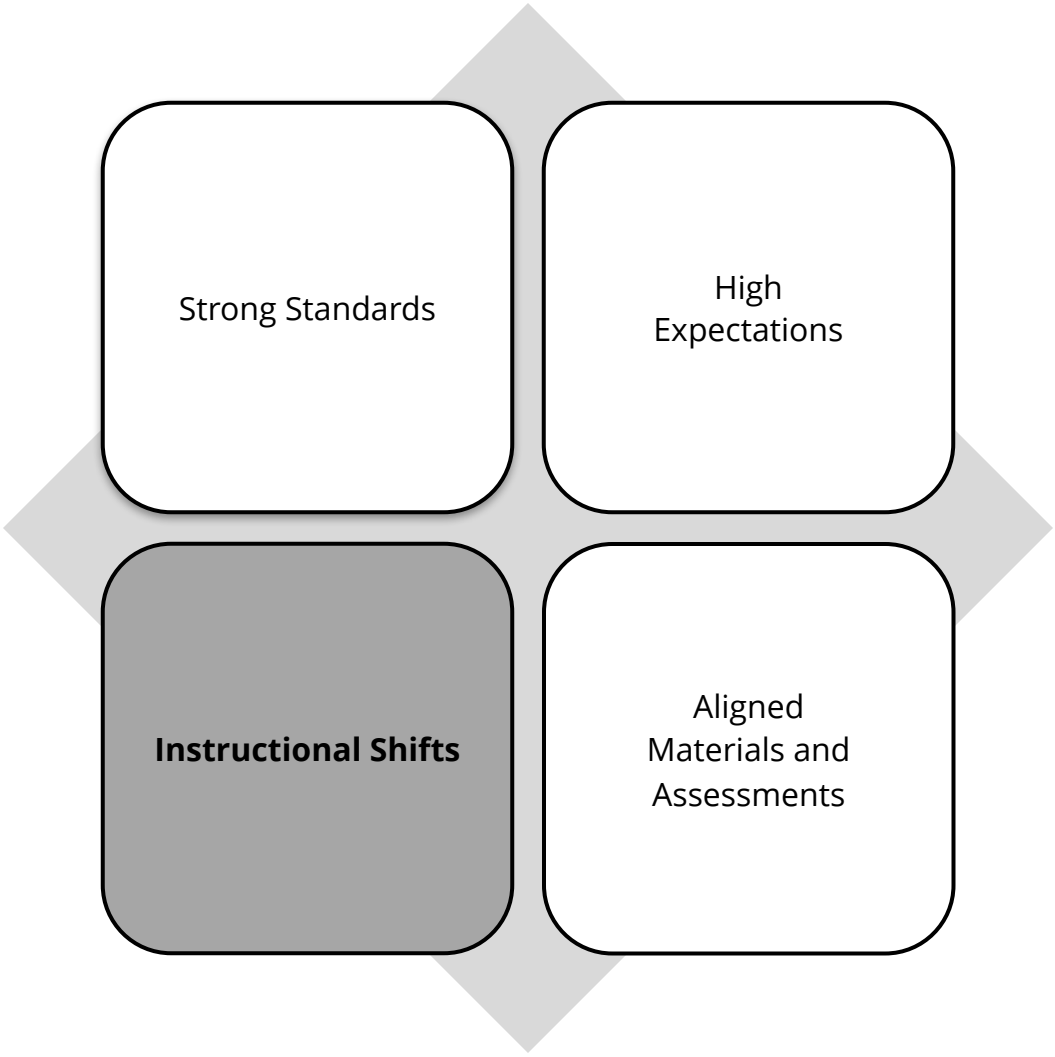
TAB PAGE

Part 3: Instructional Shifts

Module 6: Literacy Skills for Mathematical Proficiency



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Goal

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

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.

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.

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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.

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Literacy Skills for Math Proficiency

Categorize the strategies you listed and discussed with your table partners in the chart below.

Reading	
Vocabulary	
Speaking & Listening	
Writing	

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Literacy Skills for Mathematical Proficiency

1. Read and annotate your assigned section from pages 13–14 of the TN Math Standards. Work with your group to present this information to your colleagues.
2. Use the chart below to take notes and highlight the main ideas of each section.

Reading	
Vocabulary	
Speaking & Listening	
Writing	

Strategies for Incorporating 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?

Notes:

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Strategies for Incorporating Literacy

Graphic Organizers

Graphs

Tables

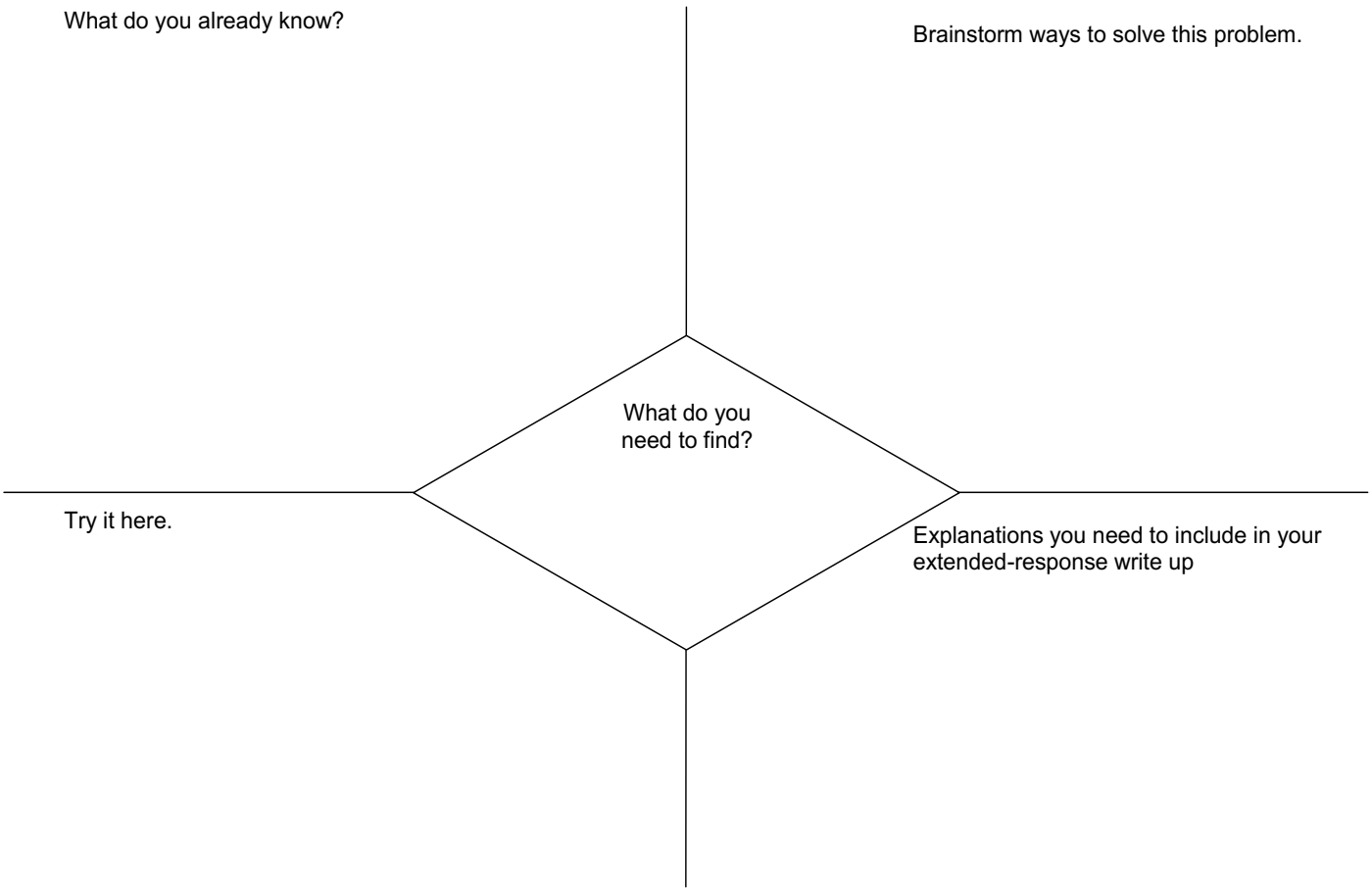
Four Corner's and a Diamond

Frayer's Model

Four Square Graphic Organizer

Semantic Grid Analysis

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



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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.

