Achieve Alignment and Commentary:
Yellow highlighted rows indicates a gap in the alignment between the CCSS and AZ.
Differences in grade level requirements are indicated in pink when the concept is addressed later in AZ than in the CCSS.

| CCSS | AZ | Notes and Comments |
|---|---|---|
| MP.1 Make sense of problems and persevere in solving them. | MP.1 Make sense of problems and persevere in solving them. | The CCSS Standards for Mathematical Practice are identified at each grade level in the AZ standards. While there are wording changes, the spirit and emphases are the same. |
| MP.2 Reason abstractly and quantitatively. | MP.2 Reason abstractly and quantitatively. | |
| MP.3 Construct viable arguments and critique the reasoning of others. | MP.3 Construct viable arguments and critique the reasoning of others. | |
| MP.4 Model with mathematics. | MP.4 Model with mathematics. | |
| MP.5 Use appropriate tools strategically. | MP.5 Use appropriate tools strategically. | |
| MP.6 Attend to precision. | MP.6 Attend to precision. | |
| MP.7 Look for and make use of structure. | MP.7 Look for and make use of structure. | |
| MP.8 Look for and express regularity in repeated reasoning. | MP.8 Look for and express regularity in repeated reasoning. | |
| **GRADE K** | | . |
| **Counting and Cardinality** | **Counting and Cardinality (CC)** | . |
| **Know number names and the count sequence.** | **K.CC.A Know number names and the count sequence.** | . |
| K.CC.1. Count to 100 by ones and by tens. | K.CC.A.1 Count to 100 by ones and by tens. | . |
| K.CC.2. Count forward beginning from a given number within the known sequence (instead of having to begin at 1). | K.CC.A.2 Count forward beginning from a given number instead of having to begin at 1. | . |
| K.CC.3. Write numbers from 0 to 20. Represent a number of objects with a written numeral 0-20 (with 0 representing a count of no objects). | K.CC.A.3 Write numbers from 0–20. Represent a number of objects with a written numeral 0–20 (with 0 representing a count of no objects). | . |
| **Count to tell the number of objects.** | **K.CC.B Understand the relationship between numbers and quantities.** | AZ uses K.CC.4 as the header for this cluster. |

| CCSS | AZ | Notes and Comments |
|---|---|---|
| K.CC.4. Understand the relationship between numbers and quantities; connect counting to cardinality. | K.CC.B.4 Connect counting to cardinality. | The first part of the CCSS was used as the cluster header. |
| K.CC.4a When counting objects, say the number names in the standard order, pairing each object with one and only one number name and each number name with one and only one object. | a. When counting objects, say the number names in the standard order, pairing each object with one and only one number name and each number name with one and only one object. | . |
| K.CC.4b Understand that the last number name said tells the number of objects counted. The number of objects is the same regardless of their arrangement or the order in which they were counted. | b. Understand that the last number name said tells the number of objects counted. The number of objects is the same regardless of their arrangement or the order in which they were counted. | . |
| K.CC.4c Understand that each successive number name refers to a quantity that is one larger. | c. Understand that each successive number name refers to a quantity that is one larger. | . |
| KCC.5. Count to answer "how many?" questions about as many as 20 things arranged in a line, a rectangular array, or a circle, or as many as 10 things in a scattered configuration; given a number from 1–20, count out that many objects. | K.CC.B.5 Count to answer questions about "how many?" when 20 or fewer objects are arranged in a line, a rectangular array, or a circle or as many as 10 things in a scattered configuration; given a number from 1–20, count out that many objects. | The slight wording change in AZ causes no significant change in the standards' meaning. |
| **Compare numbers.** | **K.CC.C Compare numbers and quantities.** | AZ adds "and quantities" to the header. |
| K.CC.6. Identify whether the number of objects in one group is greater than, less than, or equal to the number of objects in another group, e.g., by using matching and counting strategies. [Include groups with up to 10 objects.] | K.CC.C.6 Identify whether the number of objects in one group is greater than, less than, or equal to the number of objects in another group. (Include groups with up to ten objects.) | AZ removed the CCSS example. |
| K.CC.7. Compare two numbers between 1 and 10 presented as written numerals. | K.CC.C.7 Compare two numbers between 1 and 10 presented as written numerals. | . |

| CCSS | AZ | Notes and Comments |
|---|---|---|
| **Operations and Algebraic Thinking** | **Operations and Algebraic Thinking** | . |
| **Understand addition as putting together and adding to, and under- stand subtraction as taking apart and taking from.** | **K.OA.A Understand addition as putting together and adding to, and understand subtraction as taking apart and taking from.** | . |
| K.OA.1. Represent addition and subtraction with objects, fingers, mental images, drawings, sounds (e.g., claps), acting out situations, verbal explanations, expressions, or equations. [Drawings need not show details, but should show the mathematics in the problem.] | K.0A.A.1 Represent addition and subtraction with objects, fingers, mental images, drawings, sounds, acting out situations, verbal explanations, expressions, or equations. | . |
| K.OA.2. Solve addition and subtraction word problems, and add and subtract within 10, e.g., by using objects or drawings to represent the problem. | K.0A.A.2 Use addition and subtraction through 10 to solve word problems involving multiple problem types (See Table 1), using a variety of strategies. | CCSS includes more detail about the type of strategies expected at this level. AZ draws attention to Table 1. AZ replaces "within" with "through" to imply a closed interval. However this slight change in wording causes confusion as to the performance expectation. Does "use addition and subtraction through 10" include, for example, 7 + 6?<br><br>It is not clear what the "multiple problem types" and "a variety of strategies" would be. |
| K.OA.3. Decompose numbers less than or equal to 10 into pairs in more than one way, e.g., by using objects or drawings, and record each decomposition by a drawing or equation (e.g., 5 = 2 + 3 and 5 = 4 + 1). | K.0A.A.3 Decompose numbers less than or equal to 10 into pairs in more than one way by using objects or drawings, and record each decomposition with a drawing or equation. | AZ removed the CCSS example. |

| CCSS | AZ | Notes and Comments |
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| K.OA.4. For any number from 1 to 9, find the number that makes 10 when added to the given number, e.g., by using objects or drawings, and record the answer with a drawing or equation. | K.0A.A.4 For any number from 1 to 9, find the number that makes 10 when added to the given number by using objects or drawings, and record the answer with a drawing or equation. | AZ removed the CCSS example. |
| K.OA.5. Fluently add and subtract within 5. | K.0A.A.5 Fluently add and subtract through 5. | AZ replaces "within" with "through" to imply a closed interval. However, this slight change in wording causes confusion as to the performance expectation. Does "use add and subtract through 5" include, for example, 4 + 5? |
| **Numbers and Operations in Base Ten** | **Number and Operations in Base Ten (NBT)** | . |
| **Work with numbers 11–19 to gain foundations for place value.** | **K.NBT.A Work with numbers 11-19 to gain foundations for place value.** | . |
| K.NBT.1. Compose and decompose numbers from 11 to 19 into ten ones and some further ones, e.g., by using objects or drawings, and record each composition or decomposition by a drawing or equation (e.g., 18 = 10 + 8); understand that these numbers are composed of ten ones and one, two, three, four, five, six, seven, eight, or nine ones. | K.NBT.A.1 Compose and decompose numbers from 11 to 19 into ten ones and additional ones by using objects or drawings and record each composition or decomposition with a drawing or equation. | CCSS offers an example of decomposition and requires (explains) understanding of number composition. AZ removed the second example and made the first example part of the standard. They also removed the requirement for understanding place value in terms of compositions. |
| | **K.NBT.B Use place value understanding and properties of operations to add and subtract.** | This AZ addition is not directly addressed in the CCSS at this grade level. This concept seems to overlap with K.OA.2, 3, and 4, and extends K.OA.5.The distinction between the OA expectations and this header and standard is not clear. It is also not explained how place value understanding would be addressed in a way that is different from 1.NBT.A.1. |

| CCSS | AZ | Notes and Comments |
|---|---|---|
| | K.NBT.B.2 Demonstrate conceptual understanding of addition and subtraction through 10 using a variety of strategies. | In this standard, students are asked to operate with numbers "through 10." This implies the possibility of adding, for example 8 + 7. Also, how does this standard connect to the new cluster header? The header implies that place value understanding and properties of operations would be required. That is not clear in the standard and may not be appropriate for this level. It might be more realistic to expect decomposing numbers and making 10s as seen in K.OA.A.5 and K.NBT.A.1. It also would be important at this level to inform teachers as to what "a variety of strategies" would entail. |
| **Measurement and Data** | **Measurement and Data (MD)** | . |
| **Describe and compare measurable attribute** | **K.MD.A Describe and compare measurable attributes.** | . |
| K.MD.1. Describe measurable attributes of objects, such as length or weight. Describe several measurable attributes of a single object. | K.MD.A.1 Describe several measurable attributes of a single object such as length and weight. | The slight wording change in AZ makes for no significant change in the standards' meaning. |
| K.MD.2. Directly compare two objects with a measurable attribute in common, to see which object has "more of"/"less of" the attribute, and describe the difference. *For example, directly compare the heights of two children and describe one child as taller/shorter.* | K.MD.A.2 Directly compare two objects with a measurable attribute in common, to see which object has "more of" or "less of" the attribute, and describe the difference. | AZ removed the CCSS example. |
| **Classify objects and count the number of objects in each category.** | **K.MD.B Classify objects and count the number of objects in each category.** | . |

| CCSS | AZ | Notes and Comments |
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| K.MD.3. Classify objects into given categories; count the numbers of objects in each category and sort the categories by count. [Limit category counts to be less than or equal to 10.] | K.MD.B.3 Classify objects or people into given categories; count the number in each category and sort the categories by count. (Note: limit category counts to be less than or equal to 10.) | The slight wording change in AZ makes for no significant change in the standards' meaning. |
| **Geometry** | **Geometry (G)** | . |
| **Identify and describe shapes (squares, circles, triangles, rectangles, hexagons, cubes, cones, cylinders, and spheres).** | **K.G.A Identify and describe shapes.** | The limitation on the types of shapes is removed in AZ. |
| K.G.1. Describe objects in the environment using names of shapes, and describe the relative positions of these objects using terms such as *above* , *below* , *beside* , *in front of* , *behind* , and *next to* . | K.G.A.1 Describe objects in the environment using names of shapes, and describe the relative positions of these objects using terms such as above, below, beside, in front of, behind, and next to. | . |
| K.G.2. Correctly name shapes regardless of their orientations or overall size. | K.G.A.2 Correctly name shapes regardless of their orientation or overall size. | . |
| K.G.3. Identify shapes as two-dimensional (lying in a plane, "flat") or three- dimensional ("solid"). | K.G.A.3 Identify shapes as two-dimensional (lying in a plane, flat) or three-dimensional (solid). | . |
| **Analyze, compare, create, and compose shapes.** | **K.G.B Analyze, compare, create, and compose shapes.** | . |
| K.G.4. Analyze and compare two- and three-dimensional shapes, in different sizes and orientations, using informal language to describe their similarities, differences, parts (e.g., number of sides and vertices/"corners") and other attributes (e.g., having sides of equal length). | K.G.B.4 Analyze and compare two-dimensional and three-dimensional shapes, in different sizes and orientations, using informal language to describe their similarities and differences. | AZ removed the CCSS example and also leaves out the examples of the parts and attributes of the figures. |
| K.G.5. Model shapes in the world by building shapes from components (e.g., sticks and clay balls) and drawing shapes. | K.G.B.5 Model shapes in the world by building and drawing shapes. | AZ removed the CCSS example. |

| CCSS | AZ | Notes and Comments |
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| K.G.6. Compose simple shapes to form larger shapes. *For example, "Can you join these two triangles with full sides touching to make a rectangle?"* | K.G.B.6 Compose simple shapes to form larger shapes. | AZ removed the CCSS example. |
| **GRADE 1** | | . |
| **Operations and Algebraic Thinking** | **Operations and Algebraic Thinking (OA)** | . |
| **Represent and solve problems involving addition and subtraction.** | **1.OA.A Represent and solve problems involving addition and subtraction.** | . |
| 1.OA.1. Use addition and subtraction within 20 to solve word problems involving situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all positions, e.g., by using objects, drawings, and equations with a symbol for the unknown number to represent the problem*. [*See Glossary, Table 1.] | 1.OA.A.1 Use addition and subtraction through 20 to solve word problems involving multiple problem types (see Table 1) using a variety of strategies. | The CCSS specificity is lost in the "multiple problem types" and "variety of strategies." However these are clarified in the AZ Table 1. NOTE: Table 1 in AZ is part of the Introduction, which is a separate document from the grade level standards.<br>AZ replaces "within" with "through" to imply a closed interval. However this slight change in wording causes confusion as to the performance expectation. Does "Use addition and subtraction through 20" include, for example, 17 + 19? |
| 1.OA.2. Solve word problems that call for addition of three whole numbers whose sum is less than or equal to 20, e.g., by using objects, drawings, and equations with a symbol for the unknown number to represent the problem. | 1.OA.A.2 Solve word problems that call for addition of three whole numbers whose sum is less than or equal to 20 using objects, drawings, and equations with a symbol for the unknown number to represent the problem. (See Table 1) | AZ removed the example that is included in the CCSS, making the methods listed appear to be the only requirements and that they must be used the same time. |
| **Understand and apply properties of operations and the relationship between addition and subtraction.** | **1.OA.B Understand and apply properties of operations and the relationship between addition and subtraction.** | . |

| CCSS | AZ | Notes and Comments |
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| 1.OA.3. Apply properties of operations as strategies to add and subtract. *Examples: If 8 + 3 = 11 is known, then 3 + 8 = 11 is also known. (Commutative property of addition.) To add 2 + 6 + 4, the second two numbers can be added to make a ten, so 2 + 6 + 4 = 2 + 10 = 12. (Associative property of addition.)* [Students need not use formal terms for these properties.] | 1.OA.B.3 Apply properties of operations (commutative and associative properties of addition) as strategies to add and subtract through 20. (Students need not use formal terms for these properties.) | AZ removed the examples for the commutative and associative properties. |
| 1.OA.4. Understand subtraction as an unknown-addend problem. *For example, subtract 10 – 8 by finding the number that makes 10 when added to 8.* | 1.OA.B.4 Understand subtraction through 20 as an unknown-addend problem. (See Table 1) | AZ removed the CCSS example. |
| **Add and subtract within 20.** | **1.OA.C Add and subtract through 10.** | AZ appears in this cluster header to be lowering the bar for Gr 1 operations. However, the requirement to add and subtract through 20 actually match that of the CCSS. [AZ replaces "within" with "through" to imply a closed interval.] |
| 1.OA.5. Relate counting to addition and subtraction (e.g., by counting on 2 to add 2). | | This conceptual understanding standard in the CCSS is not addressed in AZ Gr 1. |
| 1.OA.6. Add and subtract within 20, demonstrating fluency for addition and subtraction within 10. Use strategies such as counting on; making ten (e.g., 8 + 6 = 8 + 2 + 4 = 10 + 4 = 14); decomposing a number leading to a ten (e.g., 13 – 4 = 13 – 3 – 1 = 10 – 1 = 9); using | 1.OA.C.5 Fluently add and subtract through 10. | AZ replaces "within" with "through" to imply a closed interval. However, this slight change in wording causes confusion as to the performance expectation. Does "Use addition and subtraction through 10" include, for example, 7 + 9? |

| CCSS | AZ | Notes and Comments |
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| the relationship between addition and subtraction (e.g., knowing that 8 + 4 = 12, one knows 12 – 8 = 4); and creating equivalent but easier or known sums (e.g., adding 6 + 7 by creating the known equivalent 6 + 6 + 1 = 12 + 1 = 13). | 1.NBT.C.7 Demonstrate understanding of addition and subtraction through 20 using a variety of place value strategies, properties of operations, and the relationship between addition and subtraction. | This conceptual understanding standard in CCSS 1.OA.6 is partially addressed in NBT in AZ Gr 1. Most examples are removed in AZ.<br><br>The differences in coding for these two standards will make it difficult for AZ teachers to make national searches for materials aligned to CCSS 1.OA.5 or 1.OA.6 or to 1.NBT.7, which does not exist in the CCSS. |
| **Work with addition and subtraction equations.** | **1.OA.D Work with addition and subtraction equations.** | . |
| 1.OA.7. Understand the meaning of the equal sign, and determine if equations involving addition and subtraction are true or false. *For example, which of the following equations are true and which are false? 6 = 6, 7 = 8 – 1, 5 + 2 = 2 + 5, 4 + 1 = 5 + 2.* | 1.OA.D.6 Understand the meaning of the equal sign, regardless of its placement within an equation, and determine if equations involving addition and subtraction are true or false. | AZ removed the example and added a non-limitation on placement of the equal sign in an equation. (It is not clear what that non-limitation means exactly.) |
| 1.OA.8. Determine the unknown whole number in an addition or subtraction equation relating three whole numbers. *For example, determine the unknown number that makes the equation true in each of the equations 8 + ? = 11, 5 = □– 3, 6 + 6 = □.* | 1.OA.D.7 Determine the unknown whole number in any position in an addition or subtraction equation relating three whole numbers. | AZ removed the CCSS example. |
| **Numbers and Operations in Base 10** | **Number and Operations in Base Ten (NBT)** | . |
| **Extend the counting sequence.** | **1.NBT.A Extend the counting sequence.** | . |
| 1.NBT 1. Count to 120, starting at any number less than 120. In this range, read and write numerals and represent a number of objects with a written numeral. | 1.NBT.A.1 Count to 120, starting at any number less than 120. In this range, read and write numerals and represent a number of objects with a written numeral. | . |
| **Understand place value.** | **1.NBT.B Understand place value.** | . |

| CCSS | AZ | Notes and Comments |
|---|---|---|
| 1.NBT 2. Understand that the two digits of a two-digit number represent amounts of tens and ones. Understand the following as special cases:<br>a. 10 can be thought of as a bundle of ten ones — called a "ten."<br>b. The numbers from 11 to 19 are composed of a ten and one, two, three, four, five, six, seven, eight, or nine ones.<br>c. The numbers 10, 20, 30, 40, 50, 60, 70, 80, 90 refer to one, two, three, four, five, six, seven, eight, or nine tens (and 0 ones). | 1.NBT.B.2 Understand that the two digits of a two-digit number represent groups of tens and some ones. Understand the following as special cases: a. 10 can be thought of as a group of ten ones — called a "ten." b. The numbers from 11 to 19 are composed of a ten and one, two, three, four, five, six, seven, eight, or nine ones. c. The numbers 10, 20, 30, 40, 50, 60, 70, 80, 90 refer to one, two, three, four, five, six, seven, eight, or nine tens (and 0 ones). | . |
| 1.NBT.3. Compare two two-digit numbers based on meanings of the tens and ones digits, recording the results of comparisons with the symbols >, =, and <. | 1.NBT.B.3 Compare two two-digit numbers based on meanings of the tens and ones digits, recording the results of comparisons with the symbols >, =, and <. | . |
| **Use place value understanding and properties of operations to add and subtract.** | **1.NBT.C Use place value understanding and properties of operations to add and subtract.** | . |

| CCSS | AZ | Notes and Comments |
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| 1.NBT.4. Add within 100, including adding a two-digit number and a one-digit number, and adding a two-digit number and a multiple of 10, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning used. Understand that in adding two-digit numbers, one adds tens and tens, ones and ones; and sometimes it is necessary to compose a ten. | 1.NBT.C.4 Add through 100 using models and/or strategies based on place value, properties of operations, and the relationship between addition and subtraction. | Much of the detail in the CCSS was removed in AZ:<br>- AZ replaced "within" with "through" to imply a closed interval. It is not clear whether "add through 100" means that the sum cannot be more than 100 or that any two 2-digit number is fair game. Would the sum, 78 + 54 be included in the AZ translation? If so, the requirements are different from the CCSS counterpart.<br>- The descriptions of the types of addition that are required (e.g. 2-digit and 1-digit) are removed in AZ.<br><br>Also:<br>- By deleting the adjective "concrete," we lose the distinction between the two uses of the term "model" that is important for teachers to understand. Also deleted is "drawings" as an example.<br>- The description of how students are to relate the strategies to the written method is removed, lowering the rigor from that of the CCSS.<br>- The conceptual understanding of composing a ten is missing in AZ. |
| 1.NBT.5. Given a two-digit number, mentally find 10 more or 10 less than the number, without having to count; explain the reasoning used. | 1.NBT.C.5 Given a two-digit number, mentally find 10 more or 10 less than the number, without having to count; explain the reasoning used. | . |

| CCSS | AZ | Notes and Comments |
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| 1.NBT.6. Subtract multiples of 10 in the range 10-90 from multiples of 10 in the range 10-90 (positive or zero differences), using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning used. | 1.NBT.C.6 Add and subtract multiples of 10 through 100 using models and/or strategies based on place value, properties of operations, and the relationship between addition and subtraction. | AZ adds addition to the operations required here and by changing 10-90 to "through 100," they add the 3-digit number to the Gr 1 requirement.<br>Much of the detail included in the CCSS is missing:<br>- The limitation for "positive or zero differences" is missing.<br>- By deleting the adjective "concrete," we lose the distinction between the two uses of the term "model" that is so important for teachers to understand. Also deleted is "drawings" as an example.<br>- The description of how students are to relate the strategies to the written method is removed. |
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| **Measurement and Data** | **Measurement and Data (MD)** | . |
| **Measure lengths indirectly and by iterating length units.** | **1.MD.A Measure lengths indirectly and by iterating length units.** | . |
| 1.MD.1. Order three objects by length; compare the lengths of two objects indirectly by using a third object. | 1.MD.A.1 Order three objects by length. Compare the lengths of two objects indirectly by using a third object. | . |

| CCSS | AZ | Notes and Comments |
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| 1.MD.2. Express the length of an object as a whole number of length units, by laying multiple copies of a shorter object (the length unit) end to end; understand that the length measurement of an object is the number of same-size length units that span it with no gaps or overlaps. Limit to contexts where the object being measured is spanned by a whole number of length units with no gaps or overlaps. | 1.MD.A.2 Express the length of an object as a whole number of length units by laying multiple copies of a shorter object (the length unit) end to end; understand that the length measurement of an object is the number of same-size length units that span it with no gaps or overlaps. | AZ did not include the limitation. |
| **Tell and write time.** | **1.MD.B Work with time and money.** | . |
| 1.MD.3. Tell and write time in hours and half-hours using analog and digital clocks. | 1.MD.B.3 Tell and write time in hours and half-hours using analog and digital clocks. | . |
| | 1.MD.B.4 Identify coins by name and value (pennies, nickels, dimes and quarters). | AZ added requirements to identify coins. Note: Inserting this standard caused a difference in coding when comparing the AZ standard to the CCSS. Changing the coding here may cause confusion for teachers who do national searches for materials aligned to 1.MD.4 in the CCSS. |
| **Represent and interpret data.** | **1.MD.C Represent and interpret data.** | . |
| 1.MD.4. Organize, represent, and interpret data with up to three categories; ask and answer questions about the total number of data points, how many in each category, and how many more or less are in one category than in another. | 1.MD.C.5 Organize, represent, and interpret data with up to three categories; ask and answer questions about the total number of data points, how many in each category, and how many more or less are in one category than in another. | There is a coding difference here, which may cause confusion for teachers who do national searches for 1.MD.5 in the CCSS. |
| **Geometry** | | |
| **Reason with shapes and their attributes.** | **1.G.A Reason with shapes and their attributes.** | . |

| CCSS | AZ | Notes and Comments |
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| 1.G.1. Distinguish between defining attributes (e.g., triangles are closed and three-sided) versus non-defining attributes (e.g., color, orientation, overall size); build and draw shapes to possess defining attributes. | 1.G.A.1 Distinguish between defining attributes (open, closed, number of sides, vertices) versus non-defining attributes (color, orientation, size) for two-dimensional shapes; build and draw shapes to possess defining attributes. | AZ removed the reference to examples in the CCSS, making it appear that only those attributes are required. |
| 1.G.2. Compose two-dimensional shapes (rectangles, squares, trapezoids, triangles, half-circles, and quarter-circles) or three-dimensional shapes (cubes, right rectangular prisms, right circular cones, and right circular cylinders) to create a composite shape, and compose new shapes from the composite shape. [Students do not need to learn formal names such as "right rectangular prism."] | 1.G.A.2 Compose two-dimensional shapes or three-dimensional shapes to create a composite shape and compose new shapes from the composite shape. | The details in the CCSS about the types of 2- and 3-D shape and vocabulary requirements are removed in AZ. |
| 1.G.3. Partition circles and rectangles into two and four equal shares, describe the shares using the words *halves* , *fourths* , and *quarters* , and use the phrases *half of* , *fourth of* , and *quarter of* . Describe the whole as two of, or four of the shares. Understand for these examples that decomposing into more equal shares creates smaller shares. | 1.G.A.3 Partition circles and rectangles into two and four equal shares, describe the shares using the words halves and fourths. Understand that decomposing into more equal shares creates smaller shares. | Additional vocabulary and description requirements are specified in the CCSS. |
| **GRADE 2** | | . |
| **Operations and Algebraic Thinking** | **Operations & Algebraic Thinking (OA)** | . |
| **Represent and solve problems involving addition and subtraction.** | **2.OA.A Represent and solve problems involving addition and subtraction.** | |

| CCSS | AZ | Notes and Comments |
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| 2.OA.1. Use addition and subtraction within 100 to solve one- and two-step word problems involving situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all positions, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem*. [*See Glossary, Table 1.] | 2.OA.A.1 Use addition and subtraction through 100 to solve one-step word problems. (See Table 1) Use addition and subtraction through 20 to solve two-step word problems. Represent a word problem as an equation with a symbol for the unknown. | AZ limits two-step problems to within 20 and removed the examples of the types of addition and subtraction problems. They limit the strategies to just using an equation.<br>AZ replaces "within" with "through" to imply a closed interval. However, this slight change in wording causes confusion as to the performance expectation. Does "Use addition and subtraction through 100" include, for example, 57 + 79? |
| **Add and subtract within 20.** | **2.OA.B Add and subtract through 20.** | AZ replaced "within" with "through" to imply a closed interval, possibly causing specificity issues. |
| 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. [See standard 1.OA.6 for a list of mental strategies.] | 2.OA.B.2 Fluently add and subtract through 20. By the end of Grade 2, know from memory all sums of two one-digit numbers. | AZ removed "mental strategies" as the method of operating fluently. Since the examples for 1.OA.6 were removed in AZ, this CCSS reference has no basis. |
| **Work with equal groups of objects to gain foundations for multiplication.** | **2.OA.C Work with equal groups of objects to gain foundations for multiplication.** | . |
| 2.OA.3. Determine whether a group of objects (up to 20) has an odd or even number of members, e.g., by pairing objects or counting them by 2s; write an equation to express an even number as a sum of two equal addends. | 2.OA.C.3 Determine whether a group of objects (up to 20) has an odd or even number of members. Write an equation to express an even number as a sum of two equal addends. | AZ removed the CCSS example. |