Mathematics Vocabulary

Notes:

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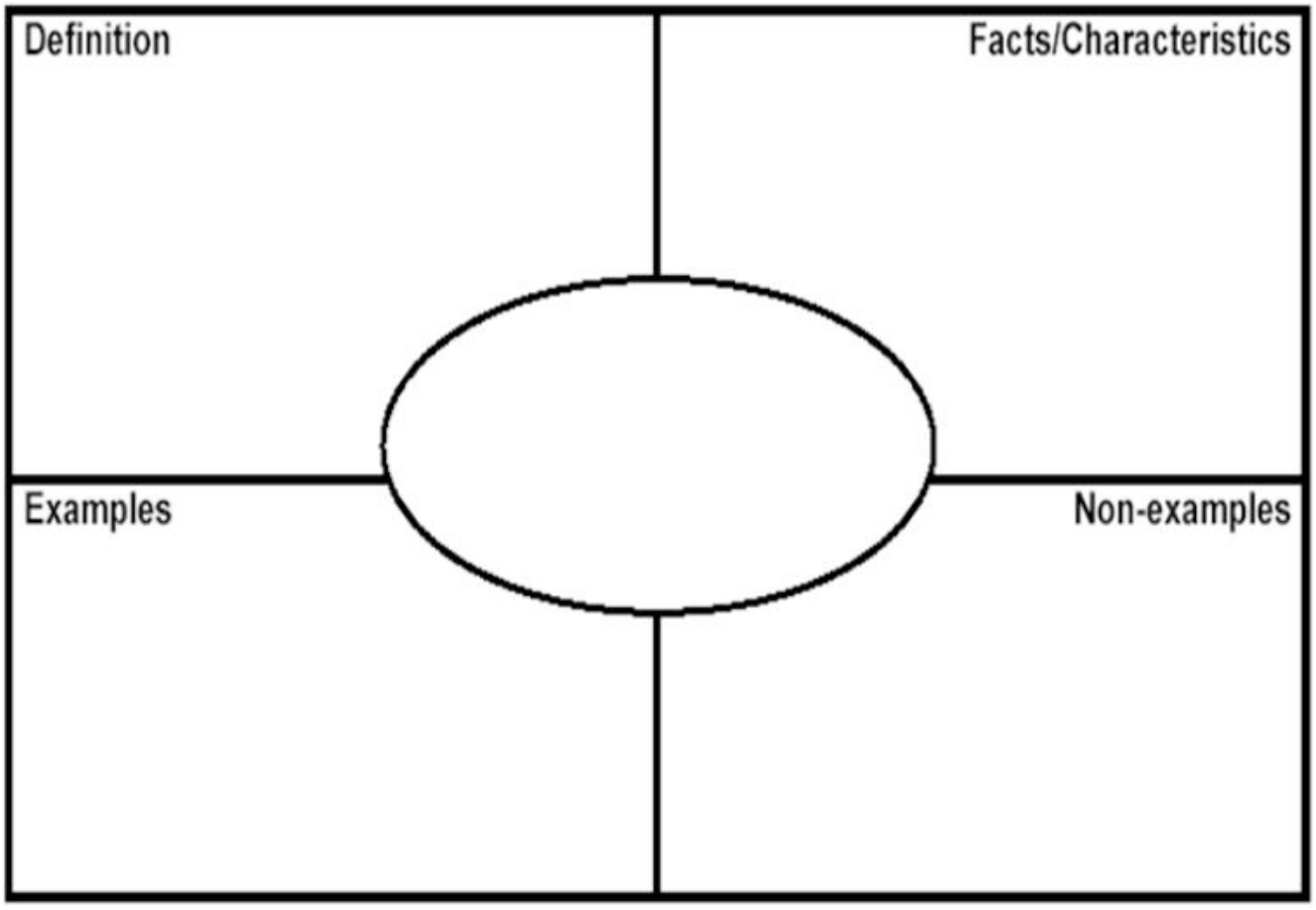
Mathematical Vocabulary

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

Frayer's Model



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.

Instructional Shifts

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

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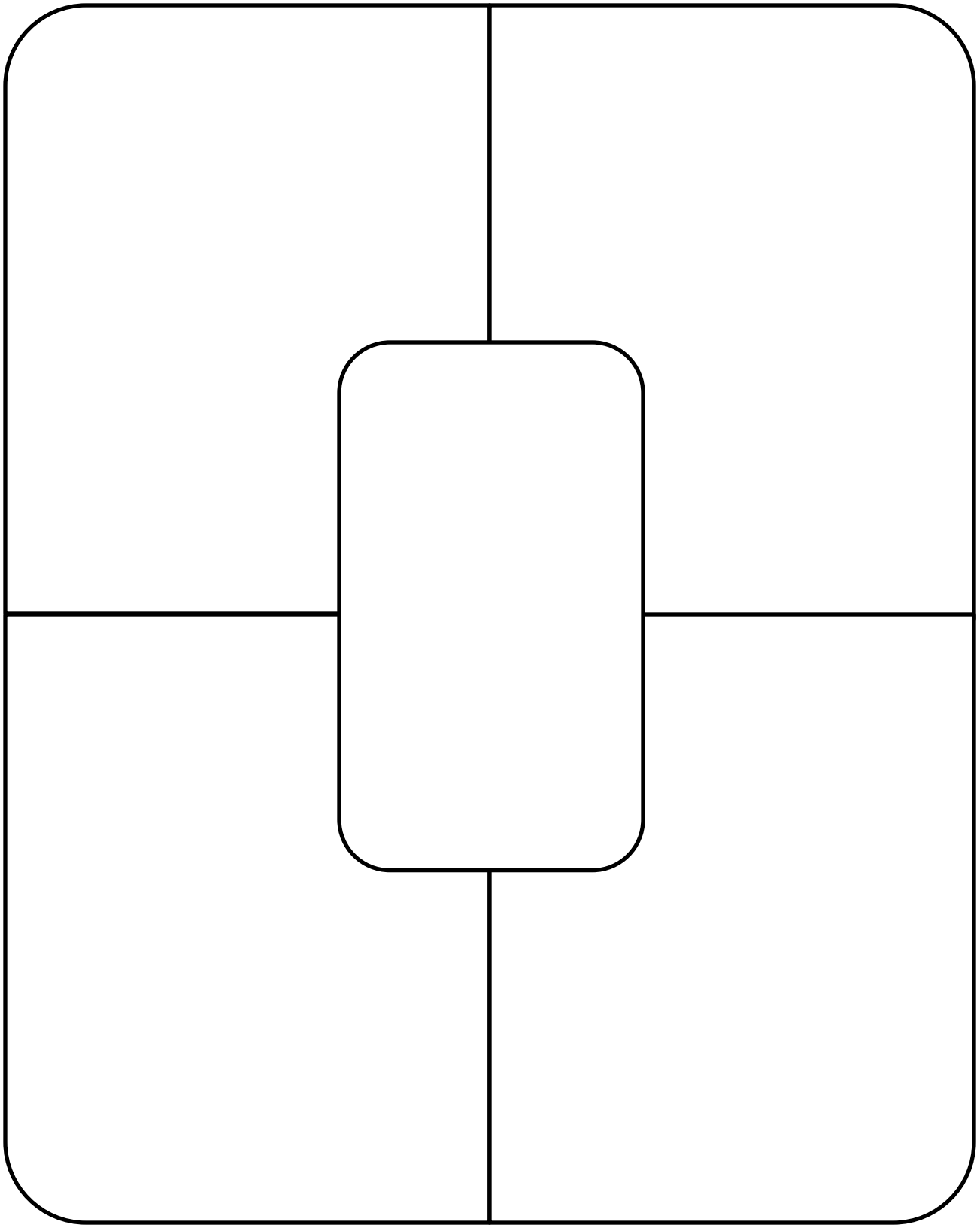
Making Connections



Appointment with Peers

Please meet with your second partner to discuss the following:

- What are your key takeaways from today?
- How does the align to your observation rubric?

Notes:

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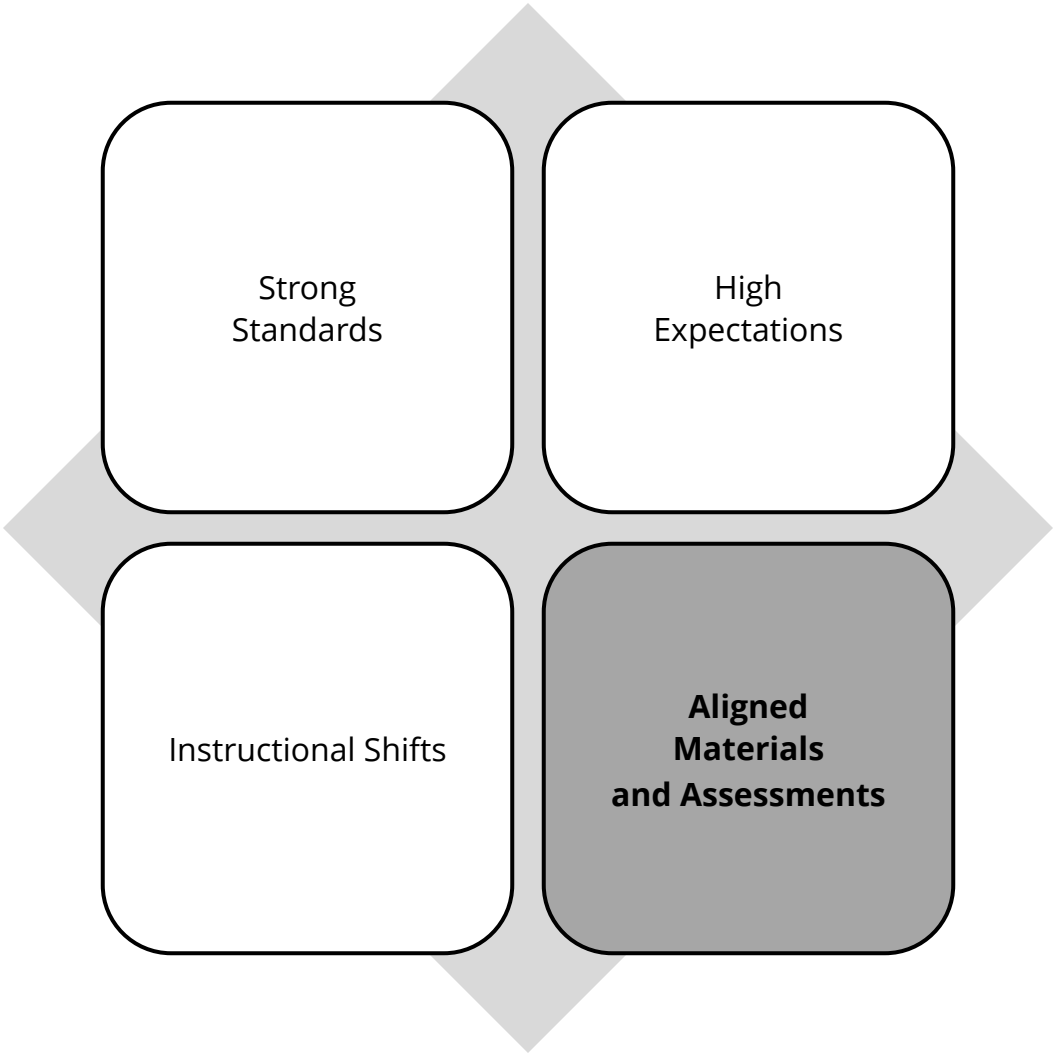
TAB PAGE

Part 4: Assessment and Materials

Module 7: Connecting Standards and Assessment



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Goals

- Discuss the role assessment plays in the integrated system of learning.
- Discuss the cycle of assessment.
- Discuss the areas of focus for standards-aligned assessments.
- Review and write mathematics assessment items.

Strong Standards

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High Expectations

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Instructional Shifts

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Aligned Materials and Assessments

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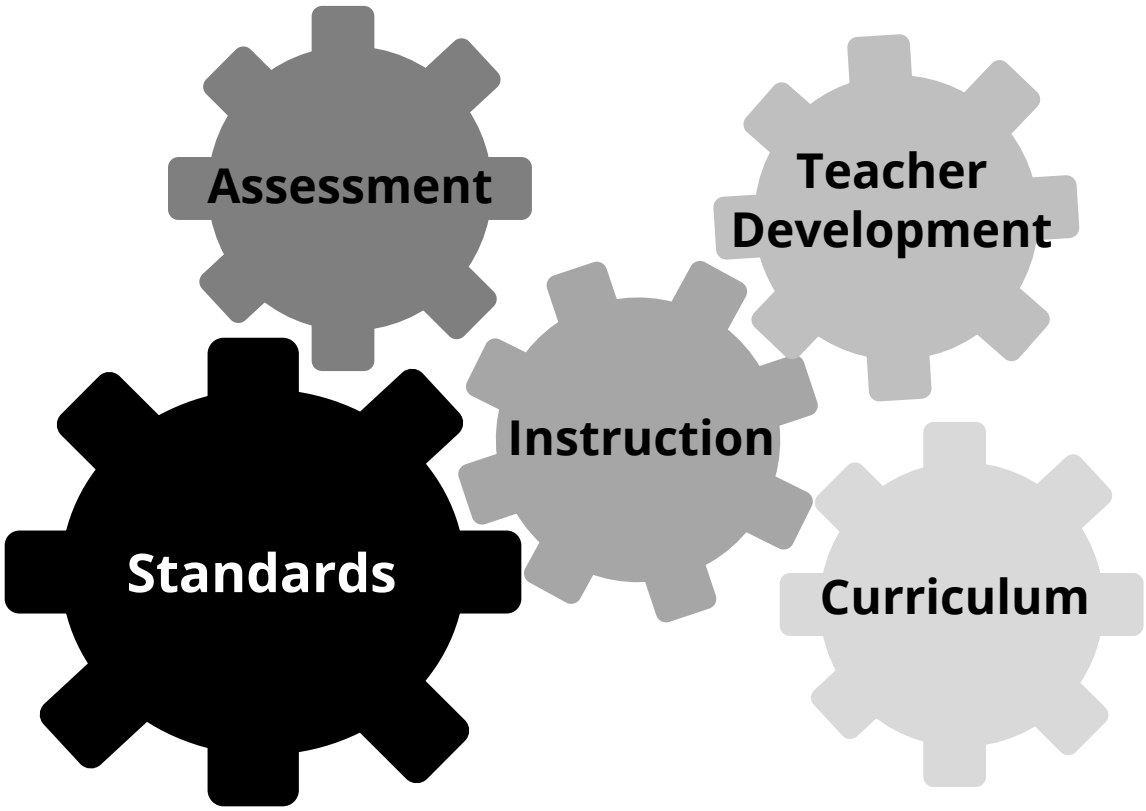
Connecting Standards and Assessment



Assessment is

_____.

Considering this definition of assessment, what are educators "making a judgement about" when assessing students?

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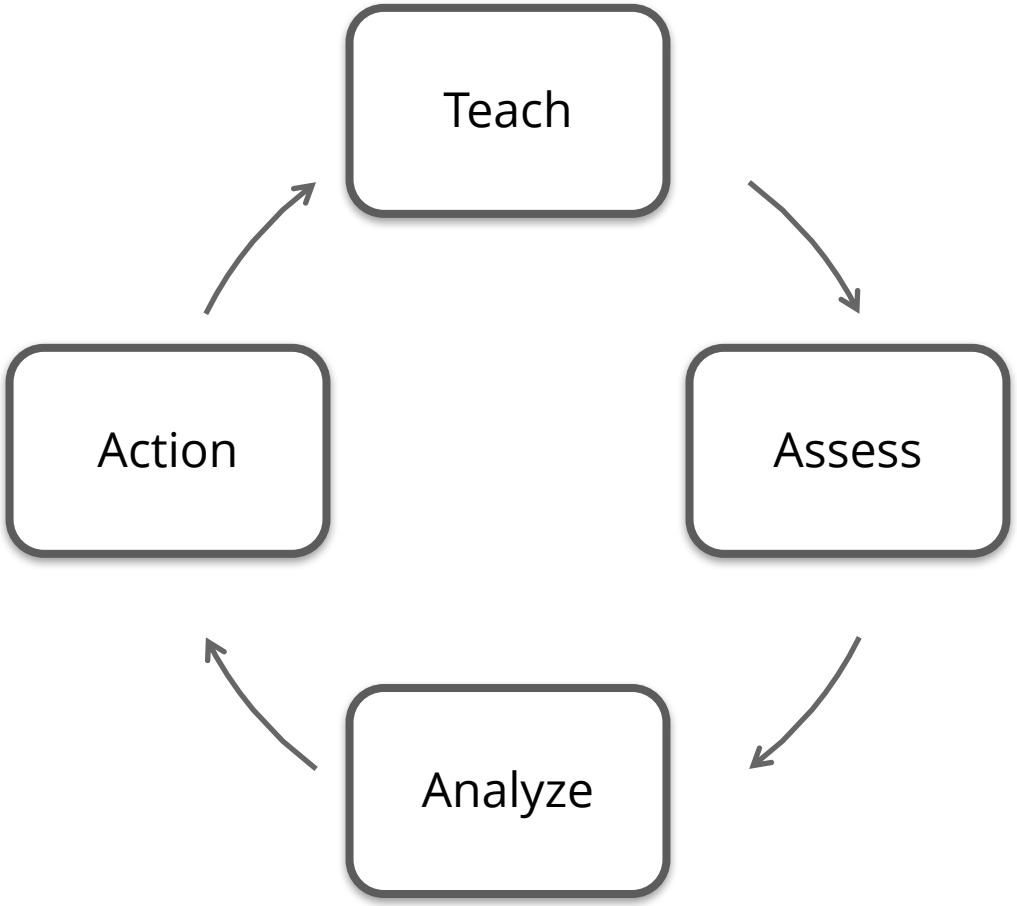
The Cycle of Assessment



"The good news is that research has shown for years that consistently applying principles of assessment for learning has yielded remarkable, if not unprecedented, gains in student achievement, especially for low achievers."