| CCSS | AZ | Notes and Comments |
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| 2.OA.4. Use addition to find the total number of objects arranged in rectangular arrays with up to 5 rows and up to 5 columns; write an equation to express the total as a sum of equal addends. | 2.OA.C.4 Use addition to find the total number of objects arranged in rectangular arrays. Write an equation to express the total as a sum of equal addends. | The CCSS limitation of the size of the arrays was removed in the AZ.<br><br>Note: In the AZ technical review, it states that "parenthesis [sic] were added to define the limit of rectangular arrays used in 2nd grade." Those parentheses are missing. |
| **Numbers and Operations in Base Ten** | | . |
| **Understand place value.** | **2.NBT.A Understand place value.** | . |
| 2.NBT.1. Understand that the three digits of a three-digit number represent amounts of hundreds, tens, and ones; e.g., 706 equals 7 hundreds, 0 tens, and 6 ones. Understand the following as special cases:<br>a. 100 can be thought of as a bundle of ten tens — called a “hundred.”<br>b. The numbers 100, 200, 300, 400, 500, 600, 700, 800, 900 refer to one, two, three, four, five, six, seven, eight, or nine hundreds (and 0 tens and 0 ones). | 2.NBT.A.1 Understand that the three digits of a three-digit number represent amounts of hundreds, tens, and ones. Understand the following as special cases: a. 100 can be thought of as a group of ten tens—called a “hundred.” b. The numbers 100, 200, 300, 400, 500, 600, 700, 800, 900 refer to one, two, three, four, five, six, seven, eight, or nine hundreds (and 0 tens and 0 ones). | AZ removed the CCSS example. |

| CCSS | AZ | Notes and Comments |
|---|---|---|
| 2.NBT.2. Count within 1000; skip-count by 5s, 10s, and 100s. | 2.NBT.A.2 Count to 1000 by 1's, 5's, 10's, and 100's from different starting points. | AZ changed "within 1000" to "to 1000." The latter would mean that the requirement is to always count up to 1000 from different starting places but not necessarily to different end places. The CCSS expects counting to different numbers that fall within 1000. AZ also added the requirement to start at different points. Do "points" mean "numbers?" This should be clarified.<br>Note: The AZ technical review mentions that "parenthesis [sic] were added to clarify that students should skip count starting at different numbers." However none are here. |
| 2.NBT.3. Read and write numbers to 1000 using base-ten numerals, number names, and expanded form. | 2.NBT.A.3 Read and write numbers to 1000 using base-ten numerals, number names, and expanded form. | . |
| 2.NBT.4. Compare two three-digit numbers based on meanings of the hundreds, tens, and ones digits, using >, =, and < symbols to record the results of comparisons. | 2.NBT.A.4 Compare two three-digit numbers based on meanings of the hundreds, tens, and ones digits, using >, =, and < symbols to record the results of comparisons. | . |
| **Use place value understanding and properties of operations to add and subtract.** | **2.NBT.B Use place value understanding and properties of operations to add and subtract.** | . |
| 2.NBT.5. Fluently add and subtract within 100 using strategies based on place value, properties of operations, and/or the relationship between addition and subtraction. | 2.NBT.B.5 Demonstrate understanding of addition and subtraction through 100 using a variety of strategies based on place value, properties of operations, and/or the relationship between addition and subtraction. | The requirement for fluency is removed in this AZ standard (and moved to Grade 3). AZ replaced "within" with "through" to imply a closed interval, possibly causing specificity issues. |
| 2.NBT.6. Add up to four two-digit numbers using strategies based on place value and properties of operations. | 2.NBT.B.6 Add up to four two-digit numbers using strategies based on place value and properties of operations. | . |

| CCSS | AZ | Notes and Comments |
|---|---|---|
| 2.NBT.7. Add and subtract within 1000, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method. Understand that in adding or subtracting three- digit numbers, one adds or subtracts hundreds and hundreds, tens and tens, ones and ones; and sometimes it is necessary to compose or decompose tens or hundreds. | 2.NBT.B.7 Demonstrate understanding of addition and subtraction through 1000, connecting concrete models or drawings to strategies based on place value, properties of operations, and/or the relationship between addition and subtraction. Relate the strategy to a written form. | AZ put the emphasis only on demonstration of conceptual understanding of the two operations, while the CCSS primarily expects students to understand and also to perform the operations using the described strategies. The example of "understanding" offered in the CCSS emphasizes and defines operations based on place value. AZ removed the reference to composition or decomposition of 10s or 100s. AZ replaced "within" with "through" to imply a closed interval, possibly causing specificity issues. |
| 2.NBT.8. Mentally add 10 or 100 to a given number 100–900, and mentally subtract 10 or 100 from a given number 100–900. | 2.NBT.B.8 Mentally add 10 or 100 to a given number 100–900, and mentally subtract 10 or 100 from a given number 100–900. | In the AZ technical review there is a note about adding "different starting points," based on public comments. This did not make it into the AZ standard.<br>Note: In the AZ technical review, there is a mention of using different starting points. This clarification does not appear in this draft. |
| 2.NBT.9. Explain why addition and subtraction strategies work, using place value and the properties of operations. [Explanations may be supported by drawings or objects.] | 2.NBT.B.9 Explain why addition and subtraction strategies work, using place value and the properties of operations. (Explanations may be supported by drawings or objects.) | . |
| **Measurement and Data** | **Measurement and Data (MD)** | . |
| **Measure and estimate lengths in standard units.** | **2.MD.A Measure and estimate lengths in standard units.** | . |

| CCSS | AZ | Notes and Comments |
|---|---|---|
| 2.MD.1. Measure the length of an object by selecting and using appropriate tools such as rulers, yardsticks, meter sticks, and measuring tapes. | 2.MD.A.1 Measure the length of an object by selecting and using appropriate tools. | AZ removed the CCSS examples. |
| 2.MD.2. Measure the length of an object twice, using length units of different lengths for the two measurements; describe how the two measurements relate to the size of the unit chosen. | 2.MD.A.2 Understand that the length of an object does not change regardless of the units used. Measure the length of an object twice, using different standard length units for the two measurements; describe how the two measurements relate to the size of the unit chosen. | The AZ requirement to "understand" in the first part of their standard is a partial description that is required in the last part of the CCSS. |
| 2.MD.3. Estimate lengths using units of inches, feet, centimeters, and meters. | 2.MD.A.3 Estimate lengths using units of inches, feet, centimeters, and meters. | . |
| 2.MD.4. Measure to determine how much longer one object is than another, expressing the length difference in terms of a standard length unit. | 2.MD.A.4 Measure to determine how much longer one object is than another, expressing the length difference in terms of a standard length unit | . |
| **Relate addition and subtraction to length.** | **2.MD.B Relate addition and subtraction to length.** | . |
| 2.MD.5. Use addition and subtraction within 100 to solve word problems involving lengths that are given in the same units, e.g., by using drawings (such as drawings of rulers) and equations with a symbol for the unknown number to represent the problem. | 2.MD.B.5 Use addition and subtraction through 100 to solve word problems involving lengths that are given in the same units, by using drawings and equations with a symbol for the unknown number to represent the problem. | AZ replaced "within" with "through" to imply a closed interval, possibly causing specificity issues.<br>Removing the "e.g." may lead to the implication that only drawings and equations are required. |
| 2.MD.6. Represent whole numbers as lengths from 0 on a number line diagram with equally spaced points corresponding to the numbers 0, 1, 2, ..., and represent whole-number sums and differences within 100 on a number line diagram. | 2.MD.B.6 Represent whole numbers as lengths from 0 on a number line diagram with equally spaced points corresponding to the numbers 0, 1, 2, ..., and represent whole-number sums and differences through 100 on a number line diagram. | AZ replaced "within" with "through" to imply a closed interval, possibly causing specificity issues. |

| CCSS | AZ | Notes and Comments |
|---|---|---|
| **Work with time and money.** | **2.MD.C Work with time and money.** | . |
| 2.MD.7. Tell and write time from analog and digital clocks to the nearest five minutes, using a.m. and p.m. | 2.MD.C.7 Tell and write time from analog and digital clocks to the nearest five minutes, using a.m. and p.m. | . |
| 2.MD.8. Solve word problems involving dollar bills, quarters, dimes, nickels, and pennies, using $ and ¢ symbols appropriately. *Example: If you have 2 dimes and 3 pennies, how many cents do you have?* | 2.MD.C.8 Find the value of a collection of coins and dollars. Record the total using $ and ¢ appropriately. | The CCSS requires word problems here, while AZ moved this requirement to Grade 3. This is arguably a lower expectation at this grade level in AZ. Also the CCSS specifies which bills and coins are required. AZ removed the CCSS example. |
| **Represent and interpret data.** | **2.MD.D Represent and interpret data.** | . |
| 2.MD.9. Generate measurement data by measuring lengths of several objects to the nearest whole unit, or by making repeated measurements of the same object. Show the measurements by making a line plot, where the horizontal scale is marked off in whole-number units. | 2.MD.D.9 Generate measurement data by measuring lengths of several objects to the nearest whole unit, or by making repeated measurements of the same object. Show the measurements by making a line plot, where the horizontal scale is marked off in whole-number units. | . |
| 2.MD.10. Draw a picture graph and a bar graph (with single-unit scale) to represent a data set with up to four categories. Solve simple put-together, take-apart, and compare problems* using information presented in a bar graph. [*See Glossary, Table 1.] | 2.MD.D.10 Draw a picture graph and a bar graph (with single-unit scale) to represent a data set with up to four categories. Solve simple put-together, take-apart, and compare problems using information presented in the graph. (See Table 1.) | AZ removed the reference to a "bar graph" in the last sentence, making both picture and bar graphs part of the problem solving requirement. |
| **Geometry** | | . |
| **Reason with shapes and their attributes.** | **2.G.A Reason with shapes and their attributes.** | |

| CCSS | AZ | Notes and Comments |
|---|---|---|
| 2.G.1. Recognize and draw shapes having specified attributes, such as a given number of angles or a given number of equal faces. Identify triangles, quadrilaterals, pentagons, hexagons, and cubes. [Sizes are compared directly or visually, not compared by measuring.] | 2.G.A.1 Identify and describe specified attributes of two-dimensional and three-dimensional shapes, according to the number and shape of faces, number of angles, and the number of sides and/or vertices. Draw two- dimensional shapes. | AZ replaced "recognize" with "identify and describe." Identification is required in the CCSS for specific shapes, which are not specified in AZ. (Teachers may need help with the limitations at this grade level.) In removing the specific shapes listed in the CCSS, AZ opens the door to any and all 2- and 3-dimensional shapes. Drawing in AZ is restricted to 2-dimensional shapes. The CCSS suggestion and limitation for comparing size is removed in AZ. |
| 2.G.2. Partition a rectangle into rows and columns of same-size squares and count to find the total number of them. | 2.G.A.2 Partition a rectangle into rows and columns of same-size squares and count to find the total number of squares. | |
| 2.G.3. Partition circles and rectangles into two, three, or four equal shares, describe the shares using the words *halves* , *thirds* , *half of* , *a third of* , etc., and describe the whole as two halves, three thirds, four fourths. Recognize that equal shares of identical wholes need not have the same shape. | 2.G.A.3 Partition circles and rectangles into two, three, or four equal shares, describe the shares using the words halves, thirds, half of, third of, etc., and describe the whole as two halves, three thirds, four fourths. Recognize that equal shares of identical wholes need not have the same shape. | . |
| **GRADE 3** | . | . |
| **Operations and Algebraic Thinking** | **Operations & Algebraic Thinking (OA)**<br>**Note: Grade 3 expectations in this domain are limited to multiplication through 10 x 10 and division with both quotients and divisors less than or equal to 10.** | AZ added this limitation for Gr 3. |
| **Represent and solve problems involving multiplication and division.** | **3.OA.A Represent and solve problems involving multiplication and division.** | . |

| CCSS | AZ | Notes and Comments |
|---|---|---|
| 3.OA.1. Interpret products of whole numbers, e.g., interpret 5 x 7 as the total number of objects in 5 groups of 7 objects each. *For example, describe a context in which a total number of objects can be expressed as 5 × 7.* | 3.OA.A.1 Interpret products of whole numbers as the total number of objects in equal groups. Describe a context in which multiplication can be used to find a total number of objects. (See Table 2) | AZ used the CCSS example as part of the requirement. |
| 3.OA.2. Interpret whole-number quotients of whole numbers, e.g., interpret 56 ÷ 8 as the number of objects in each share when 56 objects are partitioned equally into 8 shares, or as a number of shares when 56 objects are partitioned into equal shares of 8 objects each. *For example, describe a context in which a number of shares or a number of groups can be expressed as 56 ÷ 8.* | 3.OA.A.2 Interpret quotients of whole numbers by:<br>•determining the number of objects in each share when a total number of objects are partitioned into a given number of equal shares.<br>•determining the number of shares when the total number of objects and the size of each share is given.<br>Describe a context in which division can be used to find the numbers of objects in each share or the number of shares. (See Table 2) | AZ does not specify that the quotients are also whole numbers. CCSS examples are included as part of the AZ requirement. In rewriting the standard, AZ did not make it clear whether the final sentence is intended to be a bullet, is part of the stem statement for the standard, or is meant to be an example. Clarity is needed. |
| 3.OA.3. Use multiplication and division within 100 to solve word problems in situations involving equal groups, arrays, and measurement quantities, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem*. [See Glossary, Table2.] | 3.OA.A.3 Use multiplication and division to solve word problems in situations involving equal groups, arrays, and measurement quantities. (See Table 2) | AZ removed the limitation and the CCSS example, possibly leaving the specificity for this standard open to interpretation. However, since the domain explanation includes a limitation of multiplication and division through 10x10, this limitation is a match. |
| 3.OA.4. Determine the unknown whole number in a multiplication or division equation relating three whole numbers. *For example, determine the unknown number that makes the equation true in each of the equations 8 × ? = 48, 5 = ? ÷ 3, 6 × 6 = ?.* | 3.OA.A.4 Determine the unknown whole number in a multiplication or division equation using properties of operations and/or the relationship between multiplication and division. | It is not clear in the AZ version that the equations relate three whole numbers. AZ removed the example, which might have accomplished that. They add the requirement to use the properties (already required in 3.OA.B.5) and relationship between multiplication and division. |

| CCSS | AZ | Notes and Comments |
|---|---|---|
| **Understand properties of multiplication and the relationship between multiplication and division.** | **3.OA.B Understand properties of multiplication and the relationship between multiplication and division.** | . |
| 3.OA.5. Apply properties of operations as strategies to multiply and divide.* Examples: If 6 × 4 = 24 is known, then 4 × 6 = 24 is also known. (Commutative property of multiplication.) 3 × 5 × 2 can be found by 3 × 5 = 15, then 15 × 2 = 30, or by 5 × 2 = 10, then 3 × 10 = 30. (Associative property of multiplication.) Knowing that 8 × 5 = 40 and 8 × 2 = 16, one can find 8 × 7 as 8 × (5 + 2) = (8 × 5) + (8 × 2) = 40 + 16 = 56. (Distributive property.) [Students need not use formal terms for these properties.] | 3.OA.B.5 Apply properties of operations as strategies to multiply and divide. This includes use of known facts to solve unknown facts through the application of the commutative, associative, and distributive properties of multiplication. (Students do not need to use the formal terms for these properties.) | AZ removed the CCSS examples. It is not clear what "use of known facts to solve unknown facts" means. There may be a word missing. |
| 3.OA.6. Understand division as an unknown-factor problem. *For example, find 32 ÷ 8 by finding the number that makes 32 when multiplied by 8.* | 3.OA.B.6 Understand division as an unknown-factor problem. Represent division as a multiplication problem with a missing factor. | The second part of this AZ standard repeats the first. AZ removed the CCSS example. The new sentence seems to repeat the first. However, it is not completely clear what is meant by, "Represent division as a multiplication problem with a missing factor." |
| **Multiply and divide within 100.** | **3.OA.C Multiply and divide through 100.** | . |
| 3.OA.7. Fluently multiply and divide within 100, using strategies such as the relationship between multiplication and division (e.g., knowing that 8 x 5 = 40, one knows 40 ÷ 5 = 8) or properties of operations. By the end of Grade 3, know from memory all products of two one-digit numbers. | 3.OA.C.7 Demonstrate understanding of multiplication and division through 100 (limited through 10 x 10) using strategies such as the relationship between multiplication and division or properties of operations. | AZ split this CCSS into two standards. The CCSS examples were removed.<br><br>AZ does not specify that the products to be memorized are 1-digit but limits to 10x10 instead. This possibly adds only the product of 10x10 to the CCSS requirement. They also add |

| CCSS | AZ | Notes and Comments |
|---|---|---|
| | 3.OA.C.8 Fluently multiply and divide through 100. By the end of Grade 3, know from memory all multiplication products through 10 x 10 and division quotients when both the quotient and divisor are less than or equal to 10. | memorization of quotients related to those multiplication facts.<br>Notes: Changing the coding from that of the CCSS may cause problems for teachers who search nationally for materials aligned to the CCSS's 3.OA.8.<br>Adding "multiplication" to products is redundant and unnecessary. |
| **Solve problems involving the four operations, and identify and explain patterns in arithmetic.** | **3.OA.D Solve problems involving the four operations and identify and explain patterns in arithmetic.** | . |
| 3.OA.8 Solve two-step word problems using the four operations. 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. [This standard is limited to problems posed with whole numbers and having whole-number answers; students should know how to perform operations in the conventional order when there are no parentheses to specify a particular order (Order of Operations).] | 3.OA.D.9 Solve two-step word problems using the four operations. 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. (Limited to problems posed with whole numbers and having whole-number answers; students should know how to perform operations in the conventional order when there are no parentheses to specify a particular order-Order of Operations). | Note: The coding of the AZ standards differs from that of the CCSS. This may cause problems for teachers who search nationally for materials aligned to the CCSS's 3.OA.8 or 3.OA.9. |

| CCSS | AZ | Notes and Comments |
|---|---|---|
| 3.OA.9. Identify arithmetic patterns (including patterns in the addition table or multiplication table), and explain them using properties of operations. *For example, observe that 4 times a number is always even, and explain why 4 times a number can be decomposed into two equal addends.* | 3.OA.D.10 Identify arithmetic patterns (including patterns in the addition table or multiplication table) and explain them using properties of operations. | AZ removed the CCSS example.<br>Note: The coding of the AZ standards differs from that of the CCSS. This may cause problems for teachers who search nationally for materials aligned to 3.OA.10, since this standard does not exist in the CCSS. |
| **Numbers and Operations in Base Ten** | **Number and Operations in Base Ten (NBT)**<br>**Note: A range of algorithms may be used.** | . |
| **Use place value understanding and properties of operations to perform multi-digit arithmetic.** [A range of algorithms may be used.] | **3.NBT.A Use place value understanding and properties of operations to perform multi-digit arithmetic.** | . |
| 3.NBT.1. Use place value understanding to round whole numbers to the nearest 10 or 100. | 3.NBT.A.1 Use place value understanding to round whole numbers to the nearest 10 or 100. | . |
| 3.NBT.2. Fluently add and subtract within 1000 using strategies and algorithms based on place value, properties of operations, and/or the relationship between addition and subtraction. | 3.NBT.A.2 Demonstrate understanding of addition and subtraction through 1000 using a variety of strategies such as properties of operations and the relationship between addition and subtraction. | These two AZ standards show separation between calculations to 1000 and fluency. At this grade level, AZ only requires fluency with addition and subtraction through 100 and understanding to 1000. AZ replaced "within" with "through" to imply a closed interval, possibly causing specificity issues. |
| | 3.NBT.A.3 Fluently add and subtract through 100. | This is a requirement in Grade 2 of the CCSS (2.NBT.5).<br>Note: The coding of the AZ standards differs from that of the CCSS. This may cause problems for teachers who search nationally for materials aligned to the CCSS's 3.NBT.3. |

| CCSS | AZ | Notes and Comments |
|---|---|---|
| 3.NBT.3. Multiply one-digit whole numbers by multiples of 10 in the range 10–90 (e.g., 9 x 80, 5 x 60) using strategies based on place value and properties of operations. | 3.NBT.A.4 Multiply one-digit whole numbers by multiples of 10 in the range 10–90 using strategies based on place value and properties of operations. | Note: The coding of the AZ standards differs from that of the CCSS. This may cause problems for teachers who search nationally for materials aligned to 3.NBT.4, since this standard does not exist in the CCSS. |
| **Number and Operations – Fractions**<br>[Grade 3 expectations in this domain are limited to fractions with denominators 2, 3, 4, 6, and 8.] | **Number and Operations-Fractions (NF)**<br>**Note: Grade 3 expectations are limited to fractions with denominators: 2,3,4,6,8.** | AZ lost the footnote that restricts fractions to denominators of 2, 3, 4, 6, 8. Is there any limitation intended here? |
| **Develop understanding of fractions as numbers.** | **3.NF.A Understand fractions as numbers.** | |
| 3.NF.1. Understand a fraction *1/b* as the quantity formed by 1 part when a whole is partitioned into *b* equal parts; understand a fraction *a* /*b* as the quantity formed by *a* parts of size *1/b* . | 3.NF.A.1 Understand a unit fraction (*1/b* ) as the quantity formed by one part when a whole is partitioned into b equal parts; understand a fraction a/b as the quantity formed by a parts *1/b* . | Clarity: Removing "of size" in AZ may lead to misunderstanding the quantitative reasoning used in the CCSS counterpart (and therefore some - if not all - of the need for recognizing fractions as numbers with the denominator used to indicate the size of the part). The expression "a parts *1/b* " is not clear. |
| 3.NF.2. Understand a fraction as a number on the number line; represent fractions on a number line diagram. | 3.NF.A.2 Understand a fraction as a number on a number line; represent fractions on a number line diagram. | . |
| 3.NF.2a Represent a fraction 1/*b* on a number line diagram by defining the interval from 0 to 1 as the whole and partitioning it into *b* equal parts. Recognize that each part has size 1/*b* and that the endpoint of the part based at 0 locates the number 1/*b* on the number line. | a. Represent a unit fraction (*1/b* ) on a number line diagram by defining the interval from 0 to 1 as the whole and partitioning it from 0 into b equal parts.<br><br>b. Represent a fraction a/b on a number line | Clarity: Partitioning "from zero" does not make sense. The additional wording is unnecessary. AZ also removed the CCSS example, which might have added clarity. |

| CCSS | AZ | Notes and Comments |
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| 3.NF.2b Represent a fraction *a* /*b* on a number line diagram by marking off *a* lengths 1/*b* from 0. Recognize that the resulting interval has size *a* /*b* and that its endpoint locates the number *a* /*b* on the number line. | diagram by marking off *a* lengths of unit fractions *1/b* from 0. Understand that the resulting interval has size a/b and that its endpoint locates the number a/b on the number line including values greater than 1. | The "including values…" addition reads as if the number line should include values greater than 1. In its current form, it is grammatically awkward and mathematically unnecessary. If the intent is for *a/b* to include values greater than 1, It might be that a comma is needed after "number line." However, it would be more clear to clearly state, "including values for *a/b* that are greater than 1," or "including values where *a* > *b* ." |
| 3.NF.3. Explain equivalence of fractions in special cases, and compare fractions by reasoning about their size. | 3.NF.A.3 Explain equivalence of fractions in special cases, and compare fractions by reasoning about their size. | . |
| 3.NF.3a Understand two fractions as equivalent (equal) if they are the same size, or the same point on a number line. | a. Understand two fractions as equivalent if they represent the same size part of the whole, or the same point on a number line. | . |
| 3.NF.3b Recognize and generate simple equivalent fractions, e.g., 1/2 = 2/4, 4/6 = 2/3). Explain why the fractions are equivalent, e.g., by using a visual fraction model. | b. Understand and generate simple equivalent fractions. Explain why the fractions are equivalent. | AZ changed "recognize" to "understand," possibly increasing rigor, and removed the CCSS example. |
| 3.NF.3c Express whole numbers as fractions, and recognize fractions that are equivalent to whole numbers. *Examples: Express 3 in the form 3 = 3/1; recognize that 6/1 = 6; locate 4/4 and 1 at the same point of a number line diagram.* | c. Express whole numbers as fractions, and understand fractions that are equivalent to whole numbers.<br><br>d. Compare two fractions with the same numerator or the same denominator by | AZ changed recognition to understanding and removed the example. The apparent AZ decision to replace the verb "recognize" with "understand" in the AZ standards sometimes causes reduced clarity and sometimes increases the rigor. In this case it is less correct/clear to say, "understand fractions that are equivalent to whole numbers." Here, using "recognize" is more accurate, measurable, and clear. |

| CCSS | AZ | Notes and Comments |
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| 3.NF.3d Compare two fractions with the same numerator or the same denominator by reasoning about their size. Recognize that comparisons are valid only when the two fractions refer to the same whole. Record the results of comparisons with the symbols >, =, or <, and justify the conclusions, e.g., by using a visual fraction model. | reasoning about their size. Understand that comparisons are valid only when the two fractions refer to the same whole. Record results of comparisons with the symbols >, =, or <, and justify conclusions. | AZ changed "recognize" to "understand" (possibly making this a higher level of rigor). |
| **Measurement and Data** | **Measurement and Data (MD)** | . |
| **Solve problems involving measurement and estimation of intervals of time, liquid volumes, and masses of objects.** | **3.MD.A Solve problems involving measurement.** | AZ removed the specificity in this CCSS cluster header. |
| 3.MD.1. Tell and write time to the nearest minute and measure time intervals in minutes. Solve word problems involving addition and subtraction of time intervals in minutes, e.g., by representing the problem on a number line diagram. | 3.MD.A.1 Tell and write time to the nearest minute and solve word problems involving addition and subtraction of time intervals in minutes. | AZ removed the example and the requirement to measure time intervals in minutes outside of word problems. |

| CCSS | AZ | Notes and Comments |
|---|---|---|
| | 3.MD.A.2 Solve word problems involving money through $20.00, using symbols $, ₵, and "." as a distinction between dollars and cents. | AZ added this standard addressing problems involving money. This is addressed in Gr 2 in the CCSS but without the $20 limit and without the reference to the decimal point. Since students at this grade have not been introduced to decimal numbers, requiring the use of a decimal point in their notation is beyond the reach of students in this grade level and may present a coherence issue.<br><br>In moving this Gr 2 CCSS to AZ Gr 3, the numbering is off for this domain. That change of codes for the subsequent standards makes sharing materials more difficult. |
| 3.MD.2. Measure and estimate liquid volumes and masses of objects using standard units of grams (g), kilograms (kg), and liters (l).* Add, subtract, multiply, or divide to solve one-step word problems involving masses or volumes that are given in the same units, e.g., by using drawings (such as a beaker with a measurement scale) to represent the problem**. [* Excludes compound units such as cm^3 and finding the geometric volume of a container. **Excludes multiplicative comparison problems (problems involving notions of "times as much"; see Glossary, Table 2.] | 3.MD.A.3 Measure and estimate liquid volumes and masses of objects using metric and customary units. (Excludes compound units such as cm3 and finding the geometric volume of a container. Add, subtract, multiply, or divide to solve one-step word problems involving masses or volumes that are given in the same units. Excludes multiplicative comparison problems involving notions of “times as much” (see Table 2). | The specific units used to measure liquid volume were removed in AZ.<br>Either a closing parenthesis is missing after "container" or the parenthesis before the first "excludes" should be removed.<br>Note: The coding of the AZ standards differs from that of the CCSS. This may cause problems for teachers who search nationally for materials aligned to 3.NMD.3. |
| **Represent and interpret data.** | **3.MD.B Represent and interpret data.** | . |

| CCSS | AZ | Notes and Comments |
|---|---|---|
| 3.MD.3. Draw a scaled picture graph and a scaled bar graph to represent a data set with several categories. Solve one- and two-step "how many more" and "how many less" problems using information presented in scaled bar graphs. *For example, draw a bar graph in which each square in the bar graph might represent 5 pets.* | 3.MD.B.4 Create a scaled picture graph and a scaled bar graph to represent a data set with several categories. Solve one- and two-step problems using information presented in scaled picture and bar graphs (See table 1). | AZ removed the CCSS examples.<br>Note: The coding of the AZ standards differs from that of the CCSS. This may cause problems for teachers who search nationally for materials aligned to 3.MD.4. |
| 3.MD.4. Generate measurement data by measuring lengths using rulers marked with halves and fourths of an inch. Show the data by making a line plot, where the horizontal scale is marked off in appropriate units— whole numbers, halves, or quarters. | 3.MD.B.5 Generate measurement data by measuring lengths to the nearest quarter inch. Show the data by making a line plot, where the horizontal scale is marked off in appropriate units— whole numbers, halves, or quarters. | AZ changed the CCSS description of the ruler to a measurement precision requirement that may not be appropriate for this grade level.<br>Note: The coding of the AZ standards differs from that of the CCSS. This may cause problems for teachers who search nationally for materials aligned to 3.MD.5. |
| **Geometric measurement: understand concepts of area and relate area to multiplication and to addition.** | **3.MD.C Geometric measurement: Understand concepts of area and perimeter.** | The CCSS cluster header illustrates the connection to be made between area and operations - this has been removed in AZ. AZ adds perimeter to this header. |
| 3.MD.5 Recognize area as an attribute of plane figures and understand concepts of area measurement.<br>a. A square with side length 1 unit, called "a unit square," is said to have "one square unit" of area, and can be used to measure area.<br>b. A plane figure which can be covered without gaps or overlaps by n unit squares is said to have an area of n square units. | 3.MD.C.6 Understand area as an attribute of plane figures and understand concepts of area measurement.<br>a. A square with side length 1 unit, called "a unit square," is said to have "one square unit" of area, and can be used to measure area.<br>b. A plane figure which can be covered without gaps or overlaps by n unit squares is said to have an area of n square units. | AZ changed "recognize" to "understand," increasing the rigor but making the AZ standard less easily measured. They also removed the CCSS example.<br>Note: The coding of the AZ standards differs from that of the CCSS. This may cause problems for teachers who search nationally for materials aligned to 3.MD.6. |

| CCSS | AZ | Notes and Comments |
|---|---|---|
| 3.MD.6. Measure areas by counting unit squares (square cm, square m, square in, square ft., and improvised units). | . | This CCSS has no specific match in AZ. However, this can be seen as covered by 3.MD.7. |
| 3.MD.7. Relate area to the operations of multiplication and addition. | 3.MD.C.7 Relate area to the operations of multiplication and addition. | . |
| 3.MD.7a Find the area of a rectangle with whole-number side lengths by tiling it, and show that the area is the same as would be found by multiplying the side lengths. | a. Find the area of a rectangle with whole-number side lengths by tiling it and show that the area is the same as would be found by multiplying the side lengths. | . |
| 3.MD.7b Multiply side lengths to find areas of rectangles with whole- number side lengths in the context of solving real world and mathematical problems, and represent whole-number products as rectangular areas in mathematical reasoning. | b. Multiply side lengths to find areas of rectangles with whole-number side lengths in the context of solving real world and mathematical problems. | AZ removed the reasoning requirement to represent products as areas. |
| 3.MD.7c Use tiling to show in a concrete case that the area of a rectangle with whole-number side lengths *a* and *b* + *c* is the sum of a x b and a x c. Use area models to represent the distributive property in mathematical reasoning. | c. Use tiling to show that the area of a rectangle with whole-number side lengths a and b + c is the sum of a × b and a × c. Use area models to represent the distributive property in mathematical reasoning. | |
| 3.MD.7d Recognize area as additive. Find areas of rectilinear figures by decomposing them into non-overlapping rectangles and adding the areas of the non-overlapping parts, applying this technique to solve real world problems. | d. Understand area as additive by finding the areas of rectilinear figures. | AZ changed "recognize" to "understand," possibly increasing rigor but also making it less easily measured. The emphasis of the AZ standard is on the concept, area as additive, as opposed to finding the area. In addition by removing the example for how to find area, AZ further distances itself from the computation. |

| CCSS | AZ | Notes and Comments |
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| **Geometric measurement: recognize perimeter as an attribute of plane figures and distinguish between linear and area measures.** | 3.MD.C.8 Understand perimeter as a linear attribute of plane figures and distinguish between linear and area measures. | This CCSS cluster header was removed in AZ and the CCSS cluster title became a standard. AZ changed recognize to understand, which makes sense in this context. |
| 3.MD.8. Solve real world and mathematical problems involving perimeters of polygons, including finding the perimeter given the side lengths, finding an unknown side length, and exhibiting rectangles with the same perimeter and different areas or with the same area and different perimeters. | 3.MD.C.9 Solve problems utilizing real-world contexts involving perimeters of polygons. (See Table 1-unknown in various positions) | AZ removed the CCSS examples of problem types. Pointing to the table is less clear in AZ than in the CCSS.<br>Note: The coding of the AZ standards differs from that of the CCSS. This may cause problems for teachers who search nationally for materials aligned to 3.MD.9, which does not exist in the CCSS. |
| **Geometry** | **Geometry (G)** | . |
| **Reason with shapes and their attributes.** | **3.G.A Reason with shapes and their attributes.** | . |
| 3.G.1. Understand that shapes in different categories (e.g., rhombuses, rectangles, and others) may share attributes (e.g., having four sides), and that the shared attributes can define a larger category (e.g., quadrilaterals). Recognize rhombuses, rectangles, and squares as examples of quadrilaterals, and draw examples of quadrilaterals that do not belong to any of these subcategories. | 3.G.A.1 Understand that shapes in different categories may share attributes and those shared attributes can define a larger category. Draw examples of shapes that do not belong to any of these subcategories. | AZ removed the specificity in this CCSS, regarding the types of shapes that are required and the attributes they share. Recognition of the shapes and drawing examples of, specifically, quadrilaterals is not required in this AZ standard. |
| 3.G.2. Partition shapes into parts with equal areas. Express the area of each part as a unit fraction of the whole. *For example, partition a shape into 4 parts with equal area, and describe the area of each part as 1/4 of the area of the shape.* | 3.G.A.2 Partition shapes into parts with equal areas. Express the area of each part as a unit fraction (1/b) of the whole. (Grade 3 expectations are limited to fractions with denominators: 2,3,4,6,8.) | AZ removed the CCSS example. |

| CCSS | AZ | Notes and Comments |
|---|---|---|
| **GRADE 4** | . | . |
| **Operations and Algebraic Thinking** | **Operations & Algebraic Thinking (OA)** | . |
| **Use the four operations with whole numbers to solve problems.** | **4.OA.A Use the four operations with whole numbers to solve problems.** | . |
| 4.OA.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.1 Interpret a multiplication equation as a comparison. Represent verbal statements of multiplicative comparisons as multiplication equations. (35 = 5 x 7 as a statement that 35 is 5 times as many as 7 and 7 times as many as 5.) | The slight rewording does not change the meaning or intent of the CCSS or reduce the rigor in the AZ standard. |
| 4.OA.2. Multiply or divide to solve word problems involving multiplicative comparison, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem, distinguishing multiplicative comparison from additive comparison. [See Glossary, Table 2.] | 4.OA.A.2 Multiply or divide to solve word problems involving multiplicative comparison, distinguishing multiplicative comparison from additive comparison by using models and equations with a symbol for the unknown number to represent the problem. (See Table 2.) | AZ moved this CCSS example so that it appears to be exemplifying distinguishing between multiplicative and additive comparisons rather than how the problems are solved. AZ also implies that every word problem should include distinguishing multiplicative from additive comparison. |
| 4.OA.3. Solve multistep word 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. | 4.OA.A.3 Solve multistep word 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. | . |
| **Gain familiarity with factors and multiples.** | **4.OA.B Gain familiarity with factors and multiples.** | |

| CCSS | AZ | Notes and Comments |
|---|---|---|
| 4.OA.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. | 4.OA.B.4 Find all factor pairs for a whole number in the range 1–100. Understand 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. | The AZ technical review states that there are no changes in this standard. However AZ changed "recognize" to "understand," increasing the rigor but making the AZ standard less easily measured. |
| **Generate and analyze patterns.** | **4.OA.C Generate and analyze patterns.** | . |
| 4.OA.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.* | 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. | . |
| **Numbers and Operations in Base Ten** [Grade 4 expectations in this domain are limited to whole numbers less than or equal to 1,000,000.] | **Number and Operations in Base Ten (NBT) Note: Grade 4 expectations in this domain are limited to whole numbers less than or equal to 1,000,000.** | . |
| **Generalize place value understanding for multi-digit whole numbers.** | **4.NBT.A Generalize place value understanding for multi-digit whole numbers.** | . |

| CCSS | AZ | Notes and Comments |
|---|---|---|
| 4.NBT.1. Recognize that in a multi-digit whole number, a digit in one place represents ten times what it represents in the place to its right. *For example, recognize that 700 ÷ 70 = 10 by applying concepts of place value and division.* | 4.NBT.A.1 Apply concepts of place value, multiplication, and division to understand that in a multi-digit whole number, a digit in one place represents ten times what it represents in the place to its right. | AZ changed "recognize" to "understand," increasing the rigor but making the AZ standard less easily measured.<br><br>How a student would "apply concepts" in order "to understand" is unclear, as is how a teacher would measure the understanding of place value through application of place value and operations. |
| 4.NBT.2. Read and write multi-digit whole numbers using base-ten numerals, number names, and expanded form. Compare two multi-digit numbers based on meanings of the digits in each place, using >, =, and < symbols to record the results of comparisons. | 4.NBT.A.2 Read and write multi-digit whole numbers using base-ten numerals, number names, and expanded form. Compare two multi-digit numbers based on meanings of the digits in each place, using >, =, and < symbols to record the results of comparisons. | . |
| 4.NBT.3. Use place value understanding to round multi-digit whole numbers to any place. | 4.NBT.A.3 Use place value understanding to round multi-digit whole numbers to any place. | . |
| **Use place value understanding and properties of operations to perform multi-digit arithmetic.** | **4.NBT.B Use place value understanding and properties of operations to perform multi-digit arithmetic.** | . |
| 4.NBT.4. Fluently add and subtract multi-digit whole numbers using the standard algorithm. | 4.NBT.B.4 Fluently add and subtract multi-digit whole numbers using a standard algorithm. | . |

| CCSS | AZ | Notes and Comments |
|---|---|---|
| 4.NBT.5. Multiply a whole number of up to four digits by a one-digit whole number, and multiply two two-digit numbers, using strategies based on place value and the properties of operations. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models. | 4.NBT.B.5 Demonstrate understanding of multiplication by multiplying whole numbers up to four digits by a one-digit | The product of two 2-dgit numbers is not specifically required in AZ.<br>AZ changed the intent of this CCSS by asking for multiplication of whole numbers of up to four digit by one digit as  a way of demonstrating understanding of the operation. The CCSS asks for the calculations and an explanation of the solution. |
| 4.NBT.6. Find whole-number quotients and remainders with up to four-digit dividends and one-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models. | 4.NBT.B.6 Demonstrate understanding of division by finding whole-number quotients and remainders with up to four- digit dividends and one-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division. Illustrate and explain the calculation. | AZ changed the intent of this CCSS by asking for division of whole numbers of up to four digit by one digit as a way to "demonstrate understanding" of the operation. Both versions expect students to be able to illustrate and explain their calculation, making the "demonstrate understanding" a double requirement in the AZ version but without the basic requirement to do the division problems. |
| **Number and Operations – Fractions**<br>[Grade 4 expectations in this domain are limited to fractions with denominators 2, 3, 4, 5, 6, 8, 10, 12, and 100.] | **Number and Operations - Fractions (NF)**<br>**Note: Grade 4 expectations in this domain are limited to fractions with denominators 2, 3, 4, 5, 6, 8, 10, 12, and 100.** | AZ lost the footnote that restricts fractions to denominators of  2, 3, 4, 5, 6, 8, 10, 12, and 100. Is there any limitation intended here? |
| **Extend understanding of fraction equivalence and ordering.** | **4.NF.A Extend understanding of fraction equivalence and ordering.** | . |

| CCSS | AZ | Notes and Comments |
|---|---|---|
| 4.NF.1. Explain why a fraction a/b is equivalent to a fraction (n x a)/(n x b) by using visual fraction models, with attention to how the number and size of the parts differ even though the two fractions themselves are the same size. Use this principle to recognize and generate equivalent fractions. | 4.NF.A.1 Explain why a fraction a/b is equivalent to a fraction (n x a)/(n x b) by using visual fraction models, with attention to how the number and size of the parts differ even though the two fractions themselves are the same size. Use this principle to understand and generate equivalent fractions. | AZ changed "recognize" to "understand," increasing the rigor but making the AZ standard less easily measured. |
| 4.NF.2. Compare two fractions with different numerators and different denominators, e.g., by creating common denominators or numerators, or by comparing to a benchmark fraction such as 1/2. Recognize that comparisons are valid only when the two fractions refer to the same whole. Record the results of comparisons with symbols >, =, or <, and justify the conclusions, e.g., by using a visual fraction model. | 4.NF.A.2 Compare two fractions with different numerators and different denominators by creating common denominators or numerators and by comparing to a benchmark fraction such as 1/2. Use number sense of fractions to assess the reasonableness of answers. Understand that comparisons are valid only when the two fractions refer to the same whole. Record the results of comparisons with symbols >, =, or <, and justify the conclusions. | AZ's deletion of "e.g." in the first part of the standard makes it seem that this example is the only method required. They also changed "recognize" to "understand," increasing the rigor but making the AZ standard less easily measured. AZ added a requirement to assess the reasonableness of results. |
| **Build fractions from unit fractions by applying and extending previous understandings of operations on whole numbers.** | **4.NF.B Build fractions from unit fractions by applying and extending previous understanding of operations on whole numbers.** | . |
| 4.NF.3. Understand a fraction *a* /*b* with *a* > 1 as a sum of fractions 1/*b* . | 4.NF.B.3 Understand a fraction a/b with a > 1 as a sum of unit fractions (1/b).<br>a. Understand addition and subtraction of fractions as joining and separating parts referring to the same whole. | . |
| 4.NF.3a Understand addition and subtraction of fractions as joining and separating parts referring to the same whole. | | . |

| CCSS | AZ | Notes and Comments |
|---|---|---|
| 4.NF.3b Decompose a fraction into a sum of fractions with the same denominator in more than one way, recording each decomposition by an equation. Justify decompositions, e.g., by using a visual fraction model. *Examples: 3/8 = 1/8 + 1/8 + 1/8 ; 3/8 = 1/8 + 2/8 ; 2 1/8 = 1 + 1 + 1/8 = 8/8 + 8/8 + 1/8.* | b. Decompose a fraction into a sum of fractions with the same denominator by recording decompositions using a variety of representations, including equations. Justify decompositions. | AZ removed the CCSS examples. |
| 4.NF.3c Add and subtract mixed numbers with like denominators, e.g., by replacing each mixed number with an equivalent fraction, and/or by using properties of operations and the relationship between addition and subtraction. | c. Add and subtract mixed numbers with like denominators by using properties of operations and the relationship between addition and subtraction or by replacing each mixed number with an equivalent fraction. | AZ removed the "e.g." making it seem that these methods are the only ones required. |
| 4.NF.3d Solve word problems involving addition and subtraction of fractions referring to the same whole and having like denominators, e.g., by using visual fraction models and equations to represent the problem. | d. Solve word problems involving addition and subtraction of fractions referring to the same whole and having like denominators using a variety of representations. | It appears that AZ attempted to include a generic version of the CCSS example in the standard. However, it is not clear what is meant by "using a variety of representations" in the context of word problems involving addition and subtraction of fractions. This should be specified. |
| 4.NF.4. Apply and extend previous understandings of multiplication to multiply a fraction by a whole number. | 4.NF.B.4 Apply and extend previous understandings of multiplication to multiply a fraction by a whole number. | . |
| 4.NF.4a Understand a fraction *a* /*b* as a multiple of 1/*b* . *For example, use a visual fraction model to represent 5/4 as the product 5 × (1/4), recording the conclusion by the equation 5/4 = 5 × (1/4).* | a. Understand a fraction a/b as a multiple of a unit fraction (1/b). (In general, a/b = a x (1/b).)<br><br>b. Understand a multiple of a/b as a multiple of | AZ removed the CCSS example. |

| CCSS | AZ | Notes and Comments |
|---|---|---|
| 4.NF.4b Understand a multiple of *a* /*b* as a multiple of 1/*b* , and use this understanding to multiply a fraction by a whole number. *For example, use a visual fraction model to express 3 × (2/5) as 6 × (1/5), recognizing this product as 6/5. (In general, n × (a/b) = (n × a)/b.)* | a unit fraction (1/b), and use this understanding to multiply a fraction by a whole number. (In general, n x (a/b) = (n x a)/b.)<br><br>c. Solve word problems involving multiplication of a fraction by a whole number. | AZ removed the CCSS example. |
| 4.NF.4c Solve word problems involving multiplication of a fraction by a whole number, e.g., by using visual fraction models and equations to represent the problem. *For example, if each person at a party will eat 3/8 of a pound of roast beef, and there will be 5 people at the party, how many pounds of roast beef will be needed? Between what two whole numbers does your answer lie?* | | AZ removed the CCSS examples.<br><br>Here, the practice of making the CCSS example part of the AZ standard (e.g. 4.NF.3d) was not followed. Is there a reason for including the example strategy as part of the statement in one place and not the other? |
| **Understand decimal notation for fractions, and compare decimal fractions.** | **4.NF.C Understand decimal notation for fractions, and compare decimal fractions.** | . |
| 4.NF.5. Express a fraction with denominator 10 as an equivalent fraction with denominator 100, and use this technique to add two fractions with respective denominators 10 and 100.4 *For example, express 3/10 as 30/100, and add 3/10 + 4/100 = 34/100.* [Students who can generate equivalent fractions can develop strategies for adding fractions with unlike denominators in general. But addition and subtraction with unlike denominators in general is not a requirement at this grade.] | 4.NF.C.5 Express a fraction with denominator 10 as an equivalent fraction with denominator 100, and use this technique to add two fractions with respective denominators 10 (tenths) and 100 (hundredths). (Addition and subtraction with unlike denominators, in general, is not a requirement at this grade.) | AZ removed the CCSS example and explanation. |

| CCSS | AZ | Notes and Comments |
|---|---|---|
| 4.NF.6. Use decimal notation for fractions with denominators 10 or 100. *For example, rewrite 0.62 as 62/100; describe a length as 0.62 meters; locate 0.62 on a number line diagram.* | 4.NF.C.6 Use decimal notation for fractions with denominators 10 (tenths) or 100 (hundredths), and locate these decimals on a number line. | The CCSS example became part of the AZ requirement. |
| 4.NF.7. Compare two decimals to hundredths by reasoning about their size. Recognize that comparisons are valid only when the two decimals refer to the same whole. Record the results of comparisons with the symbols >, =, or <, and justify the conclusions, e.g., by using a visual model. | 4.NF.C.7 Compare two decimals with tenths and hundredths by reasoning about their size. Use number sense of decimal fractions to assess the reasonableness of answers. Understand that comparisons are valid only when the two decimals refer to the same whole. Record the results of comparisons with the symbols >, =, or <, and justify the conclusions. | AZ changed "recognize" to "understand," increasing the rigor but making the AZ standard less easily measured. They also added the requirement to assess the reasonableness of answers. |
| **Measurement and Data** | | . |
| **Solve problems involving measurement and conversion of measurements from a larger unit to a smaller unit.** | **4.MD.A Solve unit problems involving measurement and conversion of measurements from a larger unit to a smaller unit.** | . |
| 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 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. | AZ removed the CCSS example. |

| CCSS | AZ | Notes and Comments |
|---|---|---|
| 4.MD.2. Use the four operations to solve word problems involving distances, intervals of time, liquid volumes, masses of objects, and money, including problems involving simple fractions or decimals, and problems that require expressing measurements given in a larger unit in terms of a smaller unit. Represent measurement quantities using diagrams such as number line diagrams that feature a measurement scale. | 4.MD.A.2 Solve word problems in a real-world context involving distances, intervals of time (hr, min, sec), liquid volumes, masses of objects, and money, including decimals and problems involving fractions with like denominators, and problems that require expressing measurements given in a larger unit in terms of a smaller unit. Represent measurement quantities using a variety of representations that feature a measurement scale. | AZ is less specific than the CCSS in their change form "diagrams such as number line diagrams" to the less specific, "a variety of representations." It is not clear what the "variety" would include. |
| 4.MD.3. Apply the area and perimeter formulas for rectangles in real world and mathematical problems. *For example, find the width of a rectangular room given the area of the flooring and the length, by viewing the area formula as a multiplication equation with an unknown factor.* | 4.MD.A.3 Apply the area and perimeter formulas for rectangles in mathematical problems and problems in real-world context including problems with unknown side lengths. | AZ removed the CCSS example problem and added a more generic type of problem to the standard. However, it is not clear whether other types of problems would be required. Would unknown areas or unknown perimeters be included? Perhaps in this case, generically blending the CCSS example into the standard may make the AZ standard less clear. |
| **Represent and interpret data.** | **4.MD.B Represent and interpret data.** | . |
| 4.MD.4. Make a line plot to display a data set of measurements in fractions of a unit (1/2, 1/4, 1/8). Solve problems involving addition and subtraction of fractions by using information presented in line plots. *For example, from a line plot find and interpret the difference in length between the longest and shortest specimens in an insect collection.* | 4.MD.B.4 Make a line plot to display a data set of measurements in fractions of a unit (1/2, 1/4, 1/8). Solve problems involving addition and subtraction of fractions by using information presented in line plots. | AZ removed the CCSS example. |

| CCSS | AZ | Notes and Comments |
|---|---|---|
| **Geometric measurement: understand concepts of angle and measure angles.** | **4.MD.C Geometric measurement: understand concepts of angle and measure angles.** | . |
| 4.MD.5. Recognize angles as geometric shapes that are formed wherever two rays share a common endpoint, and understand concepts of angle measurement:<br>a. An angle is measured with reference to a circle with its center at the common endpoint of the rays, by considering the fraction of the circular arc between the points where the two rays intersect the circle. An angle that turns through 1/360 of a circle is called a "one-degree angle," and can be used to measure angles.<br>b. An angle that turns through n one-degree angles is said to have an angle measure of n degrees. | 4.MD.C.5 Understand angles as geometric shapes that are formed wherever two rays share a common endpoint, and understand concepts of angle measurement:<br>a. An angle is measured with reference to a circle with its center at the common endpoint of the rays. An angle that turns through 1/360 of a circle is called a "one-degree angle," and can be used to measure angles.<br>b. An angle that turns through n one-degree angles is said to have an angle measure of n degrees. | AZ deleted the defining statement for angle measurement. Without that statement the next sentence, about a commonly misunderstood concept, is less clear. The technical notes indicate that the statement was removed because it was "all the how.. and not appropriate for wording in standards." The deleted statement, however, is not about "how" but is rather a key part of the understanding of what one should attend to when measuring an angle. |
| 4.MD.6. Measure angles in whole-number degrees using a protractor. Sketch angles of specified measure. | 4.MD.C.6 Measure angles in whole-number degrees using a protractor. Sketch angles of specified measure. | . |
| 4.MD.7. Recognize angle measure as additive. When an angle is decomposed into non-overlapping parts, the angle measure of the whole is the sum of the angle measures of the parts. Solve addition and subtraction problems to find unknown angles on a diagram in real world and mathematical problems, e.g., by using an equation with a symbol for the unknown angle measure. | 4.MD.C.7 Understand angle measures as additive. Solve addition and subtraction problems to find unknown angles on a diagram within mathematical problems as well as problems in real world contexts. | AZ changed "recognize" to "understand," increasing the rigor but making the AZ standard less easily measured. They also removed the example and deleted the explanation of additive for angles. In making "measure" plural, AZ appears to be thinking of the individual measurements rather than the concept. |
| **Geometry** | **Geometry (G)** | . |

| CCSS | AZ | Notes and Comments |
|---|---|---|
| **Draw and identify lines and angles, and classify shapes by properties of their lines and angles.** | **4.G.A Draw and identify lines and angles, and classify shapes by properties of their lines and angles.** | . |
| 4.G.1. Draw points, lines, line segments, rays, angles (right, acute, obtuse), and perpendicular and parallel lines. Identify these in two-dimensional figures. | 4.G.A.1 Draw points, lines, line segments, rays, angles (right, acute, obtuse), and perpendicular and parallel lines. Identify these in two-dimensional figures. | . |
| 4.G.2. Classify two-dimensional figures based on the presence or absence of parallel or perpendicular lines, or the presence or absence of angles of a specified size. Recognize right triangles as a category, and identify right triangles. | 4.G.A.2 Classify two-dimensional figures based on the presence or absence of parallel or perpendicular lines, or the presence or absence of angles of a specified size. Understand right triangles as a category, and identify right triangles. | AZ changed "recognize" to "understand," increasing the rigor but making the AZ standard less easily measured. |
| 4.G.3. Recognize a line of symmetry for a two-dimensional figure as a line across the figure such that the figure can be folded along the line into matching parts. Identify line-symmetric figures and draw lines of symmetry. | 4.G.A.3 Understand a line of symmetry for a two-dimensional figure as a line across the figure such that the figure can be folded along the line into matching parts. Identify line-symmetric figures and draw lines of symmetry. | AZ changed "recognize" to "understand," increasing the rigor but making the AZ standard less easily measured. |
| **GRADE 5** | . | . |
| **Operations and Algebraic Thinking** | **Operations & Algebraic Thinking (OA)** | . |
| **Write and interpret numerical expressions.** | **5.OA.A Write and interpret numerical expressions.** | . |
| 5.OA.1. Use parentheses, brackets, or braces in numerical expressions, and evaluate expressions with these symbols. | 5.OA.A.1 Use parentheses in numerical expressions, and evaluate expressions with this symbol. | AZ excludes other symbols of inclusion other than parentheses. It is not clear how removing brackets and braces clarifies the expectation as claimed in the AZ Technical Review. |