—Black & Wiliam, 1998

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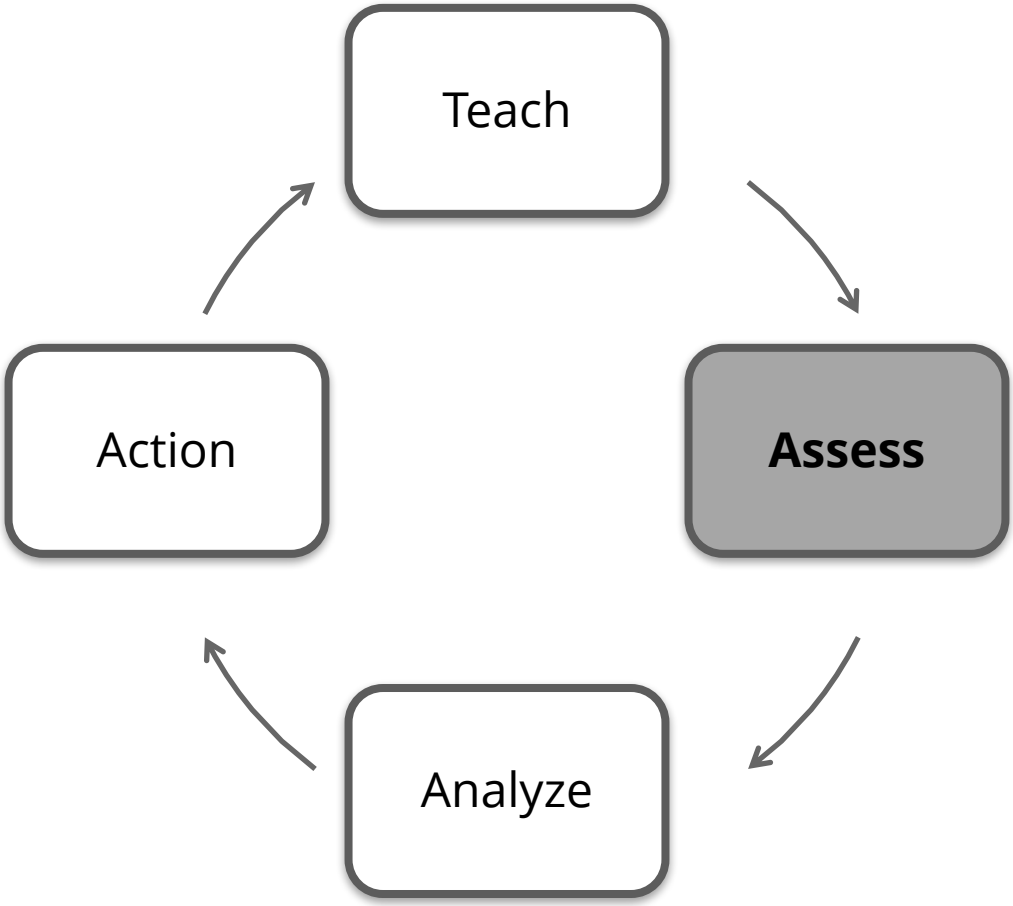
The Cycle of Assessment



Standards Aligned Assessment

Areas of Focus

1. Intent of the Assessment
    - Summative
    - Formative
2. Content and structure of Assessments
3. Analysis of Assessments

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Intent of Assessments

Areas of Focus

1. **Intent of the Assessment**
    - **Summative**
    - **Formative**
2. Content and Structure of Assessments
3. Analysis of Assessments

How are the results used?

Formative	Summative

"Benchmark assessments, either purchased by the district or from commercial vendors or developed locally, are generally meant to measure progress toward state or district content standards and to predict performance on large-scale summative tests. A common misconception is that this level of assessment is automatically formative."

—Stephen and Jan Chappuis 2012

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Intent of Assessments

Areas of Focus

1. Intent of the Assessment
    - Summative
    - Formative
2. **Content and Structure of Assessments**
3. Analysis of Assessments

Things to think about…

Universal Design Principles:

- No barriers
- Accessible for all students
- Upholds the expectations of our state standards

Notes:

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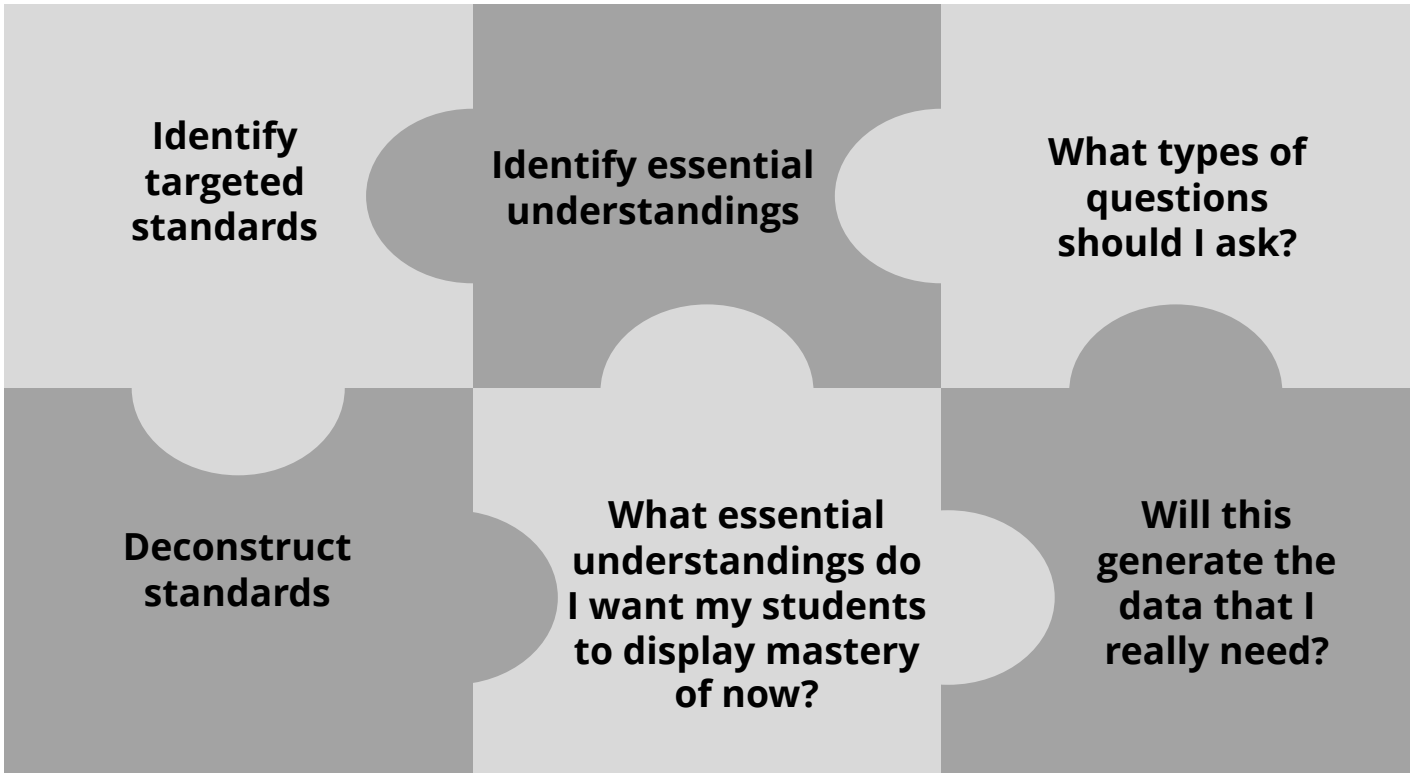
Developing a Classroom Assessment



Notes:

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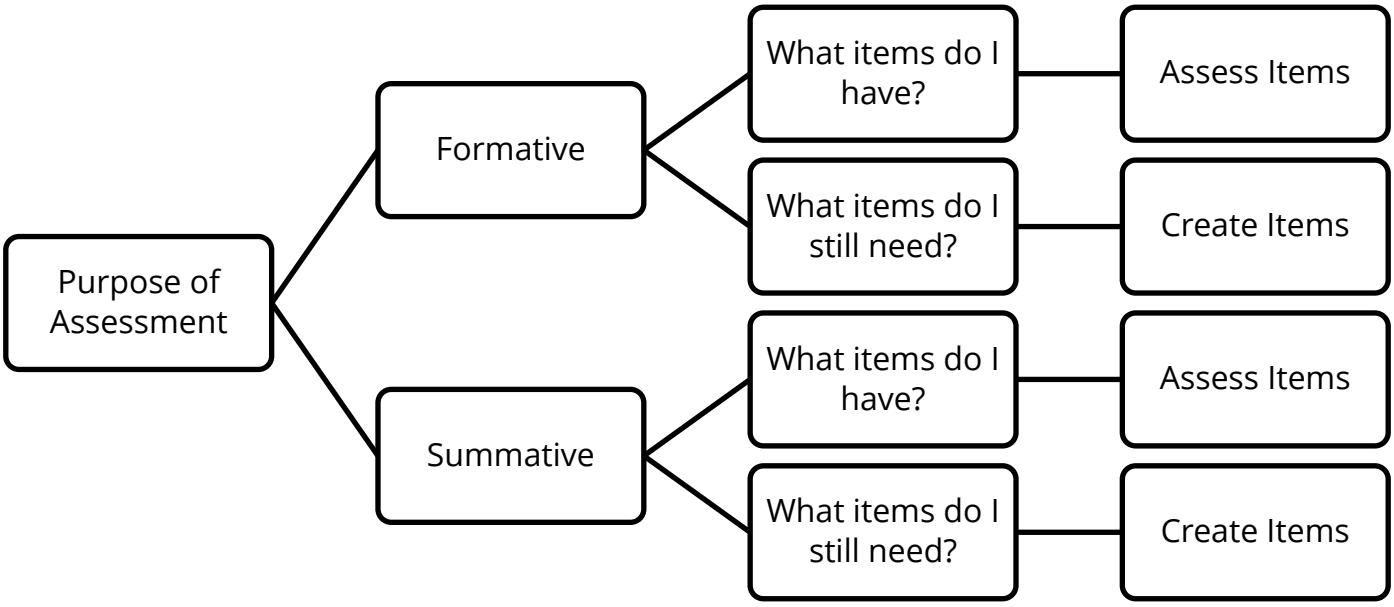
Inventory for a Classroom Assessment



Notes:

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Item Review

Standard:

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.

Which item is better?

Item 1: Samantha bought stickers.