| CCSS | AZ | Notes and Comments |
|---|---|---|
| 5.OA.2. Write simple expressions that record calculations with numbers, and interpret numerical expressions without evaluating them. *For example, express the calculation “add 8 and 7, then multiply by 2” as 2 × (8 + 7). Recognize that 3 × (18932 + 921) is three times as large as 18932 + 921, without having to calculate the indicated sum or product.* | 5.OA.A.2 Write simple expressions that record calculations with numbers, and interpret numerical expressions without evaluating them. | AZ removed the CCSS examples. |
| **Analyze patterns and relationships.** | **5.OA.B Analyze patterns and relationships.** | |
| 5.OA.3. Generate two numerical patterns using two given rules. Identify apparent relationships between corresponding terms. Form ordered pairs consisting of corresponding terms from the two patterns, and graph the ordered pairs on a coordinate plane. *For example, given the rule “Add 3” and the starting number 0, and given the rule “Add 6” and the starting number 0, generate terms in the resulting sequences, and observe that the terms in one sequence are twice the corresponding terms in the other sequence. Explain informally why this is so.* | 5.OA.B.3 Generate two numerical patterns using two given rules (i.e. generate terms in the resulting sequences). Identify and explain the apparent relationships between corresponding terms. Form ordered pairs consisting of corresponding terms from the two patterns, and graph the ordered pairs on a coordinate plane. | AZ added an explanation of "rules. "They also increased the rigor for this standard by expecting students to "explain" the relationships between corresponding terms. AZ removed the CCSS example. |
| **Numbers and Operations in Base Ten** | **Number and Operations in Base Ten (NBT)** | |
| **Understand the place value system.** | **5.NBT.A Understand the place value system.** | . |
| 5.NBT.1. Recognize that in a multi-digit number, a digit in one place represents 10 times as much as it represents in the place to its right and 1/10 of what it represents in the place to its left. | 5.NBT.A.1 Recognize that in a multi-digit number, a digit in one place represents 10 times as much as it represents in the place to its right and 1/10 of what it represents in the place to its left. | While "recognize" has fairly consistently been replaced with "understand" in the AZ standards, it is left here. Is that intentional? Or an oversight? |

| CCSS | AZ | Notes and Comments |
|---|---|---|
| 5.NBT.2. Explain patterns in the number of zeros of the product when multiplying a number by powers of 10, and explain patterns in the placement of the decimal point when a decimal is multiplied or divided by a power of 10. Use whole-number exponents to denote powers of 10. | 5.NBT.A.2 Explain patterns in the number of zeros of the product when multiplying a number by powers of 10, and explain patterns in the placement of the decimal point when a decimal is multiplied or divided by a power of 10. Use whole-number exponents to denote powers of 10. | . |
| 5.NBT.3. Read, write, and compare decimals to thousandths. | 5.NBT.A.3 Read, write, and compare decimals to thousandths. | . |
| 5.NBT.3a Read and write decimals to thousandths using base-ten numerals, number names, and expanded form, e.g., 347.392 = 3 x 100 + 4 x 10 + 7 x 1 + 3 x (1/10) + 9 x (1/100) + 2 x (1/1000). | a. Read and write decimals to thousandths using base-ten numerals, number names, and expanded form. | AZ removed the CCSS example. |
| 5.NBT.3b Compare two decimals to thousandths based on meanings of the digits in each place, using >, =, and < symbols to record the results of comparisons. | b. Compare two decimals to thousandths based on meanings of the digits in each place, using >, =, and < symbols to record the results of comparisons. | . |
| 5.NBT.4. Use place value understanding to round decimals to any place. | 5.NBT.A.4 Use place value understanding to round decimals to any place. | . |
| **Perform operations with multi-digit whole numbers and with decimals to hundredths.** | **5.NBT.B Perform operations with multi-digit whole numbers and with decimals to hundredths.** | . |
| 5.NBT.5. Fluently multiply multi-digit whole numbers using the standard algorithm. | 5.NBT.B.5 Fluently multiply multi-digit whole numbers using a standard algorithm. | By changing the article from "the" to "a," AZ opens the door to there being multiple standard algorithms. |

| CCSS | AZ | Notes and Comments |
|---|---|---|
| 5.NBT.6. Find whole-number quotients of whole numbers with up to four-digit dividends and two-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models. | 5.NBT.B.6 Apply and extend understanding of division by finding whole-number quotients of whole numbers with up to four-digit dividends and two-digit divisors, using a variety of strategies based on place value, the properties of operations, and/or the relationship between multiplication and division. Illustrate and explain the calculation using a variety of representations including equations and models. | AZ requires using the operation to extend understanding of itself. They also limit the "variety of representations" by not mentioning arrays or area models.<br><br>Clarity: It is not clear how finding quotients applies and extends understanding of division. Instead of "apply and extend understanding...by finding" (which is awkward) perhaps match previously used AZ language "apply and extend understanding to find" (See 4.NF.B.4). |
| 5.NBT.7. Add, subtract, multiply, and divide decimals to hundredths, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning used. | 5.NBT.B.7 Add, subtract, multiply, and divide decimals to hundredths, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between operations; relate the strategy to a written method and explain the reasoning used. | The CCSS requires only the relationship between addition and subtraction, while the AZ counterpart appears to be addressing the relationships between all four operations. |
| **Number and Operations – Fractions** | **Number and Operations - Fractions (NF)** | . |
| **Use equivalent fractions as a strategy to add and subtract fractions.** | **5.NF.A Use equivalent fractions to add and subtract fractions.** | . |
| 5.NF.1. Add and subtract fractions with unlike denominators (including mixed numbers) by replacing given fractions with equivalent fractions in such a way as to produce an equivalent sum or difference of fractions with like denominators. *For example, 2/3 + 5/4 = 8/12 + 15/12 = 23/12. (In general, a/b + c/d = (ad + bc)/bd.)* | 5.NF.A.1 Add and subtract fractions with unlike denominators (including mixed numbers) by replacing given fractions with equivalent fractions in such a way as to produce an equivalent sum or difference of fractions with like denominators. | AZ removed the CCSS example. |

| CCSS | AZ | Notes and Comments |
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| 5.NF.2. Solve word problems involving addition and subtraction of fractions referring to the same whole, including cases of unlike denominators, e.g., by using visual fraction models or equations to represent the problem. Use benchmark fractions and number sense of fractions to estimate mentally and assess the reasonableness of answers. *For example, recognize an incorrect result 2/5 + 1/2 = 3/7, by observing that 3/7 < 1/2.* | 5.NF.A.2 Solve word problems involving addition and subtraction of fractions referring to the same whole, including cases of unlike denominators by using a variety of representations including equations and models. Use benchmark fractions and number sense of fractions to estimate mentally and assess the reasonableness of answers. | Reading the AZ standard is awkward with "including" used twice in one sentence. Also, in AZ, one of the suggested "variety of representations" is given as "models" rather than visual fraction models. Teachers may not understand that "models" does not refer to modeling with mathematics, as required in MP.4. |
| **Apply and extend previous understandings of multiplication and division to multiply and divide fractions.** | **5.NF.B Apply and extend previous understandings of multiplication and division to multiply and divide fractions.** | . |
| 5.NF.3. Interpret a fraction as division of the numerator by the denominator (a/b = a ÷ b). Solve word problems involving division of whole numbers leading to answers in the form of fractions or mixed numbers, e.g., by using visual fraction models or equations to represent the problem. *For example, interpret 3/4 as the result of dividing 3 by 4, noting that 3/4 multiplied by 4 equals 3, and that when 3 wholes are shared equally among 4 people each person has a share of size 3/4. If 9 people want to share a 50-pound sack of rice equally by weight, how many pounds of rice should each person get? Between what two whole numbers does your answer lie?* | 5.NF.B.3 Interpret a fraction as division of the numerator by the denominator (a/b = a ÷ b). Solve word problems involving division of whole numbers leading to answers in the form of fractions or mixed numbers using a variety of representations including equations and models. | AZ replaced the specific CCSS wording with the less specific, "using a variety of representations." In this standard, again, "visual fraction models" is changed to just "models." Clarity is needed for teachers to know what "models" are included. |

| CCSS | AZ | Notes and Comments |
|---|---|---|
| 5.NF.4. Apply and extend previous understandings of multiplication to multiply a fraction or whole number by a fraction. | 5.NF.B.4 Apply and extend previous understandings of multiplication to multiply a fraction by a whole number and by a fraction. | Attention to clarity is needed here. There is a slight word order change in the stem part of the standard (5.NF.4): The required operations "whole number by a fraction" is changed to "fraction by a whole number." The difference is subtle but not insignificant. In this case, part a asks for a fraction by a whole number, which is the reverse of the AZ stem standard. It should be noted that in other AZ standards (e.g. 5.NF.B.7) the difference between the two orders is attended to by including both. |
| 5.NF.4a Interpret the product (*a* /*b* ) x *q* as *a* parts of a partition of *q* into *b* equal parts; equivalently, as the result of a sequence of operations *a x q ÷ b*. *For example, use a visual fraction model to show (2/3) × 4 = 8/3, and create a story context for this equation. Do the same with (2/3) × (4/5) = 8/15. (In general, (a/b) × (c/d) = ac/bd.)* | a. Interpret the product (a/b) x q as a parts of a partition of q into b equal parts; equivalently, as the result of a sequence of operations a x q ÷ b. Use a visual fraction model and create a story context for an equation.<br>b. Interpret the product of a fraction multiplied by a fraction (a/b) x (c/d). Use a visual fraction model and create a story context for an equation. | AZ split part a into two parts. The CCSS example was removed.<br><br>The new AZ part b comes from the example in part a of the CCSS. The support for understanding the product of a fraction by a fraction is not included in this additional AZ standard. |
| 5.NF.4b Find the area of a rectangle with fractional side lengths by tiling it with unit squares of the appropriate unit fraction side lengths, and show that the area is the same as would be found by multiplying the side lengths. Multiply fractional side lengths to find areas of rectangles, and represent fraction products as rectangular areas. | c. Find the area of a rectangle with fractional side lengths by tiling it with unit squares of the appropriate unit fraction side lengths, and show that the area is the same as would be found by multiplying the side lengths. Multiply fractional side lengths to find areas of rectangles, and represent fraction products as rectangular areas. | AZ will need to make sure to identify the standards that have the codes changed to avoid confusion when teachers match their standards with materials that are shared across states. |

| CCSS | AZ | Notes and Comments |
|---|---|---|
| 5.NF.5. Interpret multiplication as scaling (resizing), by:<br>a. Comparing the size of a product to the size of one factor on the basis of the size of the other factor, without performing the indicated multiplication.<br>b. Explaining why multiplying a given number by a fraction greater than 1 results in a product greater than the given number (recognizing multiplication by whole numbers greater than 1 as a familiar case); explaining why multiplying a given number by a fraction less than 1 results in a product smaller than the given number; and relating the principle of fraction equivalence a/b = (n x a)/(n x b) to the effect of multiplying a/b by 1. | 5.NF.B.5 Interpret multiplication as scaling (resizing) by:<br>a. Comparing the size of a product to the size of one factor on the basis of the size of the other factor, without performing the indicated multiplication.<br>b. Explaining why multiplying a given number by a fraction greater than 1 results in a product greater than the given number; explaining why multiplying a given number by a fraction less than 1 results in a product smaller than the given number; and relating the principle of fraction equivalence a/b = (n x a)/(n x b) to the effect of multiplying a/b by 1. | The CCSS explanatory parentheses was removed in the AZ standards. |
| 5.NF.6. Solve real world problems involving multiplication of fractions and mixed numbers, e.g., by using visual fraction models or equations to represent the problem. | 5.NF.B.6 Solve problems in a real-world context involving multiplication of fractions and mixed numbers by using a variety of representations including equations and models. | AZ replaced the CCSS examples with the generic, "a variety of representations." Using the general term "models" here, rather than "visual fraction models," might lead to the conclusion that MP.4 is at play. |

| CCSS | AZ | Notes and Comments |
|---|---|---|
| 5.NF.7. Apply and extend previous understandings of division to divide unit fractions by whole numbers and whole numbers by unit fractions. [Students able to multiply fractions in general can develop strategies to divide fractions in general, by reasoning about the relationship between multiplication and division. But division of a fraction by a fraction is not a requirement at this grade.] | 5.NF.B.7 Apply and extend previous understandings of division to divide unit fractions by whole numbers and whole numbers by unit fractions using a variety of representations including equations and models. | Using the term "models" here might lead to the conclusion that MP.4 is at play rather than the more likely, visual fraction models. |
| 5.NF.7a Interpret division of a unit fraction by a non-zero whole number, and compute such quotients. *For example, create a story context for (1/3) ÷ 4, and use a visual fraction model to show the quotient. Use the relationship between multiplication and division to explain that (1/3) ÷ 4 = 1/12 because (1/12) × 4 = 1/3.* | a. Interpret division of a unit fraction by a non-zero whole number, and compute such quotients. Use the relationship between multiplication and division to justify conclusions. | AZ made the CCSS example part of their requirement. |
| 5.NF.7b Interpret division of a whole number by a unit fraction, and compute such quotients. *For example, create a story context for 4 ÷ (1/5), and use a visual fraction model to show the quotient. Use the relationship between multiplication and division to explain that 4 ÷ (1/5) = 20 because 20 × (1/5) = 4.* | b. Interpret division of a whole number by a unit fraction, and compute such quotients. Use the relationship between multiplication and division to justify conclusions.<br><br>c. Solve problems in a real-world context | AZ included part of the CCSS example in their requirement, possibly increasing the rigor for this standard. |

| CCSS | AZ | Notes and Comments |
|---|---|---|
| 5.NF.7c Solve real world problems involving division of unit fractions by non-zero whole numbers and division of whole numbers by unit fractions, e.g., by using visual fraction models and equations to represent the problem. *For example, how much chocolate will each person get if 3 people share 1/2 lb of chocolate equally? How many 1/3-cup servings are in 2 cups of raisins?* | involving division of unit fractions by non-zero whole numbers and division of whole numbers by unit fractions. | AZ removed the CCSS examples. |
| **Measurement and Data** | **Measurement and Data (MD)** | . |
| **Convert like measurement units within a given measurement system.** | **5.MD.A Convert like measurement units within a given measurement system.** | . |
| 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 among different-sized standard measurement units within a given measurement system, and use these conversions in solving multi-step problems in real world context. | AZ removed the CCSS examples. |
| **Represent and interpret data.** | **5.MD.B Represent and interpret data.** | . |
| 5.MD.2. Make a line plot to display a data set of measurements in fractions of a unit (1/2, 1/4, 1/8). Use operations on fractions for this grade to solve problems involving information presented in line plots. *For example, given different measurements of liquid in identical beakers, find the amount of liquid each beaker would contain if the total amount in all the beakers were redistributed equally.* | 5.MD.B.2 Make a line plot to display a data set of measurements in fractions of a unit (1/2, 1/4, 1/8). Use appropriate grade level fraction operations to solve problems involving information presented in line plots. | AZ removed the CCSS examples. |
| **Geometric measurement: understand concepts of volume and relate volume to multiplication and to addition.** | **5.MD.C Geometric measurement: understand concepts of volume and relate volume to multiplication and to addition.** | . |

| CCSS | AZ | Notes and Comments |
|---|---|---|
| 5.MD.3 Recognize volume as an attribute of solid figures and understand concepts of volume measurement.<br>a. A cube with side length 1 unit, called a “unit cube,” is said to have “one cubic unit” of volume, and can be used to measure volume.<br>b. A solid figure which can be packed without gaps or overlaps using n unit cubes is said to have a volume of n cubic units. | 5.MD.C.3 Recognize volume as an attribute of solid figures and understand concepts of volume measurement.<br>a. A cube with side length 1 unit, called a “unit cube,” is said to have “one cubic unit” of volume and can be used to measure volume.<br>b. A solid figure which can be packed without gaps or overlaps using n unit cubes is said to have a volume of n cubic units. | . |
| 5.MD.4. Measure volumes by counting unit cubes, using cubic cm, cubic in, cubic ft, and improvised units. | 5.MD.C.4 Measure volumes by counting unit cubes, using cubic cm., cubic in., cubic ft., and improvised units. | . |
| 5.MD.5. Relate volume to the operations of multiplication and addition and solve real world and mathematical problems involving volume. | 5.MD.C.5 Relate volume to the operations of multiplication and addition and solve real world and mathematical problems involving volume.<br>a. Find the volume of a right rectangular prism with whole-number side lengths by packing it with unit cubes, and show that the volume is the same as would be found by multiplying the edge lengths, equivalently by multiplying the height by the area of the base.<br>b. Understand and use the formulas V = l ● w ● h and V = B ● h, where in this case B is the area of the base (B = l ● w), for rectangular prisms to find volumes of right rectangular prisms with | . |
| 5.MD.5a Find the volume of a right rectangular prism with whole-number side lengths by packing it with unit cubes, and show that the volume is the same as would be found by multiplying the edge lengths, equivalently by multiplying the height by the area of the base. Represent threefold whole-number products as volumes, e.g., to represent the associative property of multiplication. | | AZ removed the requirement to represent "three-fold whole-number products" as volumes. |

| CCSS | AZ | Notes and Comments |
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| 5.MD.5b Apply the formulas $V = (l)(w)(h)$ and $V = b \times h$ for rectangular prisms to find volumes of right rectangular prisms with whole- number edge lengths in the context of solving real world and mathematical problems. | find volumes of right rectangular prisms with whole-number edge lengths to solve mathematical problems and problems in a real world context.<br>c. Understand volume as additive. Find volumes of solid figures composed of two non-overlapping right rectangular prisms, applying this technique to solve mathematical problems and problems in a real world context. | . |
| 5.MD.5c Recognize volume as additive. Find volumes of solid figures composed of two non-overlapping right rectangular prisms by adding the volumes of the non-overlapping parts, applying this technique to solve real world problems. | | AZ changed "recognize" to "understand," making the AZ standard less easily measured. They also removed the explanation of how to find volumes of composed figures. |
| **Geometry** | **Geometry (G)** | |
| **Graph points on the coordinate plane to solve real-world and mathematical problems.** | **5.G.A Graph points on the coordinate plane to solve mathematical problems as well as problems in real-world context.** | . |
| 5.G.1. Use a pair of perpendicular number lines, called axes, to define a coordinate system, with the intersection of the lines (the origin) arranged to coincide with the 0 on each line and a given point in the plane located by using an ordered pair of numbers, called its coordinates. Understand that the first number indicates how far to travel from the origin in the direction of one axis, and the second number indicates how far to travel in the direction of the second axis, with the convention that the names of the two axes and the coordinates correspond (e.g., *x* -axis and *x* -coordinate, *y* -axis and *y* -coordinate). | 5.G.A.1 Understand and describe a coordinate system as perpendicular number lines that intersect at the origin (0 , 0). Identify a given point in the plane located by using an ordered pair of numbers, called its coordinates. Understand that the first number (x) indicates the distance traveled on the horizontal axis, and the second number (y) indicates the distance traveled on the vertical axis. | By including the example as part of this standard, AZ specifically identifies the variables as x and y, making it less likely that students will use other variables more appropriate to a real world context. The CCSS makes the effort to allow for any variable and uses x and y only in a parenthetical example. |

| CCSS | AZ | Notes and Comments |
|---|---|---|
| 5.G.2. Represent real world and mathematical problems by graphing points in the first quadrant of the coordinate plane, and interpret coordinate values of points in the context of the situation. | 5.G.A.2 Represent mathematical problems and problems in real-world context by graphing points in the first quadrant of the coordinate plane, and interpret coordinate values of points in the context of the situation. | . |
| **Classify two-dimensional figures into categories based on their properties.** | **5.G.B Classify two-dimensional figures into categories based on their properties** | . |
| 5.G.3. Understand that attributes belonging to a category of two- dimensional figures also belong to all subcategories of that category. *For example, all rectangles have four right angles and squares are rectangles, so all squares have four right angles.* | 5.G.B.3 Understand that attributes belonging to a category of two-dimensional figures also belong to all subcategories of that category. | . |
| 5.G.4. Classify two-dimensional figures in a hierarchy based on properties. | 5.G.B.4 Classify two-dimensional figures in a hierarchy based on properties | . |
| **GRADE 6** | . | . |
| **Ratios and Proportional Relationships** | **Ratios and Proportional Relationships (RP)** | . |
| **Understand ratio concepts and use ratio reasoning to solve problems.** | **6.RP.A Understand ratio concepts and use ratio reasoning to solve problems.** | . |
| 6.RP.1. Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. *For example, "The ratio of wings to beaks in the bird house at the zoo was 2:1, because for every 2 wings there was 1 beak." "For every vote candidate A received, candidate C received nearly three votes."* | 6.RP.A.1 Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. | . |

| CCSS | AZ | Notes and Comments |
|---|---|---|
| 6.RP.2. Understand the concept of a unit rate *a* /*b* associated with a ratio *a:b* with *b* ≠ 0, and use rate language in the context of a ratio relationship. *For example, "This recipe has a ratio of 3 cups of flour to 4 cups of sugar, so there is 3/4 cup of flour for each cup of sugar." "We paid $75 for 15 hamburgers, which is a rate of $5 per hamburger."* [Expectations for unit rates in this grade are limited to non-complex fractions.] | 6.RP.A.2 Understand the concept of a unit rate a/b associated with a ratio a:b with b ≠0, and use rate language in the context of a ratio relationship. (Complex fraction notation is not an expectation for unit rates in this grade level.) | AZ removed the CCSS examples. |
| 6.RP.3. Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations. | 6.RP.A.3 Use ratio and rate reasoning to solve mathematical problems and problems in a real-world context.<br><br>a. Make tables of equivalent ratios relating quantities with whole-number measurements, find missing values in the tables, and plot the pairs of values on the coordinate plane. Use tables to compare ratios.<br>b. Solve unit rate problems including those involving unit pricing and constant speed.<br><br>c. Find a percent of a quantity as a rate per 100 (e.g., 30% of a quantity means 30/100 times the quantity); solve problems involving finding the | AZ removed the CCSS example. |
| 6.RP.3a Make tables of equivalent ratios relating quantities with whole- number measurements, find missing values in the tables, and plot the pairs of values on the coordinate plane. Use tables to compare ratios. | | AZ removed the reference to data collected from measurements. |
| 6.RP.3b Solve unit rate problems including those involving unit pricing and constant speed. *For example, if it took 7 hours to mow 4 lawns, then at that rate, how many lawns could be mowed in 35 hours? At what rate were lawns being mowed? [Expectations for unit rates in this grade are limited to non-complex fractions.]* | | AZ removed the CCSS example. |

| CCSS | AZ | Notes and Comments |
|---|---|---|
| 6.RP.3c Find a percent of a quantity as a rate per 100 (e.g., 30% of a quantity means 30/100 times the quantity); solve problems involving finding the whole, given a part and the percent. | whole, given a part and the percent.<br>d. Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities. | . |
| 6.RP.3d Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities. | | . |
| **The Number System** | **The Number System (NS)** | . |
| **Apply and extend previous understandings of multiplication and division to divide fractions by fractions.** | **6.NS.A Apply and extend previous understandings of multiplication and division to divide fractions by fractions.** | . |
| 6.NS.1. Interpret and compute quotients of fractions, and solve word problems involving division of fractions by fractions, e.g., by using visual fraction models and equations to represent the problem. For example, create a story context for (2/3) ÷ (3/4) and use a visual fraction model to show the quotient; use the relationship between multiplication and division to explain that (2/3) ÷ (3/4) = 8/9 because 3/4 of 8/9 is 2/3. (In general, (a/b) ÷ (c/d) = ad/bc.) How much chocolate will each person get if 3 people share 1/2 lb of chocolate equally? How many 3/4-cup servings are in 2/3 of a cup of yogurt? How wide is a rectangular strip of land with length 3/4 mi and area 1/2 square mi? | 6.NS.A.1 Interpret and compute quotients of fractions to solve mathematical problems and problems in a real-world context involving division of fractions by fractions using visual fraction models and equations to represent the problem. (In general, (*a/b* ) ÷ (*c/d* ) = *ad/b* c.) | Removing the "e.g." in this CCSS gives the impression that only visual models and equations are required. AZ removed the CCSS specific example but kept the general one. |

| CCSS | AZ | Notes and Comments |
|---|---|---|
| **Compute fluently with multi-digit numbers and find common factors and multiples.** | **6.NS.B Compute fluently with multi-digit numbers and find common factors and multiples.** | |
| 6.NS.2. Fluently divide multi-digit numbers using the standard algorithm. | 6.NS.B.2 Fluently divide multi-digit numbers using a standard algorithm. | AZ changed "the" to "a," implying that there may be multiple standard algorithms. |
| 6.NS.3. Fluently add, subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation. | 6.NS.B.3 Fluently add, subtract, multiply, and divide multi-digit decimals using a standard algorithm for each operation. | AZ changed "the" to "a," implying that there may be multiple standard algorithms. |
| 6.NS.4. Find the greatest common factor of two whole numbers less than or equal to 100 and the least common multiple of two whole numbers less than or equal to 12. Use the distributive property to express a sum of two whole numbers 1–100 with a common factor as a multiple of a sum of two whole numbers with no common factor. *For example, express 36 + 8 as 4 (9 + 2).* | 6.NS.B.4 Understand the greatest common factor, understand the least common multiple, and use the distributive property.<br>a. Find the greatest common factor of two whole numbers less than or equal to 100.<br>b. Find the least common multiple of two whole numbers less than or equal to 12.<br>c. Use the distributive property to express a sum of two whole numbers 1–100 with a common factor as a multiple of a sum of two whole numbers with no common factor. | AZ split this CCSS into four parts, the stem and three sub-parts, and removed the example. The change from "find" to "understand" in the AZ stem for this standard represents an increase in rigor but is more difficult to measure. The sub-parts for this AZ standard return to the more easily measured performances of "find" and "use." |
| **Apply and extend previous understandings of numbers to the system of rational numbers.** | **6.NS.C Apply and extend previous understandings of numbers to the system of rational numbers.** | . |

| CCSS | AZ | Notes and Comments |
|---|---|---|
| 6.NS.5. Understand that positive and negative numbers are used together to describe quantities having opposite directions or values (e.g., temperature above/below zero, elevation above/below sea level, credits/debits, positive/negative electric charge); use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation. | 6.NS.C.5 Understand that positive and negative numbers are used together to describe quantities having opposite directions or values. Use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation. | AZ removed the CCSS examples. |
| 6.NS.6. Understand a rational number as a point on the number line. Extend number line diagrams and coordinate axes familiar from previous grades to represent points on the line and in the plane with negative number coordinates. | 6.NS.C.6 Understand a rational number as a point on the number line. Extend number line diagrams and coordinate axes familiar from previous grades to represent points on the line and in the plane with negative number coordinates. | . |
| 6.NS.6a Recognize opposite signs of numbers as indicating locations on opposite sides of 0 on the number line; recognize that the opposite of the opposite of a number is the number itself, e.g., –(–3) = 3, and that 0 is its own opposite. | a. Recognize opposite signs of numbers as indicating locations on opposite sides of 0 on the number line; recognize that the opposite of the opposite of a number is the number itself and that 0 is its own opposite. | AZ removed the CCSS examples. |
| 6.NS.6b Understand signs of numbers in ordered pairs as indicating locations in quadrants of the coordinate plane; recognize that when two ordered pairs differ only by signs, the locations of the points are related by reflections across one or both axes. | b. Understand signs of numbers in ordered pairs as indicating locations in quadrants of the coordinate plane; recognize that when two ordered pairs differ only by signs, the locations of the points are related by reflections across one or both axes.<br>c. Find and position integers and other rational numbers on a horizontal or vertical number line | . |

| CCSS | AZ | Notes and Comments |
|---|---|---|
| 6.NS.6c Find and position integers and other rational numbers on a horizontal or vertical number line diagram; find and position pairs of integers and other rational numbers on a coordinate plane. | diagram; find and position pairs of integers and other rational numbers on a coordinate plane. | . |
| 6.NS.7. Understand ordering and absolute value of rational numbers. | 6.NS.C.7 Understand ordering and absolute value of rational numbers. | . |
| 6.NS.7a Interpret statements of inequality as statements about the relative position of two numbers on a number line diagram. *For example, interpret –3 > –7 as a statement that –3 is located to the right of –7 on a number line oriented from left to right.* | a. Interpret statements of inequality as statements about the relative position of two numbers on a number line. | AZ removed the CCSS examples. |
| 6.NS.7b Write, interpret, and explain statements of order for rational numbers in real-world contexts. *For example, write –3 oC > –7 oC to express the fact that –3 oC is warmer than –7 oC.* | b. Write, interpret, and explain statements of order for rational numbers in real-world contexts. | AZ removed the CCSS examples. |
| 6.NS.7c Understand the absolute value of a rational number as its distance from 0 on the number line; interpret absolute value as magnitude for a positive or negative quantity in a real-world situation. *For example, for an account balance of –30 dollars, write \|–30\| = 30 to describe the size of the debt in dollars.* | c. Understand the absolute value of a rational number as its distance from 0 on the number line; interpret absolute value as magnitude for a positive or negative quantity in real-world contexts. | AZ removed the CCSS examples. |
| 6.NS.7d Distinguish comparisons of absolute value from statements about order. *For example, recognize that an account balance less than –30 dollars represents a debt greater than 30 dollars.* | d. Distinguish comparisons of absolute value from statements about order, especially when considering values in context. | The word "especially" in a standard is awkward. If the intent is that students be able to work with the comparisons both in and out of context, it should be specified. |

| CCSS | AZ | Notes and Comments |
|---|---|---|
| 6.NS.8. Solve real-world and mathematical problems by graphing points in all four quadrants of the coordinate plane. Include use of coordinates and absolute value to find distances between points with the same first coordinate or the same second coordinate. | 6.NS.C.8 Solve mathematical problems and problems in a real-world context by graphing points in all four quadrants of the coordinate plane. Include use of coordinates and absolute value to find distances between points with the same first coordinate or the same second coordinate. | . |
| **Expressions and Equations** | **Expressions and Equations (EE)** | |
| **Apply and extend previous understandings of arithmetic to algebraic expressions.** | **6.EE.A Apply and extend previous understandings of arithmetic to algebraic expressions.** | . |
| 6.EE.1. Write and evaluate numerical expressions involving whole-number exponents. | 6.EE.A.1 Write and evaluate numerical expressions involving whole-number exponents. | . |
| 6.EE.2. Write, read, and evaluate expressions in which letters stand for numbers. | 6.EE.A.2 Write, read, and evaluate algebraic expressions.<br>a. Write expressions that record operations with numbers and variables.<br>b. Identify parts of an expression using mathematical terms (sum, term, product, factor, quotient, and coefficient); view one or more parts of an expression as a single entity.<br>c. Evaluate expressions at specific values of their variables. Include expressions that arise from formulas used to solve mathematical problems and problems in a real-world context. Perform arithmetic operations, including those involving whole-number exponents, in the conventional order when there are no parentheses to specify | . |
| 6.EE.2a Write expressions that record operations with numbers and with letters standing for numbers. *For example, express the calculation "Subtract y from 5" as 5 – y.* | | AZ removed the CCSS examples. |
| 6.EE.2b Identify parts of an expression using mathematical terms (sum, term, product, factor, quotient, coefficient); view one or more parts of an expression as a single entity. *For example, describe the expression 2 (8 + 7) as a product of two factors; view (8 + 7) as both a single entity and a sum of two terms.* | | AZ removed the CCSS examples and included mathematical problems, in addition to real world problems. |

| CCSS | AZ | Notes and Comments |
|---|---|---|
| 6.EE.2c Evaluate expressions at specific values of their variables. Include expressions that arise from formulas used in real-world problems. Perform arithmetic operations, including those involving whole- number exponents, in the conventional order when there are no parentheses to specify a particular order (Order of Operations). *For example, use the formulas V = s3 and A = 6 s2 to find the volume and surface area of a cube with sides of length s = 1/2.* | order when there are no parentheses to specify a particular order (Order of Operations). | AZ removed the CCSS examples. |
| 6.EE.3. Apply the properties of operations to generate equivalent expressions. *For example, apply the distributive property to the expression 3 (2 + x) to produce the equivalent expression 6 + 3x; apply the distributive property to the expression 24x + 18y to produce the equivalent expression 6 (4x + 3y); apply properties of operations to y + y + y to produce the equivalent expression 3y.* | 6.EE.A.3 Apply the properties of operations to generate equivalent expressions. | AZ removed the CCSS examples. |
| 6.EE.4. Identify when two expressions are equivalent (i.e., when the two expressions name the same number regardless of which value is substituted into them). *For example, the expressions y + y + y and 3y are equivalent because they name the same number regardless of which number y stands for.* | 6.EE.A.4 Identify when two expressions are equivalent. | AZ removed the CCSS examples. |
| **Reason about and solve one-variable equations and inequalities.** | **6.EE.B Reason about and solve one-variable equations and inequalities.** | . |

| CCSS | AZ | Notes and Comments |
|---|---|---|
| 6.EE.5. Understand solving an equation or inequality as a process of answering a question: which values from a specified set, if any, make the equation or inequality true? Use substitution to determine whether a given number in a specified set makes an equation or inequality true. | 6.EE.B.5 Understand solving an equation or inequality as a process of reasoning to find the value(s) which make that equation or inequality true. Use substitution to determine whether a given number in a specified set makes an equation or inequality true. | AZ uses a slightly different choice of wording but the meaning is the same and may improve clarity. |
| 6.EE.6. Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set. | 6.EE.B.6 Use variables to represent numbers and write expressions to solve mathematical problems and problems in a real-world context; understand that a variable can represent an unknown number or any number in a specified set. | AZ uses a slightly different choice of wording but the meaning is the same. |
| 6.EE.7. Solve real-world and mathematical problems by writing and solving equations of the form $x + p = q$ and $px = q$ for cases in which $p$, $q$ and $x$ are all nonnegative rational numbers. | 6.EE.B.7 Solve mathematical problems and problems in a real-world context by writing and solving equations of the form $x + p = q$, $x - p = q$, $px = q$, and $p/x = q$ for cases in which $p$, $q$ and $x$ are all non-negative rational numbers. | AZ added two variations on the CCSS equations. However $p/x = q$ would not be appropriate at this level since students have not been introduced to rational expressions. It is likely that this is a typo and it should be $x/p = q$. Indiana, as referenced in the AZ notes, includes $x/p = q$ but not $p/x = q$ in their standard 6.AF.5. |
| 6.EE.8. Write an inequality of the form $x > c$ or $x < c$ to represent a constraint or condition in a real-world or mathematical problem. Recognize that inequalities of the form $x > c$ or $x < c$ have infinitely many solutions; represent solutions of such inequalities on number line diagrams. | 6.EE.B.8 Write an inequality of the form $x > c$, $x < c$, $x \geq c$, or $x \leq c$ to represent a constraint or condition to solve mathematical problems and problems in a real-world context. Recognize that inequalities have infinitely many solutions; represent solutions of such inequalities on number line. | AZ added the inclusive inequality symbols. |
| **Represent and analyze quantitative relationships between dependent and independent variables.** | **6.EE.C Represent and analyze quantitative relationships between dependent and independent variables.** | . |

| CCSS | AZ | Notes and Comments |
|---|---|---|
| 6.EE.9. Use variables to represent two quantities in a real-world problem that change in relationship to one another; 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. *For example, in a problem involving motion at constant speed, list and graph ordered pairs of distances and times, and write the equation d = 65t to represent the relationship between distance and time.* | 6.EE.C.9 Use variables to represent two quantities to solve mathematical problems and problems in a real-world context that change in relationship to one another; write an equation to express one quantity (the dependent variable) in terms of the other quantity (the independent variable). Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation. | AZ removed the CCSS examples. |
| **Geometry** | **Geometry (G)** | . |
| **Solve real-world and mathematical problems involving area, surface area, and volume.** | **6.G.A Solve real-world and mathematical problems involving area, surface area, and volume.** | . |

| CCSS | AZ | Notes and Comments |
|---|---|---|
| 6.G.1. Find the area of right triangles, other triangles, special quadrilaterals, and polygons by composing into rectangles or decomposing into triangles and other shapes; apply these techniques in the context of solving real-world and mathematical problems. | 6.G.A.1 Find the area of polygons by composing into rectangles or decomposing into triangles and other shapes; apply these techniques to solve mathematical problems and problems in a real-world context. | The CCSS provides more detail about some of the specific polygons required. Unfortunately, the AZ modification, apparently meant to remove redundancy, loses the parallel language found in critical area 5 of the front matter in the Grade 6 standards. Perhaps it would be clearer and more consistent to say, "Find the area of polygons by composing into rectangles or decomposing into triangles and other polygons." (This would match the sort of clarification made in 7.NS.A.1.) A teacher looking to see where areas of triangles are addressed in the progression may not see this modification as encompassing that notion. |
| 6.G.2. Find the volume of a right rectangular prism with fractional edge lengths by packing it with unit cubes of the appropriate unit fraction edge lengths, and show that the volume is the same as would be found by multiplying the edge lengths of the prism. Apply the formulas $V = l\ w\ h$ and $V = b\ h$ to find volumes of right rectangular prisms with fractional edge lengths in the context of solving real-world and mathematical problems. | 6.G.A.2 Find the volume of a right rectangular prism with fractional edge lengths by packing it with unit cubes of the appropriate unit fraction edge lengths, and show that the volume is the same as would be found by multiplying the edge lengths of the prism. Apply the formula $V = B \cdot h$, where in this case, $B$ is the area of the base ($B = l \cdot w$) to find volumes of right rectangular prisms with fractional edge lengths in mathematical problems and problems in a real-world context. | AZ uses a slightly different choice of wording but the meaning is the same. |

| CCSS | AZ | Notes and Comments |
|---|---|---|
| 6.G.3. Draw polygons in the coordinate plane given coordinates for the vertices; use coordinates to find the length of a side joining points with the same first coordinate or the same second coordinate. Apply these techniques in the context of solving real-world and mathematical problems. | 6.G.A.3 Draw polygons in the coordinate plane given coordinates for the vertices; use coordinates to find the length of a side joining points with the same first coordinate or the same second coordinate. Apply these techniques to solve mathematical problems and problems in a real-world context. | . |
| 6.G.4. Represent three-dimensional figures using nets made up of rectangles and triangles, and use the nets to find the surface area of these figures. Apply these techniques in the context of solving real-world and mathematical problems. | 6.G.A.4. Represent three-dimensional figures using nets made up of rectangles and triangles, and use the nets to find the surface area of these figures. Apply these techniques to solve mathematical problems and problems in a real-world context. | . |
| **Statistics and Probability** | **Statistics and Probability (SP)** | |
| **Develop understanding of statistical variability.** | **6.SP.A Develop understanding of statistical variability.** | . |
| 6.SP.1. Recognize a statistical question as one that anticipates variability in the data related to the question and accounts for it in the answers. *For example, "How old am I?" is not a statistical question, but "How old are the students in my school?" is a statistical question because one anticipates variability in students' ages.* | 6.SP.A.1 Recognize a statistical question as one that anticipates variability in the data related to the question and accounts for variability in the answers. | AZ removed the CCSS example. |
| 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. | 6.SP.A.2 Understand that a set of data collected to answer a statistical question has a distribution which can be described by its center, spread, and overall shape. | . |

| CCSS | AZ | Notes and Comments |
|---|---|---|
| 6.SP.3. Recognize that a measure of center for a numerical data set summarizes all of its values with a single number, while a measure of variation describes how its values vary with a single number. | 6.SP.A.3 Recognize that a measure of center for a numerical data set summarizes all of its values with a single number, while a variation measurement uses a single number to describe the spread of the data set. | . |
| **Summarize and describe distributions.** | **6.SP.B Summarize and describe distributions.** | . |
| 6.SP.4. Display numerical data in plots on a number line, including dot plots, histograms, and box plots. | 6.SP.B.4 Display and interpret numerical data in plots on a number line including dot plots, histograms, and box plots. | AZ increased rigor by adding the requirement to interpret. |
| 6.SP.5 Summarize numerical data sets in relation to their context, such as by:<br>a. Reporting the number of observations.<br>b. Describing the nature of the attribute under investigation, including how it was measured and its units of measurement.<br>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.<br>d. Relating the choice of measures of center and variability to the shape of the data distribution and the context in which the data were gathered. | 6.SP.B.5 Summarize numerical data sets in relation to their context, such as by:<br>a. Reporting the number of observations.<br>b. Describing the nature of the attribute under investigation, including how it was measured and its units of measurement<br>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.<br>d. Relating the choice of measures of center and variability to the shape of the data distribution and the context in which the data were gathered. | . |
| **GRADE 7** | . | . |
| **Ratios and Proportional Relationships** | **Ratios and Proportional Relationships (RP)** | . |
| **Analyze proportional relationships and use them to solve real-world and mathematical problems.** | **7.RP.A Analyze proportional relationships and use them to solve mathematical problems and problems in a real- world context.** | . |

| CCSS | AZ | Notes and Comments |
| --- | --- | --- |
| 7.RP.1. Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units. *For example, if a person walks 1/2 mile in each 1/4 hour, compute the unit rate as the complex fraction 1/2/1/4 miles per hour, equivalently 2 miles per hour.* | 7.RP.A.1 Compute unit rates associated with ratios involving both simple and complex fractions, including ratios of quantities measured in like and different units. | Complex fractions are used as examples in the CCSS rather than included in the wording of the standard. AZ specifically calls out complex fractions in this standard's requirements and removes the CCSS examples. This is a nice modification that makes the distinction from 6.RP more clear. |
| 7.RP.2. Recognize and represent proportional relationships between quantities. | 7.RP.A.2 Recognize and represent proportional relationships between quantities.<br>a. Decide whether two quantities are in a proportional relationship.<br>b. Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.<br>c. Represent proportional relationships by equations.<br>d. Explain what a point (*x, y*) on the graph of a proportional relationship means in terms of the situation, with special attention to the points (0, 0) and (1, *r*) where *r* is the unit rate. | . |
| 7.RP.2a Decide whether two quantities are in a proportional relationship, e.g., by testing for equivalent ratios in a table or graphing on a coordinate plane and observing whether the graph is a straight line through the origin. | | AZ removed the CCSS example. |
| 7.RP.2b Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships. | | . |
| 7.RP.2c Represent proportional relationships by equations. *For example, if total cost t is proportional to the number n of items purchased at a constant price p, the relationship between the total cost and the number of items can be expressed as t = pn .* | | AZ removed the CCSS example. |
| 7.RP.2d Explain what a point *(x, y)* on the graph of a proportional relationship means in terms of the situation, with special attention to the points (0, 0) and (1, *r)* where *r* is the unit rate. | | . |

| CCSS | AZ | Notes and Comments |
|---|---|---|
| 7.RP.3. Use proportional relationships to solve multistep ratio and percent problems. *Examples: simple interest, tax, markups and markdowns, gratuities and commissions, fees, percent increase and decrease, percent error.* | 7.RP.A.3 Use proportional relationships to solve multistep ratio and percent problems. (Limited to: simple interest, tax, markups and markdowns, gratuities and commissions, fees, percent increase and decrease, percent error.) | AZ changed the CCSS examples to limitations. By making this change, AZ appears to exclude other applications of the standard. For an example, see the activity provided by Illustrative Mathematics for 7.RP.3 (https://www.illustrativemathematics.org/content-standards/7/RP/A/3/tasks/102), which no longer matches the AZ standard. |
| **The Number System** | **The Number System (NS)** | . |
| **Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers.** | **7.NS.A Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers.** | . |
| 7.NS.1. Apply and extend previous understandings of addition and subtraction to add and subtract rational numbers; represent addition and subtraction on a horizontal or vertical number line diagram. | 7.NS.A.1 Apply and extend previous understandings of addition and subtraction to add and subtract integers and other rational numbers; represent addition and subtraction on a horizontal or vertical number line diagram.<br>a. Describe situations in which opposite quantities combine to make 0.<br>b. Understand $p + q$ as the number located a distance $\|q\|$ from $p$, in the positive or negative direction depending on whether q is positive or negative. Show that a number and its opposite have a sum of 0 (are additive inverses). Interpret sums of rational numbers by describing real-world contexts.<br>c. Understand subtraction of rational numbers as adding the additive inverse, $p – q = p + (–q)$. Show that the distance between two rational | AZ specifically calls out integers as part of the set of rational numbers. This clarification helps teachers spot the progression of integers in the standards. |
| 7.NS.1a Describe situations in which opposite quantities combine to make 0. *For example, a hydrogen atom has 0 charge because its two constituents are oppositely charged.* | | AZ removed the CCSS example. |
| 7.NS.1b Understand $p + q$ as the number located a distance $\|q\|$ from $p$, in the positive or negative direction depending on whether $q$ is positive or negative. Show that a number and its opposite have a sum of 0 (are additive inverses). Interpret sums of rational numbers by describing real-world contexts. | | . |

| CCSS | AZ | Notes and Comments |
| --- | --- | --- |
| 7.NS.1c Understand subtraction of rational numbers as adding the additive inverse, $p - q = p + (-q)$. Show that the distance between two rational numbers on the number line is the absolute value of their difference, and apply this principle in real-world contexts. | Show that the distance between two rational numbers on the number line is the absolute value of their difference, and apply this principle in real-world contexts.<br>d. Apply properties of operations as strategies to add and subtract rational numbers. | . |
| 7.NS.1d Apply properties of operations as strategies to add and subtract rational numbers. | | . |
| 7.NS.2. Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers. | 7.NS.A.2 Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide integers and other rational numbers.<br>a. Understand that multiplication is extended from fractions to rational numbers by requiring that operations continue to satisfy the properties of operations, particularly the distributive property, leading to products such as (–1)(–1) = 1 and the rules for multiplying signed numbers. Interpret products of rational numbers by describing real-world contexts.<br>b. Understand that integers can be divided, provided that the divisor is not zero, and every quotient of integers (with non-zero divisor) is a rational number. If $p$ and $q$ are integers, then $-(p/q) = (-p)/q = p/(-q)$. Interpret quotients of rational numbers by describing real-world contexts.<br>c. Apply properties of operations as strategies to multiply and divide rational numbers. | AZ specifically calls out integers as part of the set of rational numbers. |
| 7.NS.2a Understand that multiplication is extended from fractions to rational numbers by requiring that operations continue to satisfy the properties of operations, particularly the distributive property, leading to products such as (–1)(–1) = 1 and the rules for multiplying signed numbers. Interpret products of rational numbers by describing real-world contexts. | | . |
| 7.NS.2b Understand that integers can be divided, provided that the divisor is not zero, and every quotient of integers (with non-zero divisor) is a rational number. If $p$ and $q$ are integers, then $-(p/q) = (-p)/q = p/(-q)$. Interpret quotients of rational numbers by describing real- world contexts. | | . |

| CCSS | AZ | Notes and Comments |
| --- | --- | --- |
| 7.NS.2c Apply properties of operations as strategies to multiply and divide rational numbers. | d. Convert a rational number to a decimal using long division; know that the decimal form of a rational number terminates in 0s or eventually repeats. | . |
| 7.NS.2d Convert a rational number to a decimal using long division; know that the decimal form of a rational number terminates in 0s or eventually repeats. | | . |
| 7.NS.3. Solve real-world and mathematical problems involving the four operations with rational numbers. [Computations with rational numbers extend the rules for manipulating fractions to complex fractions.] | 7.NS.A.3 Solve mathematical problems and problems in a real-world context involving the four operations with rational numbers. (Computations with rational numbers extend the rules for manipulating fractions to complex fractions.) | . |
| **Expressions and Equations** | **Expressions and Equations (EE)** | . |
| **Use properties of operations to generate equivalent expressions.** | **7.EE.A Use properties of operations to generate equivalent expressions.** | . |
| 7.EE.1. Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients. | 7.EE.A.1 Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients. | . |

| CCSS | AZ | Notes and Comments |
| --- | --- | --- |
| 7.EE.2. Understand that rewriting an expression in different forms in a problem context can shed light on the problem and how the quantities in it are related. *For example, a + 0.05a = 1.05a means that "increase by 5%" is the same as "multiply by 1.05."* | 7.EE.A.2 Rewrite an expression in different forms in a problem context and understand the connection between the structures of the different forms. | The CCSS standard addresses how rewriting an expression can help make better sense of the relationships between quantities in a problem. AZ changed the meaning of this CCSS by requiring rewriting and leaving out how the new version of an expression can "shed light on the problem." They have made the rewriting more about the expressions themselves, rather than the context. This modification also lacks clarity. It is not clear what is meant by "the connection between the structures of different forms." |
| **Solve real-life and mathematical problems using numerical and algebraic expressions and equations.** | **7.EE.B Solve mathematical problems and problems in a real-world context using numerical and algebraic expressions and equations.** | . |

| CCSS | AZ | Notes and Comments |
|---|---|---|
| 7.EE.3. Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies. *For example: If a woman making $25 an hour gets a 10% raise, she will make an additional 1/10 of her salary an hour, or $2.50, for a new salary of $27.50. If you want to place a towel bar 9 3/4 inches long in the center of a door that is 27 1/2 inches wide, you will need to place the bar about 9 inches from each edge; this estimate can be used as a check on the exact computation.* | 7.EE.B.3 Solve multi-step mathematical problems and problems in a real-world context posed with positive and negative rational numbers in any form. Convert between forms, as appropriate, and assess the reasonableness of answers using mental computation and estimation strategies. | AZ removed the CCSS example, the requirements for specific number sets required, the strategic use of tools (addressed in MP.5), and the application of the properties of operations (addressed in 7.NS).<br>These two deletions have removed references to the Practices and to making connections across the domains. Both are important to making sure teachers do not lose sight of the importance of both. |
| 7.EE.4. Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities. | 7.EE.B.4 Use variables to represent quantities in mathematical problems and problems in a real-world context and construct simple equations and inequalities to solve problems by reasoning about the quantities. | . |

| CCSS | AZ | Notes and Comments |
|---|---|---|
| 7.EE.4a Solve word problems leading to equations of the form $px + q = r$ and $p(x + q) = r$, where $p$, $q$, and $r$ are specific rational numbers. Solve equations of these forms fluently. Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach. *For example, the perimeter of a rectangle is 54 cm. Its length is 6 cm. What is its width?* | a. Solve word problems leading to equations of the form $px + q = r$ and $p(x + q) = r$, where $p$, $q$, and $r$ are specific rational numbers. Solve equations of these forms fluently. Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach.<br>b. Solve word problems leading to inequalities of the form $px + q > r$ or $px + q < r$, where $p$, $q$, and $r$ are specific rational numbers. Graph the solution set of the inequality and interpret it in the context of the problem. | AZ removed the CCSS example. |
| 7.EE.4b Solve word problems leading to inequalities of the form $px + q > r$ or $px + q < r$, where $p$, $q$, and $r$ are specific rational numbers. Graph the solution set of the inequality and interpret it in the context of the problem. *For example: As a salesperson, you are paid $50 per week plus $3 per sale. This week you want your pay to be at least $100. Write an inequality for the number of sales you need to make, and describe the solutions.* | | AZ removed the CCSS examples. |
| **Geometry** | **Geometry (G)** | . |
| **Draw, construct, and describe geometrical figures and describe the relationships between them.** | **7.G.A Draw, construct, and describe geometrical figures and describe the relationships between them.** | . |
| 7.G.1. Solve problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale. | 7.G.A.1 Solve problems involving scale drawings of geometric figures, such as computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale. | . |

| CCSS | AZ | Notes and Comments |
|---|---|---|
| 7.G.2. Draw (freehand, with ruler and protractor, and with technology) geometric shapes with given conditions. Focus on constructing triangles from three measures of angles or sides, noticing when the conditions determine a unique triangle, more than one triangle, or no triangle. | 7.G.A.2 Draw (freehand, with ruler and protractor, and with technology) geometric shapes with given conditions. Focus on constructing triangles from three measures of angles or sides, noticing when the conditions determine a unique triangle, more than one triangle, or no triangle. | . |
| 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. | 7.G.A.3 Describe the two-dimensional figures that result from slicing three-dimensional figures, as in plane sections of right rectangular prisms and right rectangular pyramids. | . |
| **Solve real-life and mathematical problems involving angle measure, area, surface area, and volume.** | **7.G.B Solve mathematical problems and problems in a real-world context involving angle measure, area, surface area, and volume.** | . |
| 7.G.4. Know the formulas for the area and circumference of a circle and use them to solve problems; give an informal derivation of the relationship between the circumference and area of a circle. | 7.G.B.4 Understand and use the formulas for the area and circumference of a circle to solve problems; give an informal derivation of the relationship between the circumference and area of a circle. | AZ changed "know" to "understand and use." This wording has the same meaning and intent, but rigor is increased. |
| 7.G.5. Use facts about supplementary, complementary, vertical, and adjacent angles in a multi-step problem to write and solve simple equations for an unknown angle in a figure. | 7.G.B.5 Use facts about supplementary, complementary, vertical, and adjacent angles in a multi-step problem to write and solve simple equations for an unknown angle in a figure. | . |

| CCSS | AZ | Notes and Comments |
|---|---|---|
| 7.G.6. Solve real-world and mathematical problems involving area, volume and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms. | 7.G.B.6 Solve mathematical problems and problems in a real-world context involving area, volume and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms. | . |
| **Statistics and Probability** | **Statistics and Probability (SP)** | . |
| **Use random sampling to draw inferences about a population.** | **7.SP.A Use random sampling to draw inferences about a population.** | . |
| 7.SP.1. Understand that statistics can be used to gain information about a population by examining a sample of the population; generalizations about a population from a sample are valid only if the sample is representative of that population. Understand that random sampling tends to produce representative samples and support valid inferences. | 7.SP.A.1 Understand that statistics can be used to gain information about a population by examining a sample of the population; generalizations about a population from a sample are valid only if the sample is representative of that population. Understand that random sampling tends to produce representative samples and support valid inferences. | . |
| 7.SP.2. Use data from a random sample to draw inferences about a population with an unknown characteristic of interest. Generate multiple samples (or simulated samples) of the same size to gauge the variation in estimates or predictions. *For example, estimate the mean word length in a book by randomly sampling words from the book; predict the winner of a school election based on randomly sampled survey data. Gauge how far off the estimate or prediction might be.* | 7.SP.A.2 Use data from a random sample to draw inferences about a population with an unknown characteristic of interest. Generate multiple samples (or simulated samples) of the same size to gauge the variation in estimates or predictions. | AZ removed the CCSS examples. |