- She bought 6 packs of stickers.
- Each pack has 12 stickers.
- She got 8 more stickers from a friend.

How many stickers does Samantha have in all?

A. 76
B. 78
C. 80
D. 82

Item 2: Samantha bought stickers.

- She bought 6 packs of stickers.
- Each pack has 12 stickers.
- She got 8 more stickers from a friend.

How many stickers does Samantha have in all?

A. 26
B. 64
C. 72
D. 80

Notes:

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Item Review

Assessment Terminology

Item Type

Selected response	
Open response	
Verbal	
Extended writing	

Item Components

Stimulus	
Stem	
Key	
Distractor	
Rationale	

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Examining Items: Formative vs. Summative

- What is the question actually asking?
- Is the question aligned to the depth of the standard?
- Are the answers precise?
- Is the wording grade appropriate?
- Is the question aligned to the standard?
- Do the distractors give insight into student thinking?
- Is the entire standard assessed?
- Is the question precise?
- Is there a better way to assess the standard?

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Item Assessment Activity

For each of the provided formative assessment items, think about the things we just discussed. Would you include it on a formative assessment when paired with the provided standard?

You will be looking at five items. Decide if you would keep them, revise them in some way, or throw the item out all together. Look first at the items independently. Then you may work with a partner to complete the activity.

Item #1

M3.G.GPE.A.1 (G.GPE.A.1)

Know and write the equation of a circle of given center and radius using the Pythagorean Theorem.

The equation for a given circle is

$$2x^2 + 2y^2 – 8x – 12y + 8 = 0.$$

What is the radius of the circle?

A. 2
B. 3
C. 4
D. 12

Item #2

G.SRT.B.4 (M2.G.SRT.B.4)

Prove theorems about similar triangles.

Right Triangle ABC has side lengths 5, 12 and 13. If Triangle DEF is similar to ABC and has one side length 60, what are the possible missing side lengths of DEF?

A. 10 and 24
B. 25 and 65
C. 30 and 78
D. 36 and 96
E. 100 and 125
F. 144 and 156

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Item Assessment Activity

Item #3

A2.A.REI.D.6 (M1.A.REI.C.4)

Explain why the x-coordinates of the points where the graphs of the equations y = f(x) and y = g(x) intersect are the solutions of the equation f(x) = g(x); find the approximate solutions using technology.

$f(x)=|x|-2$ and $g(x)=-|x|+2$

Graph f(x) and g(x). Identify all solutions to the equation f(x)=g(x) on the graph.

Item #4

M1.F.IF.C.7 (A1.F.IF.C.8)

Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).

Two savings plans are represented by the functions f(x) and g(x) respectively, where x is the number of months and f(x) and g(x) represent the value of each account in dollars.

What is the average rate of change of the higher earning account after 6 months?

x	g(x)
1	50
2	200
3	450

Write your answer in the space provided.

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Item Assessment Activity

Item #5

A2.A.APR.A.2 (M3.A.APR.A.2)

Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.

Identify all zeroes for the following:

$$y = 2x^5 - 5x^4 - 3x^3 - 2x^2 + 5x + 3$$

Share one or two “ah-ha” moments from this activity with your neighbor.

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Creating Formative Items

Before you actually start writing items:

- Think about the purpose of the assessment as a whole. Is it formative or summative?
- Read the standards carefully with the assessment purpose in mind. Ask yourself: "What skills/knowledge are the standards asking the student to display?"
- Revisit the "I can" statements or "essential questions" you wrote for the standard(s). They may provide guidance as you write items.
- Brainstorm.

Revisiting Standard A1.F.IF.C.7

A1.F.IF.C.7 Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.

a. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.

FORMATIVE Assessment

Determine if each equation will have a minimum or a maximum value. You do not have to provide any coordinates. Match the equations on the left with the correct choice on the top.

	Maximum	**Minimum**
$y = (x-2)^2+4$		
$y = -1(x-2)^2+4$		
$y = -2x^2 + 4x\ -2$		
$y = 2x^2 - 8x + 1$		

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Creating Formative Items

Revisiting Standard A1.F.IF.C.7

Item #2

For a quadratic function, complete the square in order to identify the zeroes.

Identify the zeroes for the following quadratic equation:

$$y = 2x^2 - 4x + 1$$

Item #3

Interpret zeros and extreme values for quadratic equations in terms of a context.

A ball is thrown straight up, from 4 m above the ground with a velocity of 20 m/s. Its height is modeled by the following equation:

$$h = 4 + 20t - 5t^2$$

How long will it take the ball to hit the ground?

A. 5 seconds
B. 4.2 seconds
C. 2.2 seconds
D. 1 second

Did we cover all aspects of the standard with these items?

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Review

- Formative Assessments *may* need items that scaffold in order for the teacher to diagnose what a student does/does not understand.
- Effectively writing "I can" or "essential questions" helps target assessment items specifically to standards.
- It is very difficult to formatively assess student understanding through a single item.
- Don't forget the principles of universal design.
- It's important to ask yourself the nine essential questions during item review or item writing.

Item Writing-Your Turn

- You will be provided a set of standards.
- You and a partner will be writing items to post for our gallery walk.
  - On selected response items you do not have to post the rationale for the distractors.
  - Please post the coding for the standard(s) to which your items are written.

Selected Response

Multiple Choice	Multiple Select

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Item Writing: Your Turn

Use this space to write out your standard(s) and assessment item(s).

Option 1	Option 2
1. Choose three of the standards. 2. Write an item to assess each standard that you would use on a formative assessment. 3. Try to write at least one multiple choice or multiple select item. Focus on writing distractors that provide instructional information.	1. Choose one standard. 2. Write three formative assessment items to the single standard that you selected. Make sure that each item requires students to demonstrate a different level of understanding of the standard. 3. Try to write at least one multiple choice or multiple select item. Focus on writing distractors that provide instructional information.

Gallery Walk

As you review your colleagues' items, look for similarities and differences in the items created.

Reflection

Reflect on your experience evaluating and creating assessment items and discuss the following:

- What was challenging about this experience?
- What did you learn from this experience?
- What supports do you need to better understand the relationship between standards and assessments in this way?

Notes:

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Analyzing Assessments

Areas of Focus

1. Intent of the Assessment
    - Summative
    - Formative
2. Content and Structure of Assessments
3. **Analysis of Assessments**

Analysis of Assessment

- Is the data _____ ?
- How is it analyzed?
- On which questions _____ ? Why?
- On which questions _____ ? Why?
- Were there issues with…

  _____

  _____

  _____ ?

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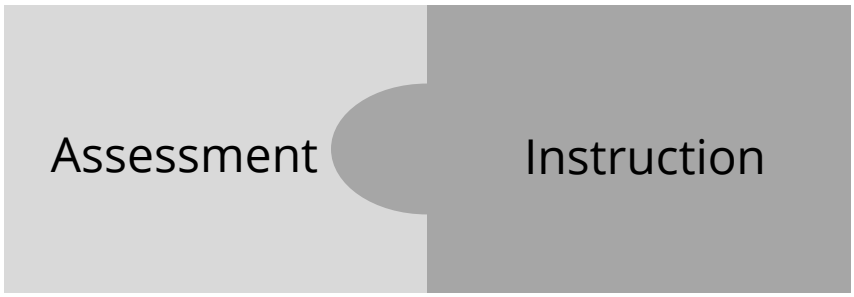
Taking Action



- How is instruction changing/adapting as a result of student data?
- Are results shared with all stakeholders (including students)?
- Are assessments adapted to address weaknesses found?

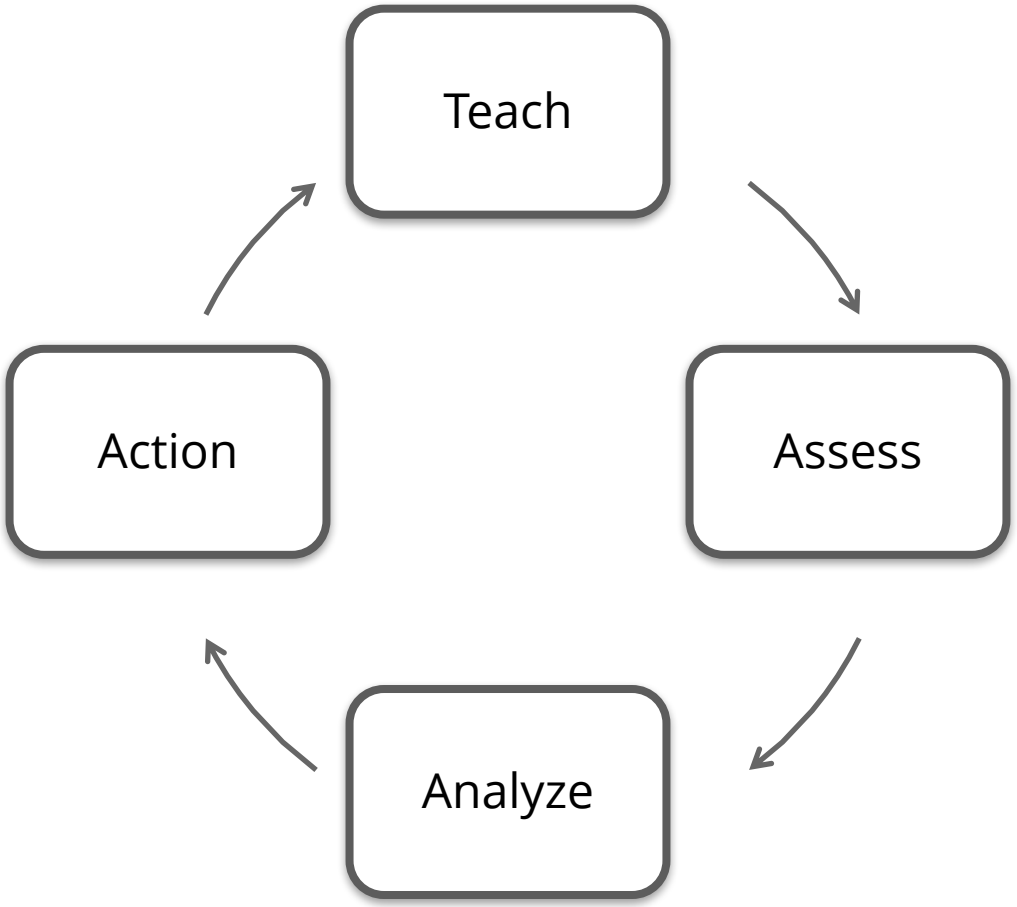
"The assessments will produce no formative benefit if teachers administer them, report the results, and then continue with instruction as previously planned."