| CCSS | AZ | Notes and Comments |
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| **Draw informal comparative inferences about two populations.** | **7.SP.B Draw informal comparative inferences about two populations.** | . |
| 7.SP.3. Informally assess the degree of visual overlap of two numerical data distributions with similar variabilities, measuring the difference between the centers by expressing it as a multiple of a measure of variability. *For example, the mean height of players on the basketball team is 10 cm greater than the mean height of players on the soccer team, about twice the variability (mean absolute deviation) on either team; on a dot plot, the separation between the two distributions of heights is noticeable .* | 7.SP.B.3 Informally assess the degree of visual overlap of two numerical data distributions with similar variabilities, measuring the difference between the centers by expressing it as a multiple of a measure of variability (mean absolute deviation). | In the CCSS, the mean absolute deviation is used in the example as a way of demonstrating the difference between centers and allows for other measures of variability. AZ's inclusion of "(mean absolute deviation)" at the end of the standard makes it seem that this defines MAD rather than serving to clarify MAD as the measure of variability that is expected here. |
| 7.SP.4. Use measures of center and measures of variability for numerical data from random samples to draw informal comparative inferences about two populations. *For example, decide whether the words in a chapter of a seventh-grade science book are generally longer than the words in a chapter of a fourth-grade science book.* | 7.SP.B.4 Use measures of center and measures of variability for numerical data from random samples to draw informal comparative inferences about two populations. | AZ removed the CCSS examples. |
| **Investigate chance processes and develop, use, and evaluate probability models.** | **7.SP.C Investigate chance processes and develop, use and evaluate probability models.** | . |

| CCSS | AZ | Notes and Comments |
| --- | --- | --- |
| 7.SP.5. Understand that the probability of a chance event is a number between 0 and 1 that expresses the likelihood of the event occurring. Larger numbers indicate greater likelihood. A probability near 0 indicates an unlikely event, a probability around 1/2 indicates an event that is neither unlikely nor likely, and a probability near 1 indicates a likely event. | 7.SP.C.5 Understand that the probability of a chance event is a number between 0 and 1 that expresses the likelihood of the event occurring. | . |
| 7.SP.6. Approximate the probability of a chance event by collecting data on the chance process that produces it and observing its long-run relative frequency, and predict the approximate relative frequency given the probability. *For example, when rolling a number cube 600 times, predict that a 3 or 6 would be rolled roughly 200 times, but probably not exactly 200 times.* | 7.SP.C.6 Approximate the probability of a chance event by collecting data on the chance process that produces it and observing its long-run relative frequency, and predict the approximate relative frequency given the probability. | AZ removed the CCSS examples. |
| 7.SP.7. Develop a probability model and use it to find probabilities of events. Compare probabilities from a model to observed frequencies; if the agreement is not good, explain possible sources of the discrepancy. | 7.SP.C.7 Develop a probability model and use it to find probabilities of events. Compare probabilities from a model to observed frequencies; if the agreement is not good, explain possible sources of the discrepancy.<br>a. Develop a uniform probability model by assigning equal probability to all outcomes and use the model to determine probabilities of events.<br>b. Develop a probability model (which may not be uniform) by observing frequencies in data generated from a chance process. | . |
| 7.SP.7a Develop a uniform probability model by assigning equal probability to all outcomes, and use the model to determine probabilities of events. *For example, if a student is selected at random from a class, find the probability that Jane will be selected and the probability that a girl will be selected.* | | AZ removed the CCSS examples. |

| CCSS | AZ | Notes and Comments |
|---|---|---|
| 7.SP.7b Develop a probability model (which may not be uniform) by observing frequencies in data generated from a chance process. *For example, find the approximate probability that a spinning penny will land heads up or that a tossed paper cup will land open-end down. Do the outcomes for the spinning penny appear to be equally likely based on the observed frequencies?* | | AZ removed the CCSS examples. |
| | **8.SP.B Investigate chance processes and develop, use, and evaluate probability models.** | This CCSS for Gr 7 is not addressed in AZ until Gr 8. |
| 7.SP.8. Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation. | 8.SP.B.1 Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation.<br><br>a. Understand that the probability of a compound event is the fraction of outcomes in the sample space for which the compound event occurs.<br><br>b. Represent sample spaces for compound events using methods such as organized lists, tables, and tree diagrams. Identify the outcomes in the sample space which compose the event.<br><br>c. Design and use a simulation to generate | AZ moved probabilities of compound events from Grade 7 to Grade 8. |
| 7.SP.8a Understand that, just as with simple events, the probability of a compound event is the fraction of outcomes in the sample space for which the compound event occurs. | | AZ removed the reference and connection between simple and compound events. |
| 7.SP.8b Represent sample spaces for compound events using methods such as organized lists, tables and tree diagrams. For an event described in everyday language (e.g., "rolling double sixes"), identify the outcomes in the sample space which compose the event. | | AZ removed the CCSS example and the requirement that the event be "described in everyday language." |

| CCSS | AZ | Notes and Comments |
|---|---|---|
| 7.SP.8c Design and use a simulation to generate frequencies for compound events. *For example, use random digits as a simulation tool to approximate the answer to the question: If 40% of donors have type A blood, what is the probability that it will take at least 4 donors to find one with type A blood?* | c. Design and use a simulation to generate frequencies for compound events | AZ removed the CCSS example. |
| **GRADE 8** | . | . |
| **The Number System** | **The Number System (NS)** | . |
| **Know that there are numbers that are not rational, and approximate them by rational numbers.** | **8.NS.A Understand that there are numbers that are not rational, and approximate them by using rational numbers.** | . |
| 8.NS.1. Know that numbers that are not rational are called irrational. Understand informally that every number has a decimal expansion; for rational numbers show that the decimal expansion repeats eventually, and convert a decimal expansion which repeats eventually into a rational number. | 8.NS.A.1 Understand informally that every number has a decimal expansion; rational numbers are those with decimal expansions that terminate in zeros or eventually repeat. Know that other numbers are called irrational. | AZ removed the expectation to convert a repeating decimal into a rational form. The notes do not reflect this change. Was it intentional?<br><br>Clarity: The AZ standard reads like a definition rather than a property of rational numbers. This is an important distinction in that "rational number" is no longer found in the glossary. |

| CCSS | AZ | Notes and Comments |
|---|---|---|
| 8.NS.2. Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions (e.g., √2). *For example, by truncating the decimal expansion of √2, show that √2 is between 1 and 2, then between 1.4 and 1.5, and explain how to continue on to get better approximations.* | 8.NS.A.2 Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions. | AZ removed the CCSS examples. |
| **Expressions and Equations** | **Expressions and Equations (EE)** | . |
| **Work with radicals and integer exponents.** | **8.EE.A Work with radicals and integer exponents.** | . |
| 8.EE.1. Know and apply the properties of integer exponents to generate equivalent numerical expressions. *For example, 3^2 × 3^(–5) = 3*(–3 )= 1/3^3 = 1/27.* | 8.EE.A.1 Understand and apply the properties of integer exponents to generate equivalent expressions. | AZ changed "know" to "understand." This wording has the same meaning, and intent as the CCSS, but may have increased rigor. |

| CCSS | AZ | Notes and Comments |
|---|---|---|
| 8.EE.2. Use square root and cube root symbols to represent solutions to equations of the form $x^2 = p$ and $x^3 = p$, where $p$ is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that √2 is irrational. | 8.EE.A.2 Use square root and cube root symbols to represent solutions to equations of the form $x^2 = p$ and $x^3 = p$, where $p$ is a positive rational number.<br>a. Evaluate square roots of perfect squares less than or equal to 225, and rewrite non-perfect squares in equivalent form.<br>b. Evaluate cube roots of perfect cubes less than or equal to 625, and rewrite non-perfect cubes in equivalent form. | AZ split this CCSS into parts and added limitations on the size of the perfect square and cube roots and removed knowing that sqrt(2) is irrational. The notes claim this is now addressed in 8.NS.1, but that connection is unclear.<br><br>In addition to other changes, AZ includes "rewrite non-perfect squares in equivalent form" and "rewrite non-perfect cubes in equivalent form." The intention here is not mathematically clear. For example, what are students expected to do with √7? This appears to overlap with A2.N-RN.A.2 and will be a time consuming addition to the standard. The technical notes indicate this is "a foundational concept that is part of the progression to Algebra" but such a claim is far from apparent. |
| 8.EE.3. Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other. *For example, estimate the population of the United States as 3 × 10^8 and the population of the world as 7 × 10^9, and determine that the world population is more than 20 times larger.* | 8.EE.A.3 Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities, and express how many times larger or smaller one is than the other. | AZ removed the CCSS example. |

| CCSS | AZ | Notes and Comments |
|---|---|---|
| 8.EE.4. Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities (e.g., use millimeters per year for seafloor spreading). Interpret scientific notation that has been generated by technology. | 8.EE.A.4 Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities. Interpret scientific notation that has been generated by technology. | AZ removed the CCSS example. |
| **Understand the connections between proportional relationships, lines, and linear equations.** | **8.EE.B Understand the connections between proportional relationships, lines, and linear equations.** | . |
| 8.EE.5. Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. *For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.* | 8.EE.B.5 Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. | AZ removed the CCSS example. |
| 8.EE.6. Use similar triangles to explain why the slope $m$ is the same between any two distinct points on a non-vertical line in the coordinate plane; derive the equation $y = mx$ for a line through the origin and the equation $y = mx + b$ for a line intercepting the vertical axis at $b$. | 8.EE.B.6 Use similar triangles to explain why the slope m is the same between any two distinct points on a non-vertical line in the coordinate plane; derive the equation y = mx for a line through the origin and the equation $y = mx + b$ for a line intercepting the vertical axis at $(0, b)$. | AZ version includes both coordinates for the intercept. This is an improvement on the CCSS version. |

| CCSS | AZ | Notes and Comments |
|---|---|---|
| **Analyze and solve linear equations and pairs of simultaneous linear equations.** | **8.EE.C Analyze and solve linear equations, inequalities, and pairs of simultaneous linear equations.** | AZ added inequalities to this linear cluster. This is a shift in focus. In this case, though, the technical notes simply say inequalities are "necessary in the progression of understanding Algebra 1." It is not clear why it needs to happen here rather than Algebra 1. |
| 8.EE.7. Solve linear equations in one variable. | 8.EE.C.7 Solve linear equations and inequalities in one variable. | AZ added inequalities to this linear requirement. |
| 8.EE.7a Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent equation of the form $x = a$, $a = a$, or $a = b$ results (where $a$ and $b$ are different numbers). | a. Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent equation of the form $x = a$, $a = a$, or $a = b$ results (where $a$ and $b$ are different numbers). | . |
| 8.EE.7b Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms. | b. Solve linear equations and inequalities with rational number coefficients, including solutions that require expanding expressions using the distributive property and collecting like terms. | AZ added inequalities to this linear requirement. |
| 8.EE.8. Analyze and solve pairs of simultaneous linear equations. | 8.EE.C.8 Analyze and solve pairs of simultaneous linear equations. | . |
| 8.EE.8a Understand that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously. | a. Understand that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously. | . |

| CCSS | AZ | Notes and Comments |
|---|---|---|
| 8.EE.8b Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations. Solve simple cases by inspection. *For example, 3x + 2y = 5 and 3x + 2y = 6 have no solution because 3x + 2y cannot simultaneously be 5 and 6.* | b. Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations. Solve simple cases by inspection. | AZ removed the CCSS example. |
| 8.EE.8c Solve real-world and mathematical problems leading to two linear equations in two variables. *For example, given coordinates for two pairs of points, determine whether the line through the first pair of points intersects the line through the second pair.* | c. Solve real-world and mathematical problems leading to two linear equations in two variables. | AZ removed the CCSS example. |
| **Functions** | **Functions (F)** | . |
| **Define, evaluate, and compare functions.** | **8.F.A Define, evaluate, and compare functions.** | . |
| 8.F.1. Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output. [Function notation is not required in Grade 8.] | 8.F.A.1 Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output. (Function notation is not required in Grade 8.) | . |

| CCSS | AZ | Notes and Comments |
|---|---|---|
| 8.F.2. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has the greater rate of change.* | 8.F.A.2 Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). | AZ removed the CCSS example. |
| 8.F.3. Interpret the equation $y = mx + b$ as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. *For example, the function A = s^2 giving the area of a square as a function of its side length is not linear because its graph contains the points (1,1), (2,4) and (3,9), which are not on a straight line.* | 8.F.A.3 Interpret the equation $y = mx + b$ as defining a linear function whose graph is a straight line; give examples of functions that are not linear. | AZ removed the CCSS example. |
| **Use functions to model relationships between quantities.** | **8.F.B Use functions to model relationships between quantities.** | . |
| 8.F.4. Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two ($x$ , $y$ ) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values. | 8.F.B.4 Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two ($x, y$ ) values, including reading these from a table or a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, its graph, or its table of values. | . |

| CCSS | AZ | Notes and Comments |
|---|---|---|
| 8.F.5. Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally. | 8.F.B.5 Describe qualitatively the functional relationship between two quantities by analyzing linear and nonlinear graphs. Sketch a graph that exhibits the qualitative features of a function that has been described verbally. | AZ removed the CCSS example. |
| **Geometry** | **Geometry (G)** | . |
| **Understand congruence and similarity using physical models, transparencies, or geometry software.** | **8.G.A Understand congruence and similarity.** | AZ removed the suggested visuals for this CCSS header. |
| 8.G.1 Verify experimentally the properties of rotations, reflections, and translations:<br>a. Lines are taken to lines, and line segments to line segments of the same length.<br>b. Angles are taken to angles of the same measure.<br>c. Parallel lines are taken to parallel lines. | 8.G.A.1 Verify experimentally the properties of rotations, reflections, and translations. Properties include: line segments taken to line segments of the same length, angles taken to angles of the same measure, parallel lines taken to parallel lines. | AZ uses a different format for this standard. This wording has the same meaning, intent, and rigor as the CCSS. |
| 8.G.2. Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that exhibits the congruence between them. | 8.G.A.2 Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that exhibits the congruence between them. | . |

| CCSS | AZ | Notes and Comments |
|---|---|---|
| 8.G.3. Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates. | 8.G.A.3 Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates (rotations and dilations about the origin). | AZ added the limitation for rotations and dilations. There should be some justification for this limitation, as there doesn't seem to be any profound mathematical or pedagogical reasons for this restriction. (See the Illustrative Mathematics activities related to this standard for possibilities.) |
| 8.G.4. Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar two- dimensional figures, describe a sequence that exhibits the similarity between them. | 8.G.A.4 Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them. | . |
| 8.G.5. 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.* | 8.G.A.5 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. | AZ removed the CCSS example. |
| **Understand and apply the Pythagorean Theorem.** | **8.G.B Understand and apply the Pythagorean Theorem.** | . |
| 8.G.6. Explain a proof of the Pythagorean Theorem and its converse. | 8.G.B.6 Explain a proof of the Pythagorean Theorem and its converse. | . |

| CCSS | AZ | Notes and Comments |
|---|---|---|
| 8.G.7. Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions. | 8.G.B.7 Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two dimensions and three dimensions (in regards to slant height). | The inclusion of the parenthetical statement, "(in regard[s] to slant height)," lacks specificity. Are the three-dimensional applications limited to slant height? |
| 8.G.8. Apply the Pythagorean Theorem to find the distance between two points in a coordinate system. | 8.G.B.8 Apply the Pythagorean Theorem to find the distance between two points in a coordinate system. | . |
| **Solve real-world and mathematical problems involving volume of cylinders, cones, and spheres.** | **8.G.C Solve real-world and mathematical problems involving volume of cylinders, cones, and spheres.** | . |
| 8.G.9. Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems. | 8.G.C.9 Understand and use given formulas for the volume of cones, cylinders and spheres to solve real-world and mathematical problems. | AZ changed "know" to "understand," appearing to increase the rigor for this standard. While "understand" is typically considered a higher demand than "know," this phrasing states that the formulas will be "given," rather than "known" by the student. |
| **Statistics and Probability** | **Statistics and Probability (SP)** | . |
| **Investigate patterns of association in bivariate data.** | **8.SP.A Investigate patterns of association in bivariate data** | . |
| 8.SP.1. Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association. | 8.SP.A.1 Construct and interpret scatter plots for bivariate measurement data to investigate and describe patterns of association between two quantities. | AZ removed the requirement to describe the patterns and the example list, included to help define "interpretation" of the plots. This seems consistent with the AZ pattern of removing CCSS examples. |

| CCSS | AZ | Notes and Comments |
|---|---|---|
| 8.SP.2. Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line. | 8.SP.A.2 Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line. | . |
| 8.SP.3. Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept. *For example, in a linear model for a biology experiment, interpret a slope of 1.5 cm/hr as meaning that an additional hour of sunlight each day is associated with an additional 1.5 cm in mature plant height.* | 8.SP.A.3 Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept. | AZ removed the CCSS example. |
| 8.SP.4. Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to describe possible association between the two variables. *For example, collect data from students in your class on whether or not they have a curfew on school nights and whether or not they have assigned chores at home. Is there evidence that those who have a curfew also tend to have chores?* | 8.SP.A.4 Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies to describe a possible association between the two variables. | AZ removed the direction for how to collect the relative frequencies and the CCSS example. |

| CCSS | AZ | Notes and Comments |
| --- | --- | --- |
| These Gr 8 AZ standards align with CCSS Gr 7 standards | **(8.SP.B)** | See the Grade 7 alignment with CCSS 7.SP.8. |
| | (8.SP.B.1) | See the Grade 7 alignment with CCSS 7.SP.8. Note: The coding of the AZ standards differs from that of the CCSS. This may cause problems for teachers who search nationally for materials aligned to 8.SP.1, which does not exist in the CCSS. |

The CCSS identified as for those students planning careers or studies in higher mathematics with the (+) are further identified in this chart in the orange highlighted cells. CCSS that are identified as modeling standards have an asterisk (*). In the rows where there is no alignment the cells are shaded in yellow: Bright yellow highlighting across a row indicates a full gap for either the CCSS or the AZ, light yellow indicates that the CCSS is addressed only outside the minimum course of study (Algebra 1,Algebra 2 and Geometry) as defined in the AZ standards. Wording differences in the two sets of standards are identified in red font and in the commentary.

| CCSS HS | AZ ALG 1 | AZ GEO | AZ ALG 2 | AZ PLUS | Notes and Comments |
|---|---|---|---|---|---|
| **NUMBER AND QUANTITY** | | | | | |
| **The Real Number System** | | | | | . |
| **Extend the properties of exponents to rational exponents.** | . | . | . | . | . |
| N-RN.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.* | . | . | A2.N-RN.A.1 Explain how the definition 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. | . | The slight change in wording in the AZ causes no significant change in meaning or rigor. AZ removed the CCSS example. |
| N-RN.2. Rewrite expressions involving radicals and rational exponents using the properties of exponents. | . | . | A2.N-RN.A.2 Rewrite expressions involving radicals and rational exponents using the properties of exponents. | . | . |
| **Use properties of rational and irrational numbers.** | . | . | . | . | . |
| N-RN.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. | A1.N-RN.B.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. | . | . | . | . |
| **Quantities*** | | | | | . |
| **Reason quantitatively and use units to solve problems.** | . | . | . | . | . |
| N-Q.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.* | 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. | G.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. | A2-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 | . | While this is an identified modeling standard in the CCSS, the AZ version does not include the phrase, "utilizing a real-world context," per the ADSM Introduction (see page 18). |

| CCSS HS | AZ ALG 1 | AZ GEO | AZ ALG 2 | AZ PLUS | Notes and Comments |
|---|---|---|---|---|---|
| N-Q.2. Define appropriate quantities for the purpose of descriptive modeling.* | A1.N-Q.A.2 Define appropriate quantities for the purpose of descriptive modeling. Include problem solving opportunities utilizing real-world context. | G.N-Q.A.2 Define appropriate quantities for the purpose of descriptive modeling. Include problem solving opportunities utilizing real-world context. | A2.N-Q.A.2 Define appropriate quantities for the purpose of descriptive modeling. | . | The limitations and/or differences for the three required course are not clear in these AZ standards. In this case the "include" statement is redundant with the notion of descriptive modeling. Also, if the "utilizing real-world context" statement is important in AZ, why does Alg 2 not have the same additional statement, identifying it as a modeling standard.<br><br>Additional note: There appears to be a typo in all of these additional statements to indicate modeling. In the Introduction (p 18) it says, "utilizing a real-world context." In every instance in the standards the "a" is left off. |
| N-Q.3. Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.* | A1.N-Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. | G.N-Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. | A2.N-Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. | . | The limitations for the three required courses are not clear in these AZ standards.<br><br>While this is an identified modeling standard in the CCSS, the AZ version does not include the phrase, "utilizing a real-world context," per the ADSM Introduction (see page 18). |
| **The Complex Number System** | | | | | . |
| **Perform arithmetic operations with complex numbers.** | . | . | . | | . |
| N-CN.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. | | | A2.N-CN.A.1 Apply the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers. Write complex numbers in the form $(a + bi)$ with $a$ and $b$ real. | | The AZ analysis explains that N-CN.1 and 2 are combined in the AZ Alg 2 course. |
| N-CN.2. Use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers. | . | . | | . | |
| N-CN.3. (+) Find the conjugate of a complex number; use conjugates to find moduli and quotients of complex numbers. | . | . | . | P.N-CN.A.3 Find the conjugate of a complex number; use conjugates to find moduli and quotients of complex numbers. | [The (+) has been removed from the code for all CCSS standards with that indicator.] |
| **Represent complex numbers and their operations on the complex plane.** | . | . | . | | . |

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| N-CN.4. (+) Represent complex numbers on the complex plane in rectangular and polar form (including real and imaginary numbers), and explain why the rectangular and polar forms of a given complex number represent the same number. | . | . | . | P.N-CN.B.4 Represent complex numbers on the complex plane in rectangular and polar form (including real and imaginary numbers), and explain why the rectangular and polar forms of a given complex number represent the same number. | . |
| N-CN.5. (+) Represent addition, subtraction, multiplication, and conjugation of complex numbers geometrically on the complex plane; use properties of this representation for computation. For example, $(-1 + \sqrt{3}\, i)^3 = 8$ because $(-1 + \sqrt{3}\, i)$ has modulus 2 and argument 120°. | . | . | . | P.N-CN.B.5 Represent addition, subtraction, multiplication, and conjugation of complex numbers geometrically on the complex plane; use properties of this representation for computation. For example, $(-1 + \sqrt{3}\, i)^3 = 8$ because $(-1 + \sqrt{3}\, i)$ has modulus 2 and argument 120°. | . |
| N-CN.6. (+) Calculate the distance between numbers in the complex plane as the modulus of the difference, and the midpoint of a segment as the average of the numbers at its endpoints. | . | . | . | P.N-CN.B.6 Calculate the distance between numbers in the complex plane as the modulus of the difference, and the midpoint of a segment as the average of the numbers at its endpoints. | . |
| **Use complex numbers in polynomial identities and equations.** | . | . | . | . | . |
| N-CN.7 Solve quadratic equations with real coefficients that have complex solutions. | . | . | A2.N-CN.C.7 Solve quadratic equations with real coefficients that have complex solutions. | . | . |
| N-CN.8 (+) Extend polynomial identities to the complex numbers. *For example, rewrite* $x^2 + 4$ *as* $(x + 2i)(x - 2i)$. | . | . | . | P.N-CN.C.8 Extend polynomial identities to the complex numbers. For example, rewrite $x^2 + 4$ as $(x + 2i)(x - 2i)$. | . |
| N-CN.9 (+) Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials. | . | . | . | P.N-CN.C.9 Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials. | . |
| **Vector and Matrix Quantities** | | | | | . |
| **Represent and model with vector quantities.** | . | . | . | . | . |
| N-VM.1. (+) Recognize vector quantities as having both magnitude and direction. Represent vector quantities by directed line segments, and use appropriate symbols for vectors and their magnitudes (e.g., ***v***, \|***v***\|, \|\|***v***\|\|, *v*). | . | . | . | P.N-VM.A.1 Recognize vector quantities as having both magnitude and direction. Represent vector quantities by directed line segments, and use appropriate symbols for vectors and their magnitudes (e.g., **v**, \|**v**\|, \|\|**v**\|\|, **v**). | . |

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| N-VM.2. (+) Find the components of a vector by subtracting the coordinates of an initial point from the coordinates of a terminal point. | . | . | . | P.N-VM.A.2 Find the components of a vector by subtracting the coordinates of an initial point from the coordinates of a terminal point. | . |
| N-VM.3. (+) Solve problems involving velocity and other quantities that can be represented by vectors. | . | . | . | P.N-VM.A.3 Solve problems involving velocity and other quantities that can be represented by vectors. | . |
| **Perform operations on vectors.** | . | . | . | . | . |
| N-VM.4. (+) Add and subtract vectors. | . | . | . | P.N-VM.B.4 Add and subtract vectors.<br>a. Add vectors end-to-end, component-wise, and by the parallelogram rule. Understand that the magnitude of a sum of two vectors is typically not the sum of the magnitudes.<br>b. Given two vectors in magnitude and direction form, determine the magnitude and direction of their sum.<br>c. Understand vector subtraction **v** – **w** as **v** + (–**w**), where –**w** is the additive inverse of w, with the same magnitude as w and pointing in the opposite direction. Represent vector subtraction graphically by connecting the tips in the appropriate order, and perform vector subtraction component-wise. | . |
| N-VM.4a Add vectors end-to-end, component-wise, and by the parallelogram rule. Understand that the magnitude of a sum of two vectors is typically not the sum of the magnitudes. | . | . | . | | . |
| N-VM.4b Given two vectors in magnitude and direction form, determine the magnitude and direction of their sum. | . | . | . | | . |
| N-VM.4c Understand vector subtraction $\boldsymbol{v} - \boldsymbol{w}$ as $\boldsymbol{v} + (-\boldsymbol{w})$, where $-\boldsymbol{w}$ is the additive inverse of $\boldsymbol{w}$, with the same magnitude as $\boldsymbol{w}$ and pointing in the opposite direction. Represent vector subtraction graphically by connecting the tips in the appropriate order, and perform vector subtraction component-wise. | . | . | . | | . |
| N-VM.5. (+) Multiply a vector by a scalar. | . | . | . | P.N-VM.B.5 Multiply a vector by a scalar.<br>a. Represent scalar multiplication graphically by scaling vectors and possibly reversing their direction; perform scalar multiplication component-wise, e.g., as c(vx, vy) = (cvx, cvy).<br>b. Compute the magnitude of a scalar multiple cv using \|\|cv\|\| = \|c\|v. Compute the direction of cv knowing that when \|c\|v ≠0, the direction of cv is either along v (for c > 0) or against v (for c < 0). | . |
| N-VM.5a Represent scalar multiplication graphically by scaling vectors and possibly reversing their direction; perform scalar multiplication component-wise, e.g., as c(vx, vy) = (cvx, cvy). | . | . | . | | . |
| N-VM.5b Compute the magnitude of a scalar multiple $c\boldsymbol{v}$ using $\|\|c\boldsymbol{v}\|\| = \|c\|v$. Compute the direction of $c\boldsymbol{v}$ knowing that when $\|c\|v \neq 0$, the direction of $c\boldsymbol{v}$ is either along $\boldsymbol{v}$ (for $c > 0$) or against $\boldsymbol{v}$ (for $c < 0$). | . | . | . | | . |

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| **Perform operations on matrices and use matrices in applications.** | . | . | . | . | . |
| N-VM.6. (+) Use matrices to represent and manipulate data, e.g., to represent payoffs or incidence relationships in a network. | . | . | . | P.N-VM.C.6 Use matrices to represent and manipulate data, e.g., to represent payoffs or incidence relationships in a network. | . |
| N-VM.7. (+) Multiply matrices by scalars to produce new matrices, e.g., as when all of the payoffs in a game are doubled. | . | . | . | P.N-VM.C.7 Multiply matrices by scalars to produce new matrices, e.g., as when all of the payoffs in a game are doubled. | . |
| N-VM.8. (+) Add, subtract, and multiply matrices of appropriate dimensions. | . | . | . | P.N-VM.C.8 Add, subtract, and multiply matrices of appropriate dimensions. | . |
| N-VM.9. (+) Understand that, unlike multiplication of numbers, matrix multiplication for square matrices is not a commutative operation, but still satisfies the associative and distributive properties. | . | . | . | P.N-VM.C.9 Understand that, unlike multiplication of numbers, matrix multiplication for square matrices is not a commutative operation, but still satisfies the associative and distributive properties. | . |
| N-VM.10. (+) Understand that the zero and identity matrices play a role in matrix addition and multiplication similar to the role of 0 and 1 in the real numbers. The determinant of a square matrix is nonzero if and only if the matrix has a multiplicative inverse. | . | . | . | P.N-VM.C.10 Understand that the zero and identity matrices play a role in matrix addition and multiplication similar to the role of 0 and 1 in the real numbers. The determinant of a square matrix is nonzero if and only if the matrix has a multiplicative inverse. | . |
| N-VM.11. (+) Multiply a vector (regarded as a matrix with one column) by a matrix of suitable dimensions to produce another vector. Work with matrices as transformations of vectors. | . | . | . | P.N-VM.C.11 Multiply a vector (regarded as a matrix with one column) by a matrix of suitable dimensions to produce another vector. Work with matrices as transformations of vectors. | . |
| N-VM.12. (+) Work with 2 X 2 matrices as transformations of the plane, and interpret the absolute value of the determinant in terms of area. | . | . | . | P.N-VM.C.12 Work with 2 x 2 matrices as transformations of the plane, and interpret the absolute value of the determinant in terms of area. | . |
| **ALGEBRA** | | | | | . |
| **Seeing structure in expressions** | | | | | . |
| **Interpret the structure of expressions** | . | . | . | . | . |

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| A-SSE.1. Interpret expressions that represent a quantity in terms of its context.* | A1.A-SSE.A.1 Interpret expressions that represent a quantity in terms of its context.<br><br>a. Interpret parts of an expression, such as terms, factors, and coefficients.<br><br>b. Interpret complicated expressions by viewing one or more of their parts as a single entity. | . | . | . | While this is an identified modeling standard in the CCSS, the AZ version does not include the phrase, "utilizing a real-world context," per the ADSM Introduction (see page 18). |
| A-SSE.1a Interpret parts of an expression, such as terms, factors, and coefficients.* | | . | . | . | While this is an identified modeling standard in the CCSS, the AZ version does not include the phrase, "utilizing a real-world context," per the ADSM Introduction (see page 18). |
| A-SSE.1b 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.** | | . | . | . | AZ removed the CCSS example.<br><br>While this is an identified modeling standard in the CCSS, the AZ version does not include the phrase, "utilizing a real-world context," per the ADSM Introduction (see page 18). |
| A-SSE.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 $(x^2 - y^2)(x^2 + y^2)$.* | A1.A-SSE.A.2 Use the structure of an expression to identify ways to rewrite it. Focus on numerical expressions, such as recognizing $53^2 - 47^2$ as a difference of squares and see an opportunity to rewrite it in the form (53+47)(53-47). Focus on polynomial expressions in one variable, such as seeing an opportunity to rewrite $a^2 + 9a + 14$ as (a+7)(a+2). | . | A2.A-SSE.A.2 Use the structure of an expression to identify ways to rewrite it. Extend polynomial expressions to multivariable expressions. Focus on rational or exponential expressions seeing that $(x^2 + 4)/(x^2 + 3)$ as $((x^2+3) + 1)/(x^2+3)$, thus recognizing an opportunity to write it as $1 + 1/(x^2 + 3)$. | . | The two courses demonstrate their differences through the examples.<br><br>It is not clear in Alg 1 whether "polynomial" expressions would be limited to degree 2. Typically we assume "polynomial" expressions include higher order. This is especially evident in the call to "extend polynomial expressions" in Alg 2.<br><br>It is not clear if there is a specific reason for using "focus" in the additional notes in Alg 1 and "extend" as a verb in the AZ. Both appear to be instructions for the teacher as opposed to requirements for the student. "Extend" can read as a connector for someone reading from A1 to A2, but it can also mean that students are able to "extend" polynomial expressions. This should be made more clear. |
| **Write expressions in equivalent forms to solve problems** | . | . | . | . | . |

| CCSS HS | AZ ALG 1 | AZ GEO | AZ ALG 2 | AZ PLUS | Notes and Comments |
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| A-SSE.3. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.* | 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. | . | A2.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. Include problem solving opportunities utilizing real-world context and focus on expressions with rational exponents. | . | AZ includes more detail about the expectations in Alg 2.<br><br>While this is an identified modeling standard in the CCSS, the AZ version only includes the phrase, "utilizing a real-world context," in Alg 2. This would be needed in Alg 1, as well, per the ADSM Introduction (see page 18). |
| A-SSE.3a Factor a quadratic expression to reveal the zeros of the function it defines.* | a. Factor a quadratic expression to reveal the zeros of the function it defines. | . | | . | While this is an identified modeling standard in the CCSS, the AZ version does not include the phrase, "utilizing a real-world context," per the ADSM Introduction (see page 18). |
| A-SSE.3b Complete the square in a quadratic expression to reveal the maximum or minimum value 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. | . | | . | While this is an identified modeling standard in the CCSS, the AZ version does not include the phrase, "utilizing a real-world context," per the ADSM Introduction (see page 18). |
| A-SSE.3c 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) ≈ 1.012^12t to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.** | c. Use the properties of exponents to transform expressions for exponential functions. Focus on expressions with integer exponents. | . | c. Use the properties of exponents to transform expressions for exponential functions. | . | The AZ identification for modeling standards is missing for this standard in Alg 1. |
| A-SSE.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.** | . | . | A2.A-SSE.B.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. | . | AZ removed the CCSS example.<br><br>While this is an identified modeling standard in the CCSS, the AZ version does not include the phrase, "utilizing a real-world context," per the ADSM Introduction (see page 18). |
| **Arithmetic with Polynomial and Rational Expressions** | | | | | . |
| **Perform arithmetic operations on polynomials** | . | . | . | . | . |

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| A-APR.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. | 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. | . | . | . | . |
| **Understand the relationship between zeros and factors of polynomials** | . | . | . | . | . |
| A-APR.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 $p(x)$. | . | . | A2.A-APR.B.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 $p(x)$. | . | . |
| A-APR.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. | A1.A-APR.B.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. | . | A2.A-APR.B.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. Focus on quadratic, cubic, and quartic polynomials including polynomials for which factors are not provided. | . | AZ provides limitations for Alg 2 that make it appear to be at a lower level than the unlimited Alg 1 requirement. An explanation may be needed to clarify the specific requirements for Alg 1. |
| **Use polynomial identities to solve problems** | . | . | . | . | . |
| A-APR.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.* | . | . | A2.A-APR.C.4 Prove polynomial identities and use them to describe numerical relationships. | . | . |
| A-APR.5. (+) Know and apply the Binomial Theorem for the expansion of $(x + y)^n$ in powers of $x$ and $y$ for a positive integer $n$, where $x$ and $y$ are any numbers, with coefficients determined for example by Pascal's Triangle.[The Binomial Theorem can be proved by mathematical induction or by a combinatorial argument.] | . | . | . | P.A-APR.C.5 Know and apply the Binomial Theorem for the expansion of $(x + y)^n$ in powers of x and y for a positive integer n, where x and y are any numbers, with coefficients determined for example by Pascal's Triangle. (The Binomial Theorem can be proved by mathematical induction or by a combinatorial argument.) | . |
| **Rewrite rational expressions** | . | . | . | . | . |

| CCSS HS | AZ ALG 1 | AZ GEO | AZ ALG 2 | AZ PLUS | Notes and Comments |
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| A-APR.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. | . | . | A2.A-APR.D.6 Rewrite 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 a computer algebra system. | . | . |
| A-APR.7. (+) Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract, multiply, and divide rational expressions. | . | . | . | P.A-APR.D.7 Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract, multiply, and divide rational expressions. | . |
| **Creating Equations*** | | | | | Note: AZ removed the asterisks that indicate the CCSS requirement to model with mathematics. |
| **Create equations that describe numbers or relationships** | . | . | . | . | . |
| A-CED.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.* * | A1.A-CED.A.1 Create equations and inequalities in one variable and use them to solve problems. Include problem-solving opportunities utilizing real-world context. Focus on equations and inequalities that are linear, quadratic, or exponential with integer exponents. | . | A2.A-CED.A.1 Create equations and inequalities in one variable and use them to solve problems. Include problem-solving opportunities utilizing real-world context. Focus on equations and inequalities arising from linear, quadratic, rational, and exponential functions with real exponents. | . | AZ added detail and limitations for the types of exponents.<br><br>Typo: According to the ADSM Introduction the phrase should be, "utilizing a real-world context." |
| A-CED.2. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.* | A1.A-CED.A.2 Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. | . | . | . | While this is an identified modeling standard in the CCSS, the AZ version does not include the phrase, "utilizing a real-world context," per the ADSM Introduction (see page 18). |

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| A-CED.3. Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non- viable options in a modeling context. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.** | 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 non-viable options in a modeling context. | . | . | . | AZ removed the CCSS example.<br><br>While this is an identified modeling standard in the CCSS, the AZ version does not include the phrase, "utilizing a real-world context," per the ADSM Introduction (see page 18). |
| A-CED.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.** | A1.A-CED.A.4 Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. | . | . | . | AZ removed the CCSS example.<br><br>While this is an identified modeling standard in the CCSS, the AZ version does not include the phrase, "utilizing a real-world context," per the ADSM Introduction (see page 18). |
| **Reasoning with Equations and Inequalities** | | | | | . |
| **Understand solving equations as a process of reasoning and explain the reasoning** | . | . | . | . | . |
| A-REI.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. | A1.A-REI.A.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. Extend from linear to quadratic 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. Extend from quadratic equations to rational and radical equations. | . | It is not clear whether by "extend" AZ intends that both linear and quadratic are required in Alg 1. Then, in Alg 2 it is not clear whether quadratic equations are required or only rational and radical. If the former, how would rational expressions be an "extension" of quadratics? If so, how would that be explained mathematically? |
| A-REI.2. Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise. | . | . | A2.A-REI.A.2 Solve rational and radical equations in one variable and give examples showing how extraneous solutions may arise. | . | AZ removed "simple" as a limitation on rational and radical equations. They will need to indicate expected limits as these types of equations can be very demanding. |
| **Solve equations and inequalities in one variable** | . | . | . | . | . |
| A-REI.3. Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters. | A1.A-REI.B.3 Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters. | . | . | . | . |
| A-REI.4. Solve quadratic equations in one variable. | A1.A-REI.B.4 Solve quadratic equations in one variable. | . | A2.A-REI.B.4 Solve quadratic equations in one variable. | . | . |

| CCSS HS | AZ ALG 1 | AZ GEO | AZ ALG 2 | AZ PLUS | Notes and Comments |
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| A-REI.4a 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. | 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. | . | | . | . |
| A-REI.4b 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*. | b. Solve quadratic equations by inspection, taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Focus on solutions for quadratic equations that have real roots. Include cases that recognize when a quadratic equation has no real solutions. | . | b. Solve quadratic equations by inspection 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*. | . | AZ includes limitations for Alg 1 but is consistent with the requirements of the CCSS. Does "focus on solutions..." really mean "limit to solutions..." here? |
| **Solve systems of equations** | . | . | . | . | . |
| A-REI.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. | A1.A-REI.C.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. | . | . | . | . |
| A-REI.6. Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables. | A1.A-REI.C.6 Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables. Include problem solving opportunities utilizing real-world context. | . | . | . | AZ added the AZ modeling requirement to apply systems to real-world contexts.<br><br>Typo: According to the ADSM Introduction the phrase should be, "utilizing a real-world context." |
| A-REI.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 $x^2 + y^2 = 3$.* | . | . | A2.A-REI.C.7 Solve a system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. | . | . |
| A-REI.8. (+) Represent a system of linear equations as a single matrix equation in a vector variable. | . | . | . | P.A-REI.C.8 Represent a system of linear equations as a single matrix equation in a vector variable. | . |

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| A-REI.9. (+) Find the inverse of a matrix if it exists and use it to solve systems of linear equations (using technology for matrices of dimension 3 X 3 or greater). | . | . | . | P.A-REI.C.9 Find the inverse of a matrix if it exists, and use it to solve systems of linear equations (using technology for matrices of dimension 3´ 3 or greater). | . |
| **Represent and solve equations and inequalities graphically** | . | . | . | . | . |
| A-REI.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). | A1.A-REI.D.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). | . | . | . | . |
| A-REI.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.* | A1.A-REI.D.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 using technology to graph the functions, tables of values, or successive approximations. Focus on cases where f(x) and/or g(x) are linear, absolute value, quadratic and, exponential functions with integer exponents. | . | A2.A-REI.D.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 using technology to graph the functions, tables of values, or successive approximations. Include problem solving opportunities utilizing real-world context. Extend from linear, quadratic, and exponential with integer exponents to cases where f(x) and/or g(x) are polynomial, rational, exponential with real exponent, and logarithmic functions. | . | AZ added detail to define differences between the two algebra courses. It is not clear whether "focus on" means "limit to" or "include." See earlier comments on using "Extend" in a standard.<br><br>It is not clear why work with exponential functions in Alg 1 would be limited to functions with integer exponents. Since exponential functions have variable exponents, is it the intent that the computations should only include integer exponents? Or that functions are discretely defined only at integer inputs? This may be an error to be corrected or clarified.<br><br>While this is an identified modeling standard in the CCSS, the AZ Alg 1 version does not include the phrase, "utilizing a real-world context," per the ADSM Introduction (see page 18).<br><br>Typo: According to the ADSM Introduction the phrase should be, "utilizing a real-world context." |
| A-REI.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. | A1.A-REI.D.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. | . | . | . | . |
| **FUNCTIONS** | | | | | . |
| **Interpreting Functions** | | | | | . |

| CCSS HS | AZ ALG 1 | AZ GEO | AZ ALG 2 | AZ PLUS | Notes and Comments |
|---|---|---|---|---|---|
| **Understand the concept of a function and use function notation** | . | . | . | . | . |
| F-IF.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* ). | 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)* . | . | . | . | . |
| F-IF.2. Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context. | A1.F-IF.A.2 Use function notations, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context. | . | . | . | AZ changed function notation to "function notations." Is the plural intentional? If so, which notations beyond that in A1.F-IF.A.1 are expected? |
| F-IF.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.* | A1.F-IF.A.3 Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. | . | . | . | . |
| **Interpret functions that arise in applications in terms of the context** | . | . | . | . | . |

| CCSS HS | AZ ALG 1 | AZ GEO | AZ ALG 2 | AZ PLUS | Notes and Comments |
|---|---|---|---|---|---|
| F-IF.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.* | A1.F-IF.B.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. Include problem-solving opportunities utilizing real-world context. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums. Focus on linear, absolute value, quadratic, and exponential with integer exponents and piecewise- defined functions (limited to the aforementioned functions). | . | A2.F-IF.B.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. Include problem-solving opportunities utilizing real-world context. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, negative; relative maximums and minimums; symmetries; end behavior; and periodicity. Extend from linear, quadratic and exponential with integer exponents to include polynomial, radical, logarithmic, rational, piecewise-defined, sine, cosine, tangent, and exponential functions with real exponents. | . | AZ adds the requirement to apply functions to real-world contexts and limitations for Alg 1.<br>By adding "include problem solving," AZ makes measurability more difficult.<br><br>It is not clear why work with exponential functions in Alg 1 would be limited to functions with integer exponents. Since exponential functions have variable exponents, is it the intent that the computations should only include integer exponents? Or that functions are discretely defined only at integer inputs? This may be an error to be corrected or clarified.<br><br>AZ's inclusion of graphs of rational functions seems to require the expectation in F-IF.7d (+). Are graphs of rational functions a part of Alg 2 in AZ? They are not included in the AzMERIT specifications.<br><br>Typo: According to the ADSM Introduction the phrase should be, "utilizing a real-world context." See earlier comments on using "focus" and "extend" in a standard. |
| F-IF.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.* * | A1.F-IF.B.5 Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. Focus on linear, absolute value, quadratic, and exponential with integer exponents and piecewise- defined functions (limited to the aforementioned functions). | . | . | . | It is not clear why work with exponential functions in Alg 1 would be limited to functions with integer exponents. Since exponential functions have variable exponents, is it the intent that the computations should only include integer exponents? Or that functions are discretely defined only at integer inputs? This may be an error to be corrected or clarified.<br><br>It seems like there should be an Alg 2 version of this CCSS, since it represents an important skill related to all function types.<br><br>While this is an identified modeling standard in the CCSS, the AZ version does not include the phrase, "utilizing a real-world context," per the ADSM Introduction (see page 18). |

| CCSS HS | AZ ALG 1 | AZ GEO | AZ ALG 2 | AZ PLUS | Notes and Comments |
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| F-IF.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.* | A1.F-IF.B.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. Include problem-solving opportunities utilizing real-world context. Focus on linear, absolute value, quadratic, and exponential functions, all with integer exponents. | . | A2.F-IF.B.6 Calculate and interpret the average rate of change of a continuous function (presented symbolically or as a table) on a closed interval. Estimate the rate of change from a graph. Include problem-solving opportunities utilizing real-world context. Extend from linear, quadratic and exponential with integer exponents to include polynomial, radical, logarithmic, rational, piecewise-defined, sine, cosine, tangent, and exponential functions with real exponents. | . | AZ includes detail to define differences in Alg 1 and Alg 2. It is not clear why work with exponential functions in Alg 1 would be limited to functions with integer exponents. Since exponential functions have variable exponents, is it the intent that the computations should only include integer exponents? Or that functions are discretely defined only at integer inputs? This may be an error to be corrected or clarified.<br><br>Typo: According to the ADSM Introduction the phrase should be, "utilizing a real-world context." |
| **Analyze functions using different representations** | . | . | . | . | . |
| F-IF.7. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.* | A1.F-IF.C.7 Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.<br><br>Functions include linear, exponential with integer exponents, quadratic, and piecewise-defined functions. | . | A2.F-IF.C.7 Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. | P.F-IF.C.7 Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. | AZ picked up all the functions listed in the non (+) CCSS by the end of Alg 2 and the (+) CCSS in Plus.<br><br>While this is an identified modeling standard in the CCSS, the AZ version does not include the phrase, "utilizing a real-world context," per the ADSM Introduction (see page 18). |
| F-IF.7a Graph linear and quadratic functions and show intercepts, maxima, and minima.* | | . | Functions include square root, cube root, | | It is not clear why work with exponential functions would be limited to functions with integer exponents in Alg 1. Since exponential functions have variable exponents, is it the intent that the computations should only include integer exponents? Or that functions are discretely defined only at integer inputs? This may be an error to be corrected or clarified. |
| F-IF.7b Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.* | | . | polynomial, | | While this is an identified modeling standard in the CCSS, the AZ version does not include the phrase, "utilizing a real-world context," per the ADSM Introduction (see page 18). |
| F-IF.7c Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.* | | . | | d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior | While this is an identified modeling standard in the CCSS, the AZ version does not include the phrase, "utilizing a real-world context," per the ADSM Introduction (see page 18). |

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| F-IF.7d (+) Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.* | | . | exponential with real exponents, logarithmic, sine, cosine, tangent, and piecewise- defined functions. | behavior. | The requirements of AZ Plus overlaps with Alg 2, F-IF.B.4.<br>While this is an identified modeling standard in the CCSS, the AZ version does not include the phrase, "utilizing a real-world context," per the ADSM Introduction (see page 18). |
| F-IF.7e Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.* | | . | | | . |
| F-IF.8. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. | A1.F-IF.C.8 Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. | . | A2.F-IF.C.8 Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. | . | . |
| F-IF.8a 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. | 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. | . | | . | . |
| F-IF.8b 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.* | | . | b. Use the properties of exponents to interpret expressions for exponential functions and classify those functions as exponential growth or decay. | . | AZ made part of the CCSS example part of the Alg 2 requirement. |
| F-IF.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.* | A1.F-IF.C.9 Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). Focus on linear, absolute value, quadratic, exponential with integer exponents and piecewise-defined functions. (limited to the aforementioned functions) | . | A2.F-IF.C.9 Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions.). Extend from linear, quadratic and exponential with integer exponents to include polynomial, radical, logarithmic, rational, piecewise-defined, sine, cosine, tangent, and exponential functions with real exponents. | . | AZ added detail to define differences between the two algebra courses.<br><br>As mentioned earlier, AZ needs to clarify what "exponential [functions] with integer exponents" means.<br><br>See earlier comments on using "focus" and "extend" in standards. |
| **Building Functions** | | | | | . |
| **Build a function that models a relationship between two quantities** | . | . | . | . | |

| CCSS HS | AZ ALG 1 | AZ GEO | AZ ALG 2 | AZ PLUS | **Notes and Comments** |
|---|---|---|---|---|---|
| F-BF.1. Write a function that describes a relationship between two quantities.* | A1.F-BF.A.1 Write a function that describes a relationship between two quantities.<br>Determine an explicit expression, a recursive process, or steps for calculation from a context. Focus on linear, absolute value, quadratic, exponential with integer exponents, and piecewise- defined functions (limited to the aforementioned functions). | | A2.F-BF.A.1 Write a function that describes a relationship between two quantities. Extend from linear, quadratic and exponential with integer exponents to include polynomial, radical, logarithmic, rational, piecewise-defined, sine, cosine, and exponential functions with real exponents. Include problem-solving opportunities utilizing real-world context.<br>a. Determine an explicit expression, a recursive process, or steps for calculation from a context.<br>b. Combine standard function types using arithmetic operations and function composition. | P.F-BF.A.1 Write a function that describes a relationship between two quantities. | Clarification is needed regarding the intent of "exponential [functions] with integer exponents." |
| F-BF.1a Determine an explicit expression, a recursive process, or steps for calculation from a context.* | | | | | AZ added detail to define differences between the two algebra courses. This is particularly true for exponential functions. Again, AZ uses "focus" and "extend" as the verbs for specifics in Alg 1 and Alg 2, respectively. These appear to be messages to the teacher as opposed to requirements for the students.<br>While this is a modeling standard in the CCSS, it does not have the AZ connection to modeling in Alg 1.<br><br>Typo: According to the ADSM Introduction the phrase should be, "utilizing a real-world context." |
| F-BF.1b 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.** | | . | | c. Compose functions. For example, if *T(y)* is the temperature in the atmosphere as a function of height, and *h(t)* is the height of a weather balloon as a function of time, then *T(h(t))* is the temperature at the location of the weather balloon as a function of time. | AZ removed the CCSS example. |
| F-BF.1c (+) Compose functions. *For example, if T(y) is the temperature in the atmosphere as a function of height, and h(t) is the height of a weather balloon as a function of time, then T(h(t)) is the temperature at the location of the weather balloon as a function of time.* * | . | . | . | | While this is an identified modeling standard in the CCSS, the AZ version removes the modeling indicator but does not include the phrase, "utilizing a real-world context," per the ADSM Introduction (see page 18). |

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| F-BF.2. Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.* | . | . | A2.F-BF.A.2 Write arithmetic and geometric sequences both recursively and explicitly. Use arithmetic and geometric sequences to model situations, and translate between explicit and recursive forms. | . | AZ changes the wording slightly but the meaning is essentially the same.<br><br>Sequences are introduced in Alg 1 in F-IF.3. Will AZ students make the connection between recognition of sequences and applying them with this distance between them? Would it make more sense to address F-BF.2 in Alg 1? Or to include an Alg 2 version of F-IF.3 in AZ?<br><br>While this is an identified modeling standard in the CCSS, the AZ version removes the modeling indicator but does not include the phrase, "utilizing a real-world context," per the ADSM Introduction (see page 18). |
| **Build new functions from existing functions** | . | . | . | . | . |
| F-BF.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. | A1.F-BF.B.3 Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $k \bullet f(x)$, $f(kx)$, 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. Focus on linear, absolute value, quadratic, exponential with integer exponents, and piecewise-defined functions (limited to the aforementioned functions). | . | 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. Include recognizing even and odd functions from their graphs and algebraic expressions for them. Extend from linear, quadratic and exponential with integer exponents to include polynomial, radical, logarithmic, rational, piecewise-defined, sine, cosine, and exponential functions with real exponents. | . | AZ provides more detail for the two algebra courses. It is not clear how exponential functions are being handled in the two courses. This needs clarity. See previous comments for more detail.<br><br>AZ uses "focus" and "extend" again in the notes. See previous comments for more detail. |

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| F-BF.4. Find inverse functions. | . | . | A2.F-BF.B.4 Find inverse functions.<br>a. Understand that an inverse function can be obtained by expressing the dependent variable of one function as the independent variable of another, recognizing that functions f and g are inverse functions if and only if *f(x) = y* and *g(y) = x* for all values of *x* in the domain of *f* and all values of *y* in the domain of *g* .<br>b. Understand that if a function contains a point (*a, b* ), then the graph of the inverse relation of the function contains the point (*b, a* ); the inverse is a reflection over the line *y = x* | P.F-BF.B.4 Find inverse functions. | There is a problematic mathematical issue in part b. The statement, "the inverse is a reflection over the line y=x" will only be true if the x-axis and y-axis quantities mean the same thing simultaneously - which would never happen in context.See the article "Inverse Functions: What Our Teachers Didn't Tell Us" written by Arizona educators (Mathematics Teacher, March 2011).<br><br>There is also a need to improve precision in part b in that a GRAPH of the function, and not the function itself, contains the point (a, b)..." |
| F-BF.4a Solve an equation of the form f(x) = c for a simple function f that has an inverse and write an expression for the inverse. *For example, f(x) =2 x^3 or f(x) = (x+1)/(x–1) for x ≠ 1.* | . | . | | | It is not clear that F.BF.4a is matched in AZ, since none of the parts of this AZ standard clearly align. |
| F-BF.4b (+) Verify by composition that one function is the inverse of another. | . | . | . | b. Verify by composition that one function is the inverse of another. c. Read values of an inverse function from a graph or a table, given that the function has an inverse.<br>d. Produce an invertible function from a non-invertible function by restricting the domain. | . |
| F-BF.4c (+) Read values of an inverse function from a graph or a table, given that the function has an inverse. | . | . | . | | . |
| F-BF.4d (+) Produce an invertible function from a non-invertible function by restricting the domain. | . | . | . | | . |
| F-BF.5 (+) Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents. | . | . | . | P.F-BF.B.5 Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents. | . |
| **Linear, Quadratic, and Exponential Models*** | | | | | . |
| **Construct and compare linear, quadratic, and exponential models and solve problems** | . | . | . | . | . |
| F-LE.1. Distinguish between situations that can be modeled with linear functions and with exponential functions.* | A1.F-LE.A.1 Distinguish between situations that can be modeled with linear functions and with exponential functions.<br><br>a. Prove that linear functions grow | . | . | . | While this is an identified modeling standard in the CCSS, the AZ version removed the modeling indicator but did not include the phrase, "utilizing a real-world context," per the ADSM Introduction (see page 18). |