—Stephen and Jan Chappuis, 2012

Notes:

Summary

The Cycle of Assessment



Aligned Materials and Assessments

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

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Appointment with Peers

Please meet with your third partner to discuss the following:

- What are your takeaways from module 7?
- How does this align to your observation rubric?

Notes:

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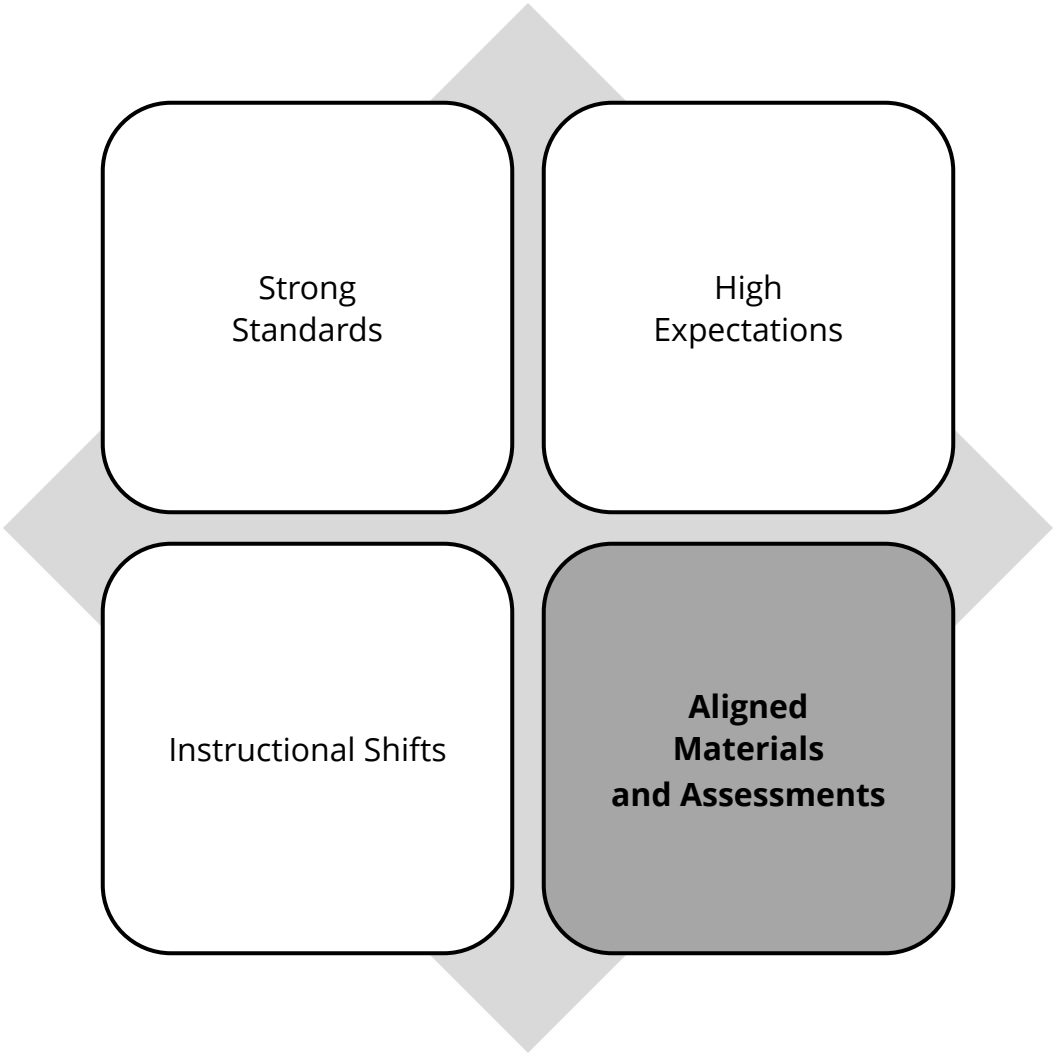
Part 4: Assessment and Materials

Module 8: Evaluating Instructional Materials



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Key Question

How do we know that our instructional materials address the depth of the content and the instructional shifts of focus, coherence, and rigor of the TN State Standards?

Goals

- Examine the TEAM rubric to define what is meant by standards based materials.
- Know which key criteria to use for reviewing materials, lessons, and/or units for alignment and quality.

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

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Standards Based Materials and Practice

"...teachers have a responsibility to make day-to-day instructional choices that ensure that students work with problems that engage their interest and their intellect."

—Cathy L. Seeley, 2014

Reflect on Our Practice

When your students' work is on public display, in the hallway or shared with families, can anyone see the math?

Are the materials and the instructional practices you are using focused on the mathematics?

If anyone looked at your students' work, would they be able to see the math or would they be left asking "**where's the math?**"

Notes:

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Standards Based Materials and Practice

TEAM Connection
Activities & Materials

- Support the lesson objective
- Are challenging
- Sustain students' attention
- Elicit a variety of thinking
- Provide time for reflection
- Provide opportunities for student-to-student interaction
- Provide students with choices
- Incorporate technology
- Induce curiosity & suspense
- In addition sometimes activities are game-like, involve simulations, require creating products, and demand self-direction and self-monitoring.
- The preponderance of activities demand complex thinking and analysis
- Texts & task are appropriately complex

TEAM Connection
Problem Solving

- Abstraction
- Categorization
- Predicting Outcomes
- Improving Solutions
- Generating Ideas
- Creating & Designing
- Observing & Experimenting
- Drawing Conclusions/Justifying Solutions
- Identify Relevant/Irrelevant Information

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Standards Based Materials and Practice

Effective Mathematics Teaching Practices

1. Establish mathematics goals to focus learning.
2. Implement tasks that promote reasoning and problem solving.
3. Use and connect mathematical representations.
4. Facilitate meaningful mathematical discourse.
5. Pose purposeful questions.
6. Build procedural fluency from conceptual understanding.
7. Support productive struggle in learning mathematics.
8. Elicit and use evidence of student thinking.

Notes:

Missing Angle Activity

- What content standard do you think these activities address?
- Where is the evidence of student understanding of the mathematical content?

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Standards Based Materials and Practice

Missing Angle Activity

If a teacher was trying to address the depth of the **content standard 8.G.A.3 ,** does the Missing Angle Activity accomplish this goal?

8.G.A.3. Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles. For example, arrange three copies of the same triangle so that the sum of the three angles appears to form a line, and give an argument in terms of transversals why this is so.

Notes:

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Criteria for Alignment and Quality

Research

"A curriculum is more than a collection of activities."

—from the Curriculum Principle in *Principles and Standards for School Mathematics*

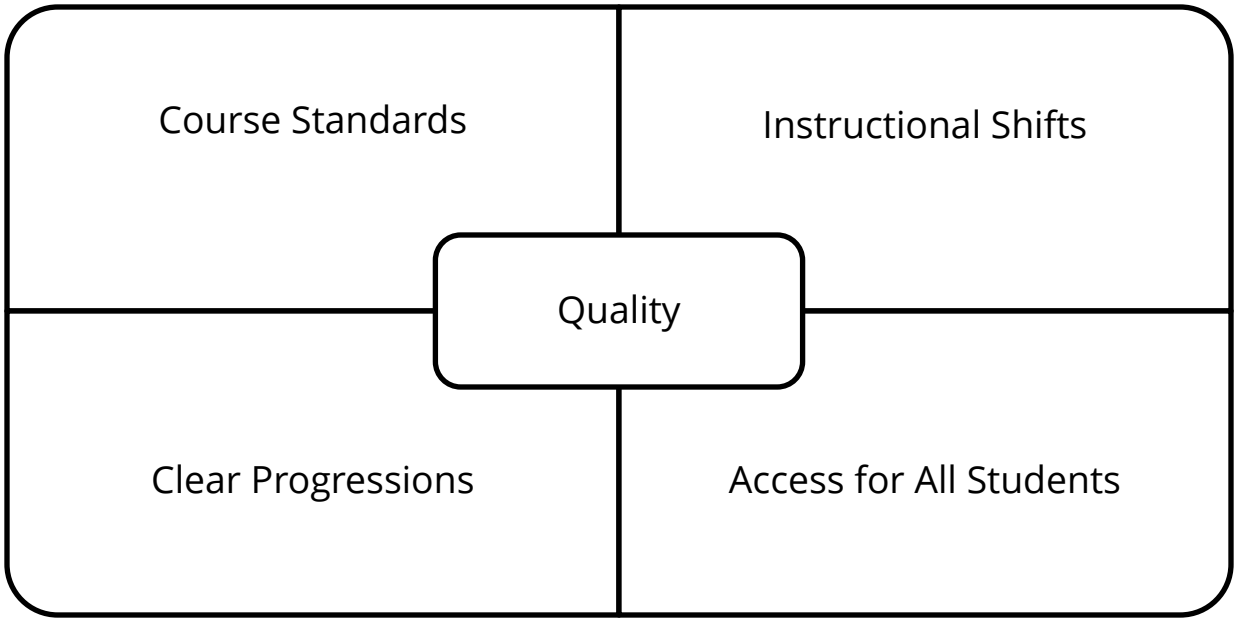
A **well-articulated curriculum** will:

- Make clear the most important mathematics of the grade level.
- Specify when concepts and skills are introduced and when they should be mastered.
- Detail how student conceptual understanding of big ideas develops across units and across multiple grade levels.

When choosing instructional materials, what should a teacher consider?

Notes:

Criteria for Alignment and Quality



Materials Review Instrument

When reviewing materials, it is important to have a deep understanding of the standards and a deep understanding of the review instrument before looking at the materials.

- Section I: Non-Negotiable Alignment Criteria
  - Part A: Standards
  - Part B: Shifts
    - Focus
    - Rigor
    - Coherence
- Section II: Additional Alignment Criteria and Indicators of Quality
  - Part A: Key areas of focus
  - Part B: Student engagement and instructional focus
  - Part C: Monitoring student progress

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Math Materials Review Instrument

SECTION I: NON-NEGOTIABLE ALIGNMENT CRITERIA		SECTION II: ADDITIONAL ALIGNMENT CRITERIA AND INDICATORS OF QUALITY		
Part A. Course Standards	Part B. Shifts in Instruction	Part A. Key Areas of Focus	Part B. Student Engagement and Instructional Supports	Part C. Monitoring Student Progress
Yes: Move to Part B No: Do not use or modify	Yes: Move to Section II No: Do not use or modify	Yes: Move to Section II:B No: Do not use or modify	Yes: Move to Section II:C No: Do not use or modify	Yes: Use materials No: Do not use or modify
The instructional materials represent 100 percent alignment with the Tennessee Math Standards and explicitly focus teaching and learning on the course standards at the rigor necessary for students to reach mastery.	1. Focus 2. Coherence 3. Rigor	Learning experiences provide opportunities for thought, discourse, and practice in an interconnected and social context. Units and instructional sequences are coherent and organized in a logical manner that builds upon knowledge and skills learned in prior grade levels or earlier in the grade. Materials support student communication within an ELA focus by providing consistent opportunities for students to utilize literacy skills for proficiency in reading, writing, vocabulary, speaking, and listening.	Material provides learning experiences that incorporate the course standards, Standards for Mathematical Practice, and Literacy Skills for Mathematical Proficiency. Material engages students through real-world, relevant, thought-provoking questions, problems, and tasks that stimulate interest and elicit critical thinking and problem solving. Material integrates appropriate supports for students who are ELL, have disabilities, or perform below grade level. Material includes differentiated materials that provide support for students approaching mastery as well as extensions for students already meeting mastery or with high interest.	Assessments provide data on the content standards. Material assesses student mastery using methods that are unbiased and accessible to all students. Material includes aligned rubrics or scoring guidelines that provide sufficient guidance for interpreting student performance. Material uses varied modes of curriculum embedded assessments that may include pre-, formative, summative, and self-assessment measures. Assessments are embedded throughout instructional materials as tools for students' learning and teachers' monitoring of instruction. Assessments provide teachers with a range of data to inform instruction.

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Evaluating Instructional Materials: Best Practices

- It's important to review instructional materials you use to determine where you have strong alignment to standards and where you may have gaps to fill.
- School leaders and teachers should engage in reviewing instructional materials on an ongoing basis to develop pedagogy and capacity.

Teachers need to review materials when:

- There is a new adoption.
- Current materials have gaps that may require supplemental materials.
- They are looking for supplemental instructional materials.

Notes:

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Supplemental Materials

Let's Discuss:

- What resources do you have on hand?
- Where do you find supplemental materials?
- How can you use this process to evaluate supplemental materials?

Reviewing Materials: A Recap

As you look for materials...

- Is it aligned to the standards?
- Does it reflect high leverage best practices?
- Is it accessible for ALL students?
- Does it lead to students being able to demonstrate mastery of the standard?

Notes:

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Potential Gaps in Materials

Grades 6-8:

- Shifted Compound Probability standard
    - Moved from seventh to eighth grade
- Revised Geometry standards
    - Removed from seventh grade: slice of 3-dimensional objects
    - Removed from eighth grade: congruency and similarity of 2-dimensional objects

Grades 9-12:

- Shifted a number of standards from Algebra II and Integrated Math III to the Additional Math Courses

Notes:

Module 8 Review

The review process of instructional materials will:

- Deepen understanding of the standards,
- Make use of review instruments to analyze materials to determine alignment or gaps, and
- Result in wise decisions about how best to use the materials already on-site to teach the new standards to mastery OR effectively fill any gaps uncovered in the review process.

Aligned Materials and Assessments

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

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Appointment with Peers

Please meet with your fourth partner to discuss the following:

- How can the materials review instrument lead to improved student outcomes in your classroom?

Notes:

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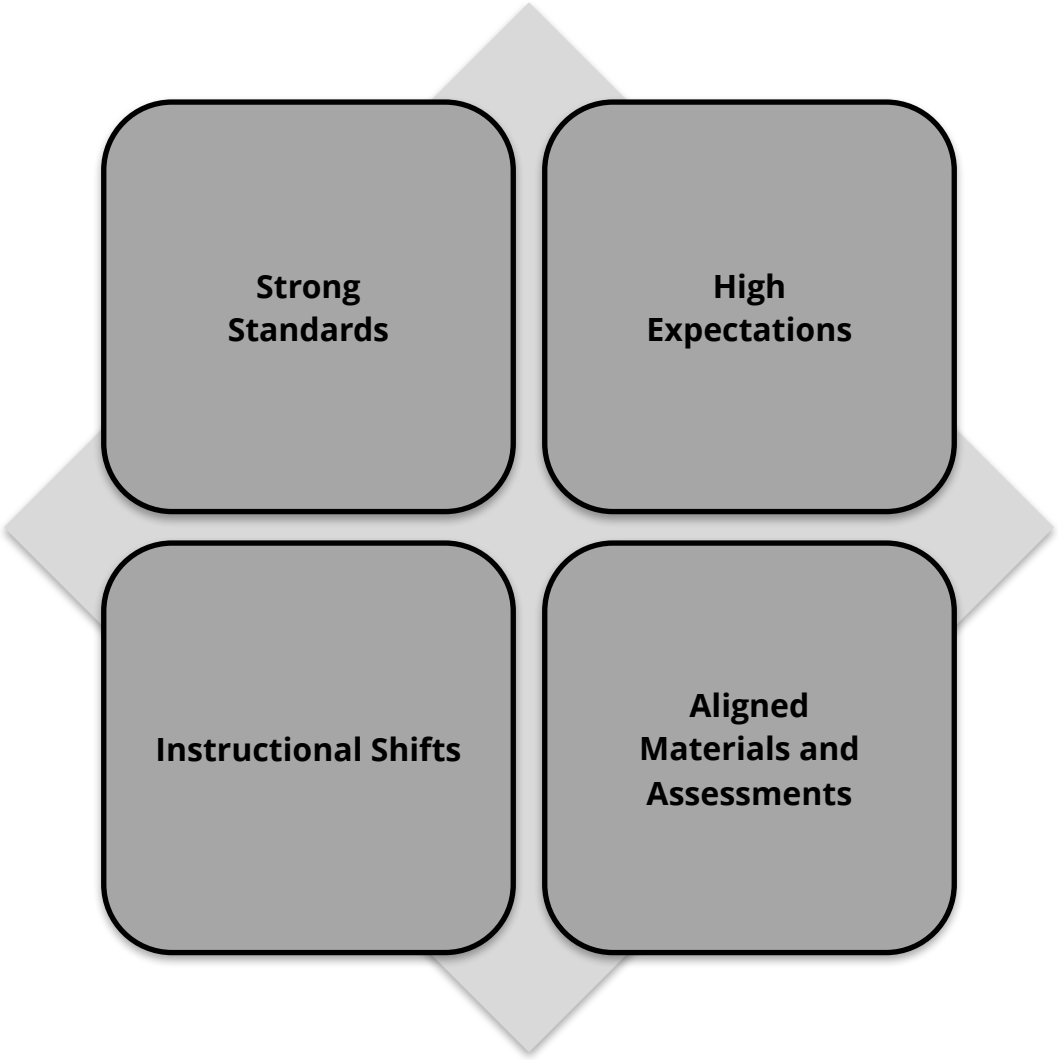
TAB PAGE

Part 5: Putting It All Together

Module 9: Instructional Planning



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Goals

- Understand intentional instruction as a bridge between strong standards and assessment.
- Develop lesson planning techniques to strengthen the understanding of the relationship between standards and practice.
- Create lessons based on the revised standards to be used for instruction.