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| F-LE.1a Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals.* | by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals.<br><br>b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.<br><br>c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another. | . | . | . | While this is an identified modeling standard in the CCSS, the AZ version removes the modeling indicator but does not include the phrase, "utilizing a real-world context," per the ADSM Introduction (see page 18). |
| F-LE.1b Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.* | | . | . | . | While this is an identified modeling standard in the CCSS, the AZ version removes the modeling indicator but does not include the phrase, "utilizing a real-world context," per the ADSM Introduction (see page 18). |
| F-LE.1c Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.* | | . | . | . | While this is an identified modeling standard in the CCSS, the AZ version removes the modeling indicator but does not include the phrase, "utilizing a real-world context," per the ADSM Introduction (see page 18). |
| F-LE.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).* | A1.F-LE.A.2 Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or input-output pairs. | . | . | . | The CCSS parenthetical statement was removed in AZ and the limitation of two input-output pairs.<br><br>While this is an identified modeling standard in the CCSS, the AZ version removes the modeling indicator but does not include the phrase, "utilizing a real-world context," per the ADSM Introduction (see page 18). |
| F-LE.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.* | A1.F-LE.A.3 Observe, using graphs and tables, that a quantity increasing exponentially eventually exceeds a quantity increasing linearly or quadratically. | . | . | . | AZ removed the requirement to observe polynomial graphs.<br><br>While this is an identified modeling standard in the CCSS, the AZ version removes the modeling indicator but does not include the phrase, "utilizing a real-world context," per the ADSM Introduction (see page 18). |
| F-LE.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.* | . | . | A2.F-LE.A.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. | . | While this is an identified modeling standard in the CCSS, the AZ version removes the modeling indicator but does not include the phrase, "utilizing a real-world context," per the ADSM Introduction (see page 18). |
| **Interpret expressions for functions in terms of the situation they model** | . | . | . | . | . |

| CCSS HS | AZ ALG 1 | AZ GEO | AZ ALG 2 | AZ PLUS | Notes and Comments |
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| F-LE.5. Interpret the parameters in a linear or exponential function in terms of a context.* | A1.F-LE.B.5 Interpret the parameters in a linear or exponential function with integer exponents in terms of a context. | . | A2.F-LE.B.5 Interpret the parameters in an exponential function with real exponents in terms of a context. | . | While this is an identified modeling standard in the CCSS, the AZ version removes the modeling indicator but does not include the phrase, "utilizing a real-world context," per the ADSM Introduction (see page 18). |
| **Trigonometric Functions** | | | | | . |
| **Extend the domain of trigonometric functions using the unit circle** | . | . | . | . | . |
| F-TF.1. Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle. | . | . | A2.F-TF.A.1 Understand radian measure of an angle as the length of the arc on any circle subtended by the angle, measured in units of the circle's radius. | . | AZ added clarification of the definition of radian measure. |
| F-TF.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. | . | . | A2.F-TF.A.2 Explain how the unit circle in the coordinate plane enables the extension of sine and cosine functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle. | . | AZ limits trigonometric functions to only sine and cosine in Alg 2. |
| F-TF.3. (+) Use special triangles to determine geometrically the values of sine, cosine, tangent for $\pi/3$, $\pi/4$ and $\pi/6$, and use the unit circle to express the values of sine, cosine, and tangent for $\pi - x$, $\pi + x$, and $2\pi - x$ in terms of their values for $x$, where $x$ is any real number. | . | . | . | P.F-TF.A.3 Use special triangles to determine geometrically the values of sine, cosine, tangent for $\pi/3$, $\pi/4$ and $\pi/6$, and use the unit circle to express the values of sine, cosine, and tangent for $\pi - x$, $\pi + x$, and $2\pi - x$ in terms of their values for x, where x is any real number. | . |
| F-TF.4. (+) Use the unit circle to explain symmetry (odd and even) and periodicity of trigonometric functions. | . | . | . | P.F-TF.A.4 Use the units circle to explain symmetry (odd and even) and periodicity of trigonometric functions. | The plural for unit(s) appears to be a typo. |
| **Model periodic phenomena with trigonometric functions** | . | . | . | . | . |
| F-TF.5. Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.* | . | . | A2.F-TF.B.5 Create and interpret trigonometric functions that model periodic phenomena with specified amplitude, frequency, and midline. | . | AZ changed "choose" to "create and interpret," increasing the rigor.<br><br>While this is an identified modeling standard in the CCSS, the AZ version removes the modeling indicator but does not include the phrase, "utilizing a real-world context," per the ADSM Introduction (see page 18). |

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|---|---|---|---|---|---|
| F-TF.6. (+) Understand that restricting a trigonometric function to a domain on which it is always increasing or always decreasing allows its inverse to be constructed. | . | . | . | P.F-TF.B.6 Understand that restricting a trigonometric function to a domain on which it is always increasing or always decreasing allows its inverse to be constructed. | . |
| F-TF.7. (+) Use inverse functions to solve trigonometric equations that arise in modeling contexts; evaluate the solutions using technology, and interpret them in terms of the context.* | . | . | . | P.F-TF.B.7 Use inverse functions to solve trigonometric equations that arise in modeling contexts; evaluate the solutions using technology, and interpret them in terms of the context. | While this is an identified modeling standard in the CCSS, the AZ version removes the modeling indicator but does not include the phrase, "utilizing a real-world context," per the ADSM Introduction (see page 18). |
| **Prove and apply trigonometric identities** | . | . | . | . | . |
| F-TF.8. Prove the Pythagorean identity *sin^2(ϑ) + cos^2(ϑ) = 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. | . | . | A2.F-TF.C.8 Prove the Pythagorean identity *sin^2(ϑ) + cos^2(ϑ) = 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. | . | . |
| F-TF.9. (+) Prove the addition and subtraction formulas for sine, cosine, and tangent and use them to solve problems. | . | . | . | P.F-TF.C.9 Prove the addition and subtraction formulas for sine, cosine, and tangent and use them to solve problems | . |
| **GEOMETRY** | . | . | . | . | . |
| **Congruence** | | | | | . |
| **Experiment with transformations in the plane** | . | . | . | . | . |
| G-CO.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.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.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.G-CO.A.2 Represent and describe transformations in the plane 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. | . | . | AZ removed the CCSS examples. |

| CCSS HS | AZ ALG 1 | AZ GEO | AZ ALG 2 | AZ PLUS | Notes and Comments |
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| G-CO.3. Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself. | . | G.G-CO.A.3 Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself. | . | . | . |
| G-CO.4. Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments. | . | G.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.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.G-CO.A.5 Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure. Specify a sequence of transformations that will carry a given figure onto another. | . | . | . |
| **Understand congruence in terms of rigid motions** | . | . | . | . | |
| G-CO.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.G-CO.B.6 Use geometric definitions 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. | . | . | AZ changed "descriptions" to "definitions." This overlaps with G-CO.A.4. |
| G-CO.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.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.8. Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions. | . | G.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. | . | . | . |
| **Prove geometric theorems** | . | . | . | . | . |

| CCSS HS | AZ ALG 1 | AZ GEO | AZ ALG 2 | AZ PLUS | Notes and Comments |
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| G-CO.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.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; and points on a perpendicular bisector of a line segment are exactly those equidistant from the segment's endpoints. | . | . | . |
| G-CO.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.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; and the medians of a triangle meet at a point. | . | . | . |
| G-CO.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* | . | G.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 rectangles are parallelograms with congruent diagonals. | . | . | By removing "conversely," AZ has made the standard more clear. |
| **Make geometric constructions** | . | . | . | . | . |
| G-CO.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.G-CO.D.12 Make formal geometric constructions with a variety of tools and methods. Constructions include: 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. | . | . | AZ removed the parenthetical examples of tools and methods. |
| G-CO.13. Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle. | . | G.G-CO.D.13 Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle | . | . | . |

| CCSS HS | AZ ALG 1 | AZ GEO | AZ ALG 2 | AZ PLUS | Notes and Comments |
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| **Similarity, Right Triangles, and Trigonometry** | | | | | . |
| **Understand similarity in terms of similarity transformations** | . | . | . | . | . |
| G-SRT.1 Verify experimentally the properties of dilations given by a center and a scale factor:<br>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.<br>b. The dilation of a line segment is longer or shorter in the ratio given by the scale factor. | . | G.G-SRT.A.1 Verify experimentally the properties of dilations given by a center and a scale factor:<br>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.<br>b. The dilation of a line segment is longer or shorter in the ratio given by the scale factor. | . | . | . |
| G-SRT.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.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.3. Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar. | . | G.G-SRT.A.3 Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar. | . | . | . |
| **Prove theorems involving similarity** | . | . | . | . | . |
| G-SRT.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.G-SRT.B.4 Prove theorems about triangles. Theorems include: an interior line parallel to one side of a triangle divides the other two proportionally; the Pythagorean Theorem proved using triangle similarity. | . | . | AZ's addition makes the standard clearer. |
| G-SRT.5. Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures. | . | G.G-SRT.B.5 Use congruence and similarity criteria to prove relationships in geometric figures and solve problems utilizing a real-world context. | . | . | AZ added their modeling requirement to apply to a real-world context. |
| **Define trigonometric ratios and solve problems involving right triangles** | . | . | . | . | . |

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| G-SRT.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.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.7. Explain and use the relationship between the sine and cosine of complementary angles. | . | G.G-SRT.C.7 Explain and use the relationship between the sine and cosine of complementary angles. | . | . | . |
| G-SRT.8. Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.* | . | G.G-SRT.C.8 Use trigonometric ratios (including inverse trigonometric ratios) and the Pythagorean Theorem to find unknown measurements in right triangles in applied problems. | . | . | Inverse functions are an Alg 2 topic in AZ, possibly putting this requirement out of order. It is not clear whether the Geometry course typically comes before or after Alg 2 in AZ.<br>While this is an identified modeling standard in the CCSS, the AZ version does not include the phrase, "utilizing a real-world context" per the ADSM Introduction (see page 18). |
| **Apply trigonometry to general triangles** | . | . | . | . | . |
| G-SRT.9. (+) Derive the formula *A* = 1/2 *ab* sin(C) for the area of a triangle by drawing an auxiliary line from a vertex perpendicular to the opposite side. | . | . | . | P.G-SRT.D.9 Derive the formula A = 1⁄2 ab sin(C) for the area of a triangle by drawing an auxiliary line from a vertex perpendicular to the opposite side. | . |
| G-SRT.10. (+) Prove the Laws of Sines and Cosines and use them to solve problems. | . | . | . | P.G-SRT.D.10 Prove the Laws of Sines and Cosines and use them to solve problems. | . |
| G-SRT.11. (+) Understand and apply the Law of Sines and the Law of Cosines to find unknown measurements in right and non-right triangles (e.g., surveying problems, resultant forces). | . | . | . | P.G-SRT.D.11 Understand and apply the Law of Sines and the Law of Cosines to find unknown measurements in right and non-right triangles (e.g., surveying problems, resultant forces). | . |
| **Circles** | | | | | . |
| **Understand and apply theorems about circles** | . | . | . | . | . |
| G-C.1. Prove that all circles are similar. | . | G.G-C.A.1 Prove that all circles are similar. | . | . | . |

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| G-C.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.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; and the radius of a circle is perpendicular to the tangent where the radius intersects the circle. | . | . | . |
| G-C.3. Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a circle. | . | G.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.4. (+) Construct a tangent line from a point outside a given circle to the circle. | . | . | . | P.G-C.A.4 Construct a tangent line from a point outside a given circle to the circle. | . |
| **Find arc lengths and areas of sectors of circles** | . | . | . | . | . |
| G-C.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.G-C.B.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. Convert between degrees and radians. | . | . | The AZ Geometry standard added conversion between degrees and radians. This makes the standard less focused and also makes it unrelated to the cluster. |
| **Expressing Geometric Properties with Equations** | | | | | . |
| **Translate between the geometric description and the equation for a conic section** | . | . | . | . | . |
| G-GPE.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.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.2 Derive the equation of a parabola given a focus and directrix. | . | . | . | P.G-GPE.A.2 Derive the equation of a parabola given a focus and directrix. | This non (+) CCSS is not matched in the three required courses. |

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| G-GPE.3 (+) Derive the equations of ellipses and hyperbolas given the foci, using the fact that the sum or difference of distances from the foci is constant. | . | . | . | P.G-GPE.A.3 Derive the equations of ellipses and hyperbolas given the foci, using the fact that the sum or difference of distances from the foci is constant. | . |
| **Use coordinates to prove simple geometric theorems algebraically** | . | . | . | . | |
| G-GPE.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)* . | . | G.G-GPE.B.4 Use coordinates to prove or disprove simple geometric theorems algebraically. Theorems include: proving or disproving geometric figures given specific points in the coordinate plane; and proving or disproving if a specific point lies on a given circle. | . | . | This standard is mathematically problematic. This standard adds, "disprove simple geometric theorems" and "disproving geometric figures." By the definition a "theorem" cannot be disproved and disproving a figure makes no sense. In the CCSS, the examples ask that a theorem be used to disprove a condition or attribute. This is different from "disproving" the theorem.<br><br>Also, the AZ version of the CCSS example may be construed to mean that only those two theorems are included. In the AZ final example, "disproving if..." should probably be "disproving that..." |
| G-GPE.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.G-GPE.B.5 Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems, including finding the equation of a line parallel or perpendicular to a given line that passes through a given point. | . | . | The change in the AZ standard does not substantially change the meaning or rigor of the CCSS. |
| G-GPE.6. Find the point on a directed line segment between two given points that partitions the segment in a given ratio. | . | G.G-GPE.B.6 Find the point on a directed line segment between two given points that partitions the segment in a given ratio. | . | . | . |
| G-GPE.7. Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula.* | . | G.G-GPE.B.7 Use coordinates to compute perimeters of polygons and areas of triangles and rectangles. | . | . | AZ removed the CCSS example.<br><br>While this is an identified modeling standard in the CCSS, the AZ version does not include the phrase, "utilizing a real-world context" per the ADSM Introduction (see page 18). |
| **Geometric Measurement and Dimension** | | | | | . |
| **Explain volume formulas and use them to solve problems** | . | . | . | . | . |

| CCSS HS | AZ ALG 1 | AZ GEO | AZ ALG 2 | AZ PLUS | Notes and Comments |
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| G-GMD.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.G-GMD.A.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.2. (+) Give an informal argument using Cavalieri's principle for the formulas for the volume of a sphere and other solid figures. | . | . | . | P.G-GMD.A.2 Give an informal argument using Cavalieri's principle for the formulas for the volume of a sphere and other solid figures. | . |
| G-GMD.3. Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.* | . | G.G-GMD.A.3 Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems utilizing real-world context. | . | . | AZ added their modeling requirement to apply to a real-world context as suggested in the ASDM Introduction for standards that require modeling with mathematics.<br><br>Typo: According to the ADSM Introduction the phrase should be, "utilizing a real-world context." |
| **Visualize relationships between two-dimensional and three-dimensional objects** | . | . | . | . | . |
| G-GMD.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.G-GMD.B.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. | . | . | . |
| **Modeling with Geometry*** | | | | | . |
| **Apply geometric concepts in modeling situations** | . | . | . | . | . |
| G-MG.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.G-MG.A.1 Use geometric shapes, their measures, and their properties to describe objects. | . | . | AZ removed the CCSS example.<br><br>While this is an identified modeling standard in the CCSS, the AZ version does not include the phrase, "utilizing a real-world context" per the ADSM Introduction (see page 18). |
| G-MG.2. Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot).* | . | G.G-MG.A.2 Apply concepts of density based on area and volume in modeling situations. | . | . | AZ removed the CCSS example.<br><br>While this is an identified modeling standard in the CCSS, the AZ version does not include the phrase, "utilizing a real-world context" per the ADSM Introduction (see page 18). |

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| G-MG.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.G-MG.A.3 Apply geometric methods to solve design problems. | . | . | AZ removed the CCSS example.<br><br>While this is an identified modeling standard in the CCSS, the AZ version does not include the phrase, "utilizing a real-world context" per the ADSM Introduction (see page 18). |
| | | | | | |
| **STATISTICS AND PROBABILITY** | . | . | . | . | . |
| **Interpreting Categorical and Quantitative Data** | | | | | . |
| **Summarize, represent, and interpret data on a single count or measurement variable** | . | . | . | . | . |
| S-ID.1. Represent data with plots on the real number line (dot plots, histograms, and box plots). | A1.S-ID.A.1 Represent data with plots on the real number line (dot plots, histograms, and box plots), for the purpose of comparing statistics between two or more data sets. | . | . | . | AZ attempts to add more detail about the intended purpose of data representation in an effort to lift this standard past the middle school version in 6.SP.4. However, clarity is needed in the additional statement. Comparison would be between two sets of data rather than comparing statistics. It would make more sense to say, "… for the purpose of comparing two or more data sets." |
| S-ID.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. | 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. | . | . | . | . |
| S-ID.3. Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers). | A1.S-ID.A.3 Interpret differences in shape, center, and spread in the context of the data sets (dot plots, histograms, and box plots), accounting for possible effects of extreme data points (outliers). | . | . | . | The purpose of the AZ addition is not clear here. The placement of the parentheses makes it appear in the AZ version that "data sets" are equivalent to the three types of plots. Also, it is not clear why they have included these three types of representations in this interpretation requirement. Are these the only displays included in the requirement? Why would a visual display be required at all? |

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| S-ID.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. | . | . | A2.S-ID.A.4 Use the mean and standard deviation of a data set and properties of a normal distribution to approximate a normal curve to estimate population percentages. Recognize and identify data sets for which such a procedure is not appropriate. Consider non-symmetric data sets and presence of outliers. | . | There are several differences in these two standards. AZ elected not to offer suggestions for tools to use in estimating the area under the normal curve. They added the requirement of non-symmetric data and consideration of outliers. This appears to be more demanding than the CCSS counterpart. |
| **Summarize, represent, and interpret data on two categorical and quantitative variables** | . | . | . | . | . |
| S-ID.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. | A1.S-ID.B.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. | . | . | . | . |
| S-ID.6. Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. | A1.S-ID.B.6 Represent data on two quantitative variables on a scatter plot, and describe how the quantities are related. | . | A2.S-ID.B.6 Represent data on two quantitative variables on a scatter plot, and describe how the quantities are related. Extend to polynomial and exponential models. | . | See previous comments on the use of "focus" and "extend" in standards. |
| S-ID.6a 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.* | a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Focus on linear models. | . | 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. | . | . |
| S-ID.6b Informally assess the fit of a function by plotting and analyzing residuals. | b. Informally assess the fit of a function by plotting and analyzing residuals. | . | | . | . |
| S-ID.6c Fit a linear function for a scatter plot that suggests a linear association. | . | . | . | . | This CCSS is not specifically addressed in AZ. It might be assumed to be sufficiently addressed by S-ID.6a. |
| **Interpret linear models** | . | . | . | . | . |
| S-ID.7. Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data. | A1.S-ID.C.7 Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data. | . | . | . | . |

| CCSS HS | AZ ALG 1 | AZ GEO | AZ ALG 2 | AZ PLUS | Notes and Comments |
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| S-ID.8. Compute (using technology) and interpret the correlation coefficient of a linear fit. | A1.S-ID.C.8 Compute and interpret the correlation coefficient of a linear fit. | . | . | . | AZ removed "using technology," which indicated the skill is to use the calculator, and that such computations, by hand, are not the intention. The emphasis in the CCSS is to teach the ability to use the calculator as a tool. |
| S-ID.9. Distinguish between correlation and causation. | A1.S-ID.C.9 Distinguish between correlation and causation. | . | . | . | . |
| | | | **A2.S-ID.C Interpret models.** | | |
| . | . | . | A2.S-ID.C.10 Interpret parameters of exponential models. | . | This AZ standard is not addressed in the CCSS. |
| **Making Inferences and Justifying Conclusions** | | | | | . |
| **Understand and evaluate random processes underlying statistical experiments** | . | . | . | . | . |
| S-IC.1. Understand statistics as a process for making inferences about population parameters based on a random sample from that population. | . | . | A2.S-IC.A.1 Understand statistics as a process for making inferences about population parameters based on a random sample from that population. | . | . |
| S-IC.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?* | . | . | A2.S-IC.A.2 Explain if a specified model is consistent with results from a given data-generating process. | . | AZ changed "decide" to "explain," increasing the rigor.<br><br>Typo: The "if" in the AZ version should be "how," "whether," or "why." |
| **Make inferences and justify conclusions from sample surveys, experiments, and observational studies** | . | . | . | . | . |
| S-IC.3. Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each. | . | . | . | P.S-IC.B.3 Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each. | This CCSS non-(+) standard is not addressed in the three required courses in AZ. Students will not see this standard if they elect to take a course other than a course that uses this AZ Plus standard. |
| S-IC.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. | . | . | . | P.S-IC.B.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. | This CCSS non-(+) standard is not addressed in the three required courses in AZ. If students elect to take a course other than AZ Plus, they will not see this standard. |

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| S-IC.5. Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant. | . | . | . | P.S-IC.B.5 Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant. | This CCSS non-(+) standard is not addressed in the three required courses in AZ. If students elect to take a course other than AZ Plus, they will not see this standard. |
| S-IC.6. Evaluate reports based on data. | . | . | . | P.S-IC.B.6 Evaluate reports based on data. | This CCSS non-(+) standard is not addressed in the three required courses in AZ. If students elect to take a course other than AZ Plus, they will not see this standard. |
| **Conditional Probability and the Rules of Probability** | . | . | . | . | . |
| **Understand independence and conditional probability and use them to interpret data** | . | . | . | . | . |
| S-CP.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”). | A1.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”). | . | . | . | . |
| S-CP.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. | A1.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. | . | . | . | . |
| S-CP.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*. | . | . | A2.S-CP.A.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. | . | The time gap between S-CP.2 and S-CP.3 seems large. |

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| S-CP.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.* | . | . | A2.S-CP.A.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 calculate conditional probabilities. | . | AZ removed the CCSS examples. |
| S-CP.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.* | . | . | A2.S-CP.A.5 Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. | . | AZ removed the CCSS examples. |
| **Use the rules of probability to compute probabilities of compound events in a uniform probability model** | . | . | . | . | . |
| S-CP.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. | . | . | A2.S-CP.B.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. | . | . |
| S-CP.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. | . | . | A2.S-CP.B.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. | . | . |
| S-CP.8. (+) Apply the general Multiplication Rule in a uniform probability model, P(A and B) = P(A)P(B\|A) = P(B)P(A\|B), and interpret the answer in terms of the model. | . | . | . | P.S-CP.B.8 Apply the general Multiplication Rule in a uniform probability model, P(A and B) = P(A)P(B\|A) = P(B)P(A\|B), and interpret the answer in terms of the model. | The AZ technical review states that this standard was moved to Alg 2. However that does not appear to be the case. |

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| S-CP.9. (+) Use permutations and combinations to compute probabilities of compound events and solve problems. | . | . | . | P.S-CP.B.9 Use permutations and combinations to compute probabilities of compound events and solve problems. | . |
| **Using Probability to Make Decisions** | | | | | . |
| **Calculate expected values and use them to solve problems** | . | . | . | . | . |
| S-MD.1. (+) Define a random variable for a quantity of interest by assigning a numerical value to each event in a sample space; graph the corresponding probability distribution using the same graphical displays as for data distributions. | . | . | . | P.S-MD.A.1 Define a random variable for a quantity of interest by assigning a numerical value to each event in a sample space; graph the corresponding probability distribution using the same graphical displays as for data distributions. | . |
| S-MD.2. (+) Calculate the expected value of a random variable; interpret it as the mean of the probability distribution. | . | . | . | P.S-MD.A.2 Calculate the expected value of a random variable; interpret it as the mean of the probability distribution. | . |
| S-MD.3. (+) Develop a probability distribution for a random variable defined for a sample space in which theoretical probabilities can be calculated; find the expected value. *For example, find the theoretical probability distribution for the number of correct answers obtained by guessing on all five questions of a multiple-choice test where each question has four choices, and find the expected grade under various grading schemes.* | . | . | . | P.S-MD.A.3 Develop a probability distribution for a random variable defined for a sample space in which theoretical probabilities can be calculated; find the expected value. For example, find the theoretical probability distribution for the number of correct answers obtained by guessing on all five questions of a multiple-choice test where each question has four choices, and find the expected grade under various grading schemes. | . |

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| S-MD.4. (+) Develop a probability distribution for a random variable defined for a sample space in which probabilities are assigned empirically; find the expected value. *For example, find a current data distribution on the number of TV sets per household in the United States, and calculate the expected number of sets per household. How many TV sets would you expect to find in 100 randomly selected households?* | . | . | . | P.S-MD.A.4 Develop a probability distribution for a random variable defined for a sample space in which probabilities are assigned empirically; find the expected value. For example, find a current data distribution on the number of TV sets per household in the United States, and calculate the expected number of sets per household. How many TV sets would you expect to find in 100 randomly selected households? | . |
| **Use probability to evaluate outcomes of decisions** | . | . | . | . | . |
| S-MD.5 (+) Weigh the possible outcomes of a decision by assigning probabilities to payoff values and finding expected values. | . | . | . | P.S-MD.B.5 Weigh the possible outcomes of a decision by assigning probabilities to payoff values and finding expected values.<br>a. Find the expected payoff for a game of chance. For example, find the expected winnings from a state lottery ticket or a game at a fast-food restaurant.<br>b. Evaluate and compare strategies on the basis of expected values. For example, compare a high-deductible versus a low-deductible automobile insurance policy using various, but reasonable, chances of having a minor or a major accident. | . |
| S-MD.5a (+) Find the expected payoff for a game of chance. *For example, find the expected winnings from a state lottery ticket or a game at a fast- food restaurant.* | . | . | . | | . |
| S-MD.5b (+) Evaluate and compare strategies on the basis of expected values. *For example, compare a high-deductible versus a low-deductible automobile insurance policy using various, but reasonable, chances of having a minor or a major accident.* | . | . | . | | . |
| S-MD.6 (+) Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator). | . | . | . | P.S-MD.B.6 Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator). | . |
| S-MD.7 (+) Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game). | . | . | . | P.S-MD.B.7 Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game). | . |
| | | | | **Contemporary Mathematics - CM** | . |

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| | | | | **Discrete Mathematics - (CM-DM)** | . |
| | | | | **P.CM-DM.A Understand and apply vertex-edge graph topics** | This AZ Plus cluster is not specifically addressed in the CCSS. |
| | | | | P.CM-DM.A.1 Study the following topics related to vertex-edge grapP: Euler circuits, Hamilton circuits, the Travelling Salesperson Problem (TSP), minimum weight spanning trees, shortest patP, vertex coloring, and adjacency matrices. | This concept is not specifically addressed in the CCSS.<br><br>Note: There are several typos in this section. It appears that "hs" was globally changed to "P." |
| | | | | P.CM-DM.A.2 Understand, analyze, and apply vertex-edge grapP to model and solve problems related to patP, circuits, networks, and relationships among a finite number of elements, in real-world and abstract settings. | This AZ Plus concept is not specifically addressed in the CCSS.<br><br>Typo: "hs" was changed to "P." |
| | | | | P.CM-DM.A.3 Devise, analyze, and apply algorithms for solving vertex-edge graph problems. | This AZ Plus concept is not specifically addressed in the CCSS. |
| | | | | P.CM-DM.A.4 Extend work with adjacency matrices for grapP, such as interpreting row sums and using the nth power of the adjacency matrix to count patP of length n in a graph. | This AZ Plus concept is not specifically addressed in the CCSS.<br><br>Typo: "hs" was changed to "P." |