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.

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.

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Designing Effective Learning Experiences

"...teachers have a responsibility to make day-to-day instructional choices that ensure that students work with problems that engage their interest and their intellect."

—Cathy L. Seeley, 2014

Notes:

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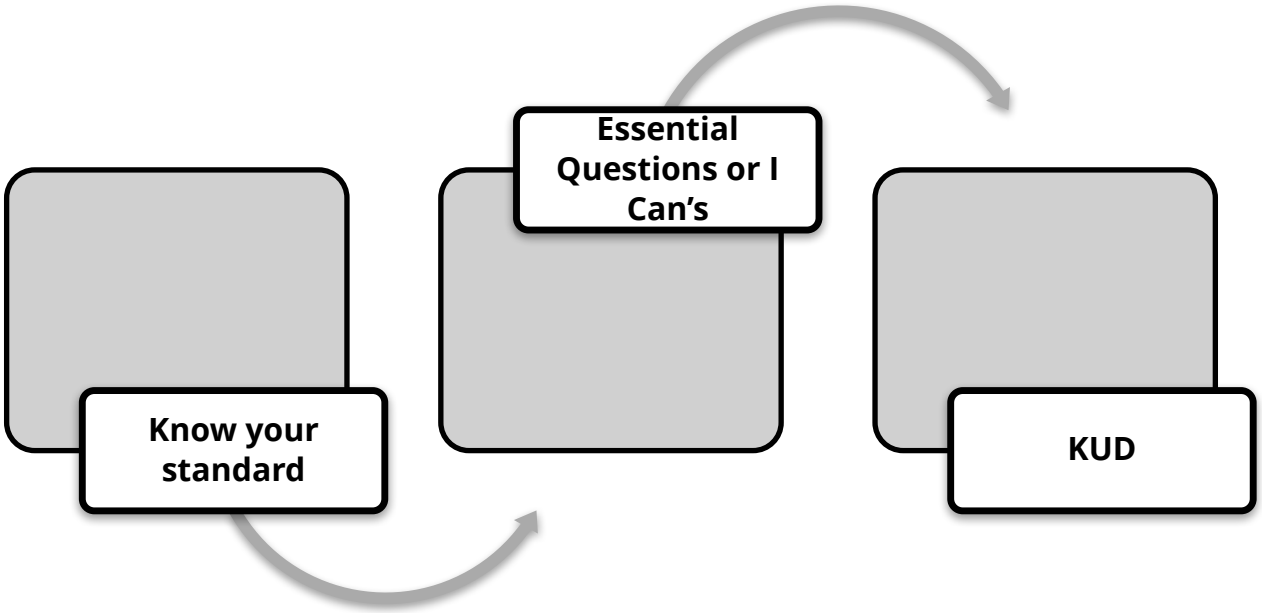
Designing Effective Learning Experiences

What is intentional instruction?

- Standards are driving your instruction.
- What does "intentional" mean?
- Gather evidence of learning (assessments)
- What are your end goals?



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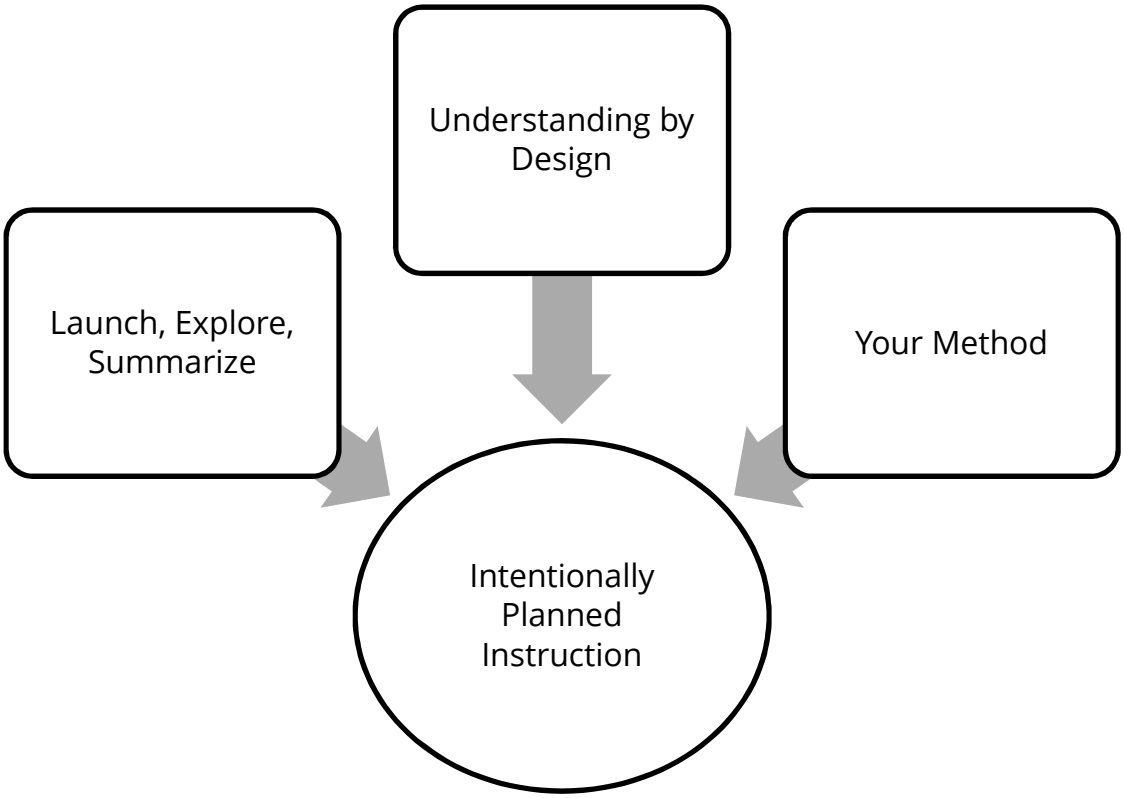
Designing Effective Learning Experiences
Putting It All Together

Now it's your turn! Use this space for your small group planning.



There are many ways to intentionally plan instruction.

Module 9 Recap

- We brought together concepts studied in the previous modules to plan for instruction.
- We were intentional in our instruction, using instruction to bridge the gap between standards and assessment.

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Module 9 Review

Strong Standards

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High Expectations

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Shifts in Instructional Practice

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Aligned Materials and Assessment

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Module 9 Review

- There are many ways to “do” intentional instruction.
- Intentional instruction is the bridge between standards and assessment.
- Start with the standard: determine what students need to know, understand, and do.
- Create learning experiences that connect to students’ experiences and give them a chance to explore the concept.
- Assessment plays a critical role in instruction, should be standards based, and should be used to determine student mastery of the standard(s).

Strong Standards

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High Expectations

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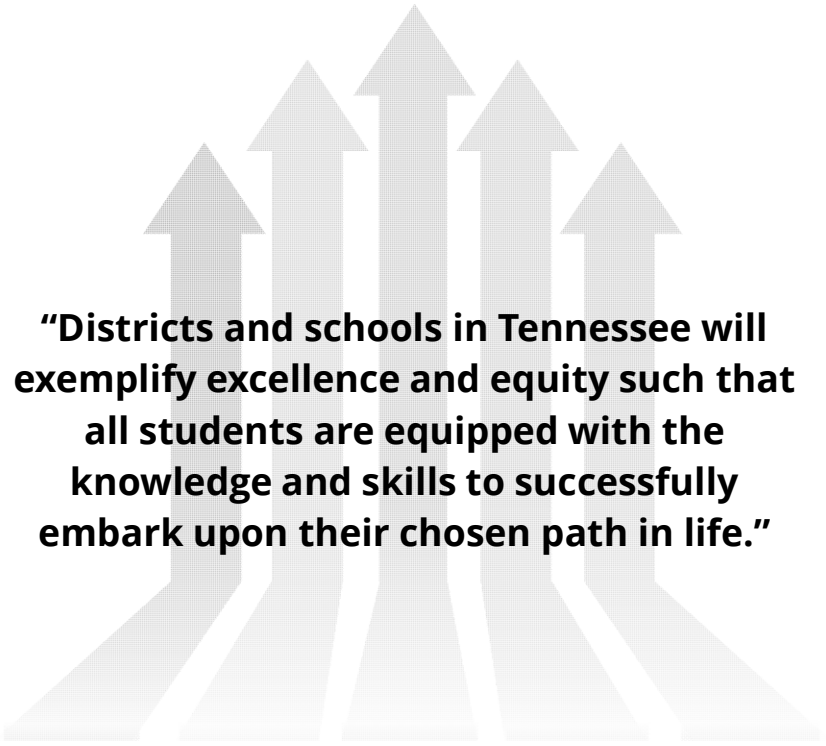

“Districts and schools in Tennessee will exemplify excellence and equity such that all students are equipped with the knowledge and skills to successfully embark upon their chosen path in life.”

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